

SCHEDULE C1. – SWTC

(Clause 1.1)



Transport
for NSW

- Sydney Metro City & Southwest

Central Station Main Works
Contract Schedules

Schedule C1

- Scope of Works and Technical Criteria

PROJECT	Sydney Metro City & Southwest	DATE	27 February 2018
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- **Sydney Metro City &
Southwest**

 - Central Station Main Works
Contract Schedules**

 - Schedule C1

- **Scope of Works and Technical Criteria
Appendix A01
Defined terms and acronyms**

PROJECT	Sydney Metro City & Southwest	DATE	20 February 2018
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AUTHOR	Transport for NSW	REVISION	1.2
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1 Defined terms and acronyms

- (a) Defined terms and acronyms which have been defined in clause 1.1 of the General Conditions have the same meaning where used in this SWTC.
- (b) For the purposes of this SWTC the defined terms and acronyms in Tables 1 and 2 respectively below have the related meanings set out opposite them unless the context requires otherwise.

Table 1 – Defined Terms

Term	Meaning
Abnormal Operation	The continuance of Normal Operations incorporating pre-planned changes to operations to accommodate special events or planned maintenance activities.
Acceptable Effects	As given in section 3.3(e) of the SWTC.
Access Consultant	As given in section 4.20.2 of the SWTC.
Advertising Provisioning Plan	The plan of that name to be prepared by the CSM Contractor in accordance with the requirements of Appendix B13 to the SWTC.
Advertising Specialist	The specialist of that name to be engaged by the CSM Contractor in accordance with the requirements of Appendix B13 to the SWTC.
Advertising Strategy	The Sydney Metro City & Southwest Advertising Strategy.
Alternative Solution	As given in the BCA.
Ambulance Service of NSW	State Government body providing ambulance services.
ASA Standards	The network standards for NSW transport assets which are set and managed by ASA.
Asset	Individual element of the Project Works, including those elements of the Project Works set out in section 4.2 of the SWTC.
Back of House Area (or BOH)	Operational areas of the stations not accessible to customers.
BCA	Building Code of Australia which forms part of the National Construction Code. It is the building code in force for building developments in NSW, as published by the Australian Building Codes Board.

Term	Meaning
BCA Consultant	As given in section 4.21 of the SWTC.
Bounce Hostel	Bounce Hostel Sydney, which is located at 28 Chalmers Street Surry Hills.
Cause And Effect Matrix	A systematic description within the FER that defines the required actions (including automatic, semi-automatic and operator led) in response to all possible forms and combinations of fire alarm (including automatic and manually initiated). Includes performance requirements for the required interlocks between Fire Safety Systems and the sequence and timing of all steps.
CBD Coordination Office (or Sydney Coordination Office)	The division of that name within Transport for NSW.
CCALC	A propriety software programme used for cantilever calculations as part of OHW design.
Central Station	The railway station located at the southern end of the Sydney CBD, and bounded by Railway Square and Pitt Street in the west, Eddy Avenue in the north, Elizabeth Street in the east and Sydney Yard Cess Area in the south. For the purposes of the SWTC, Central Station excludes the Metro Station.
Central Electric Station Building	The existing building which is generally known by that name and which is located to the north of existing platforms 12/13.
Central No 1 and Central No 2 Substations	The substations generally known by that name which are located in the ESR.
Central Station Precinct	Central Station and its contextual surrounds.
Central Station Works	The elements of the Project Works set out in section 2.3.2 of the SWTC.
Central Walk Works	The elements of the Project Works set out in section 2.3.3 of the SWTC.
Chalmers Street Entrance	The existing entrance to Central Station from Chalmers Street into the South Concourse.
Cleaners Amenities Building	The existing building which is generally known by that name and which is located in the Sydney Yard Cess Area.
Combined Design Scenario	The combination of a Design Fire Scenario with a Design Egress Scenario.

Term	Meaning
Combined High Challenge Scenario	Either: <ul style="list-style-type: none"> • the combination of Design Fire Scenario with a High Challenge Egress Scenario; or • the combination of High Challenge Fire Scenario with a Design Egress Scenario; or • a Combined Design Scenario where a single system failure is being tested for sensitivity.
Combined Extreme Event Scenario	Either: <ul style="list-style-type: none"> • the combination of any category fire scenario with an Extreme Event Egress Scenario; or • the combination of an Extreme Event Fire Scenario with any category Egress Scenario.
Conservation Management Plan (or CMP)	As given in section 3.11 of Appendix B06 to the SWTC.
Construction Traffic Management Plan	As given in MR-Prelude.
Council of the City of Sydney	The local government council which covers Central Station.
Critical Equipment	All equipment that forms part of systems and services that are: <ul style="list-style-type: none"> • critical to maintaining the Normal Operation of Sydney Trains and / or Sydney Metro services (at design train frequency for the ultimate design year); or • required for responding to an emergency (including the requirements of the CSM Contractor's FLS Strategy).
Critical Equipment Room	A room containing any Critical Equipment
Crown Certifier	A building certifier providing certificates of compliance for Crown developments on behalf of the Crown in accordance with the NSW Environmental Planning & Assessment Act 1979.
Crown Project	A development on State Government owned land as defined in the NSW Crown Lands Act 1989 and in accordance with the NSW Environmental Planning & Assessment Act 1979.
Customer Centred Design (or CCD)	The design process as explained in the Sydney Metro City & Southwest Design Guidelines.
Customer Reference Panel (or CRP)	As given in section 3.1 of SWTC Appendix B09.

Term	Meaning
Customer Satisfaction Drivers	Timeliness, convenience, safety and security, comfort, accessibility, information, ticketing, cleanliness and customer service.
Deemed-To-Satisfy (or DtS)	The BCA term describing the prescriptive provisions which are 'deemed' to satisfy the performance requirements of the BCA.
Degraded Operation	The state of continuing train operations with significant unplanned failures, such as track related and communication system failures.
Design Egress Scenario	An emergency egress scenario that could reasonably be expected to occur within the design life time of the infrastructure but with all fire safety measures and systems operating as designed.
Design Fire Scenario	A fire scenario that could reasonably be expected to occur within the design life time of the infrastructure but with all fire safety measures and systems operating as designed.
Design Life	As given in section 4.2(a) of the SWTC.
Design Review Panel	As given in the Project Planning Approval (Chatswood to Sydenham).
Deterministic Assessment	A Quantitative Assessment where definable inputs are analysed to produce a repeatable output, and statistical variation is not factored in.
Devonshire Street Tunnel	The existing customer tunnel at Central Station between the South Concourse and Henry Deane Plaza.
Disability Council NSW	The organisation acting as official advisor to the State Government and monitors the implementation of government policy with respect to disability inclusion.
Down	The direction of trains away from Central Station.
East Concourse	The new east concourse at Central Station which is described in section 2.3.3(b)(i) of the SWTC.
Eastern Entrance	The new entrance to Central Station which is described in section 2.3.3(b)v of the SWTC.
Eastern Stairs Entrance	The existing entrance to Central Station from Elizabeth Street (opposite Kippax Street), which connects to the Eastern Suburbs Railway Concourse and the North Concourse.
Eastern Suburbs Railway (or ESR) Concourse	The existing concourse at Central Station that runs between the South Concourse and the Elizabeth Street Entrance.

Term	Meaning
ESR 'Ghost' Platforms	The existing redundant platforms beneath the ESR Concourse.
Elizabeth Street Entrance	The existing entrance to Central Station from Elizabeth Street (opposite Foveaux Street), which connects to the Eastern Suburbs Railway Concourse and the North Concourse.
Emergency Operation	The state of trains operating in response to a major safety or security related event.
Emergency Services	Any or all of Fire and Rescue NSW (FRNSW), NSW Police Force, Australian Federal Police, Ambulance Service of NSW, and the NSW State Emergency Service (SES).
Enabling Works	The works delivered by others on behalf of the Principal ahead of the commencement of construction of the Project Works.
Enclosed Space	A room, space or area typically but not necessarily, bounded by walls and a roof, in which without mechanical systems, heat, contaminants, stale air, or smoke could accumulate.
Extreme Event Egress Scenario	An emergency egress event considered beyond credible or of extremely low likelihood, however if the scenario is likely to have a high consequence, it is appropriate to consider if there are reasonably practicable fire safety mitigation measures that can be applied in order to demonstrate SFAIRP.
Extreme Event Fire Scenario	A fire event considered beyond credible or of extremely low likelihood, however if the scenario is likely to have a high consequence, it is appropriate to consider if there are reasonably practicable fire safety mitigation measures that can be applied in order to demonstrate SFAIRP.
Fire Control Room	The existing fire control room for Central Station, located in Eddy Avenue.
Fire Engineering Brief (or FEB)	A document that defines the scope of work for the fire engineering analysis. Its purpose is to set down the basis, as agreed by the relevant stakeholders, on which the fire safety analysis will be undertaken. As described in the IFEG and AS4825 and Appendix B5 to the SWTC.
Fire Engineering Report (or FER)	The core document recording the fire safety design. It records the relevant project parameters, features and safety provisions, design inputs and assumptions, and the concepts behind the design. The FER documents the analysis outcomes and demonstrates and concludes that the fire safety design meets the level of performance and acceptance criteria agreed in the FEB. As described in the IFEG and AS4825 and Appendix B05 to the SWTC.

Term	Meaning
Fire Hazard Properties	The properties of a material or assembly that indicate how they behave under specific fire test conditions and includes combustibility, average specific extinction area, critical radiant heat flux, flammability index, smoke-developed index, smoke development rate, spread-of-flame index, group number, and smoke growth rate index, as defined in the BCA.
Fire & Rescue NSW (or FRNSW)	The State Government agency responsible for the provision of fire, rescue and hazmat services in cities and towns across New South Wales or any other entity appointed to undertake some or all of the functions of that agency.
Fire Resistance Level (FRL)	A measure of the fire performance of structural element or barrier expressed in 'theoretical' minutes based on a standardised lab furnace test defined in AS1530.4. Comprises of: structural adequacy (ability to maintain load carrying capacity) / integrity (ability to prevent the spread of flame) / insulation (ability to prevent the passage of heat via conduction).
Fire Safety Systems	<p>All systems and measures used to mitigate the risk of fire. Includes:</p> <ul style="list-style-type: none"> • integration with fire safety elements of rail systems, rolling stock and operations; • means of escape, including exit routes, exit widths, and fire protection of exit routes; • fire compartmentation and fire resistance; • fire hazard properties of materials; • smoke control; • fire suppression systems, including sprinklers and gaseous suppression; • automatic fire detection; • occupant warning systems; • emergency lighting and signage; • fire fighting access and facilities; • first attack firefighting equipment; • emergency and other fire related power requirements; • fire incident management; and • fire related operational requirements, maintenance and housekeeping.

Term	Meaning
First Responders Emergency Information Kit (or FREIK)	A Sydney Trains document to provide information for emergency services on arrival concerning layout of features and location of services.
Fire and Life Safety (or FLS)	The generic term adopted within the transport infrastructure industry describing the field of fire safety engineering.
Fractional Effective Dose (or FED)	A probabilistic time-integrated value used to estimate the accumulated hazard associated with inhalation of toxic gases or heat exposure on people.
Forecourt Entrance	The existing entrance to Central Station on the west side, which connects to the Grand Concourse.
Gateline	One or more gate arrays forming a barrier line dividing paid and unpaid areas of a railway station.
Grand Concourse	The existing concourse at Central Station located to the north of the Intercity Platforms. For the purposes of the SWTC, the Grand Concourse includes the unpaid and paid areas.
Help Point	An interface where a customer may request information of assistance from the Operator.
Heritage Conservation Management Plan (or HCMP)	As given in section 3.3 of Appendix B06 to the SWTC.
Heritage Interpretation Plan (or HIP)	As given in section 3.10 of Appendix B06 to the SWTC.
High Challenge Egress Scenario	Emergency egress scenarios that are unlikely to occur during the Design Life of the infrastructure but are assessed to test the sensitivity of assumptions made in the development of Design Egress Scenarios.
High Challenge Scenario	Fire scenarios that are unlikely to occur during the Design Life of the infrastructure but are assessed to test the sensitivity of the fire effects and assumptions made in the development of Design Fire Scenarios.
Human Factors	The discipline that applies knowledge of human capabilities and limitations to the design, operation and maintenance of technological systems.
Intercity Concourse	The existing concourse at Central Station located to the north of existing platforms 8/9, 10/11, 12/13 and 14,15, which provides connection between the Grand Concourse and the North Concourse.

Term	Meaning
Intercity Platforms	The existing platforms 1, 2/3, 4/5, 6/7, 8/9, 10/11, 12/13 and 14/15, including adjustments required by the Contract.
Interface Requirements Specifications (or IRS)	The documents of that name included in Appendix E01 to the SWTC.
Interface Schedules	The schedules included as Appendices E01 and E02 to the SWTC which detail responsibilities of the CSM Contractor and Interface Contractors in relation the Interface Work.
Interchange	The area where customers access the public transport network, transfer between modes or services, and connect to urban centres as part of their journey.
International Standards	The international standards published by the International Organization for Standardization.
Kiss and Ride	A dedicated limited time parking bay near a public transport mode for picking up or dropping off Customers.
Likelihood Return Period	An estimate, typically determined through a risk based statistical assessment, of the likelihood of an event occurring within a particular period of time
Loads	The Sydney Metro City & Southwest electrical power consuming devices or points which are connected to a final sub-circuit of the LV Distribution System.
Loft Building	The existing building which is generally known by that name and which is located at the north end of existing platforms 14/15.
LoS	The level of service as set out in "Pedestrian planning and design" by John J. Fruin.
LRV	Light rail vehicle as part of the Sydney Light Rail Project
Metro Utility Service	A Utility Service required for the operation and maintenance of the Metro Station.
Metro Station	The new underground metro station for the Sydney Metro City & Southwest located under Central Station.
Metro Station Works	The elements of the Project Works set out in section 2.3.1 of the SWTC.
Minimum Clear Height (or MCH)	The vertical distance between the finished floor level and the underside of the element of lowest obstruction (excluding suspended signage).

Term	Meaning
Minimum Clear Width (or MCW)	The dimensional criteria stated in this SWTC and further illustrated in the SWTC Drawings and Contract Schedules.
Minimum Dimension (or MD)	The dimensional criteria stated in this SWTC and further illustrated in the SWTC Drawings and Contract Schedules.
New South Wales Police	The State Government agency responsible for policing in NSW
Normal Load	Those Loads not defined as either Safety Service Loads or Operations Critical Loads.
Normal Operation	The general state of daily running of the trains, taking into account minor delays and disturbances.
North South Concourse	The new north south concourse at Central Station which is described in section 2.3.2(b)vii of the SWTC.
North Concourse	The existing concourse at the north end of Central Station which extends from the Northern Entrance to the entrance from Elizabeth Street and connects to all suburban platforms.
Northern Entrance	The existing entrance to Central Station which addresses Eddy Avenue Plaza and connects with the North Concourse.
Northern Y-Link Tunnel	The existing pedestrian tunnel which connects the Southern Intercity Interchange Tunnel to existing platforms 16/17 and 18/19.
Occupants	Any person within a facility who may need to evacuate in a fire event. Includes passengers, members of the public in transit, Sydney Trains staff, Sydney Metro City & Southwest staff, and unauthorised members of public. Excludes emergency services personnel attending the incident.
Occupied Spaces	An Enclosed Space, area, or room, but excluding workshops and secondary revenue spaces, which is intended or anticipated to be occupied for more than 30 minutes by any one person on any occasion in any operating mode.
Olympic Tunnel	The existing Customer tunnel at Central Station that runs between the Eastern Suburbs Railway Concourse and the Northern Baggage Tunnel.
Operations Critical Load	Those Loads that are required to be kept operational to facilitate normal operations and are not classified as Safety Service Loads.
.pdf	Electronic personal data format.
Pitt Street Entrance	The existing entrance to Central Station on the north side, which connects to the Grand Concourse.

Term	Meaning
Place Of Relative Safety	A place considered to provide a comparatively reasonable degree of protection to Occupants from the hazards of a fire event, through means such as physical barriers, separation distance or the effect of other Fire Safety Systems.
Platform Clearance	The time from the first person onto a platform to the last person onto the VT.
Platform Screen Door (or PSD)	A screen door system creating a barrier between a platform and the rail corridor.
Predicted Effects	As given in section 3.3(c) of the SWTC.
Proof Engineer	As defined in section 2.5.2 of Appendix B05.
Public Art Master Plan	The plan of that name, as updated from time to time in accordance Appendix B11 to the SWTC.
Public Domain	General publicly accessible areas not within Station Precinct areas.
Qualified Fire Engineer (or QFE)	The fire safety engineer engaged by the SSJ Contractor with responsibility for the development of the FLS strategy and the production of all FLS Design Documentation.
Qualitative Assessment	The subjective and non-numerical analysis and evaluation of a given fire scenario or fire safety issue. Typically utilising a logic-based justification.
Quantitative Assessment	The numerical analysis and evaluation of a given fire scenario or fire safety issue. Typically utilising calculation and computer modelling.
Rail Emergency Response Unit (or RERU)	Specialist team based next to Central Station, trained to deal with emergency situations, including fire, on the Sydney Trains network.
Rail Infrastructure	All systems, services and structures required for the operation of the rail network.
Railway Square Entrance	The existing entrance to the Devonshire Street Tunnel from Railway Square.
Reduced Level (or RL)	The reduced level in terms of the survey datum for the Project Works.

Term	Meaning
Redundancy	<p>Redundancy for a system is defined as 'N-x', where:</p> <p>(a) "N" is the number of items, components or sub-systems required to be operational to ensure all Operations Activities can be undertaken; and</p> <p>(b) "x" is the number of items, components or sub-systems that may 'fail' or be removed from service without affecting or reducing the Operations Activities.</p> <p>The term 'fail' above, includes but is not limited to:</p> <p>(c) electrical faults;</p> <p>(d) mechanical damage; and</p> <p>(e) fire damage.</p>
Retail Project Manager	The manager of that name to be appointed by the CSM Contractor in accordance with the requirements of Appendix B14 to the SWTC.
Retail Provisioning Plan	The plan of that name to be prepare by the CSM Contractor in accordance with the requirements of Appendix B14 to the SWTC.
Retail Provisioning Report	As given in section 2 of Appendix B14 to the SWTC.
Retail Strategy	The Sydney Metro City & Southwest Retail Strategy
Rolling Stock	The trains, infrastructure maintenance vehicles and any powered or non-powered vehicle that can be moved on the rail.
Rolling Stock Officers Building	The existing building which is generally known by that name and which is located in the Sydney Yard Cess Area.
Room Data Sheets	The data sheets describing requirement for rooms which are included in Appendix F03, F04 and F05 to the SWTC.
Room Schedules	The schedules describing requirement for rooms which are included in Appendices F01 and F02 to the SWTC.
RT01 and RT02	Running tunnel 01 and running tunnel 02 to be constructed as part of the TSE Works. Also refer to the drawings NWRLSRT-PBA-SHC-TU-DWG-930050 to NWRLSRT-PBA-SHC-TU-DWG-930053 and 930060 included in Appendix D1 to the SWTC.
Safety Service Load	Those Loads as defined by AS/NZS 3000 – Australian/New Zealand Wiring Rules.
Signalling Sighting Committee	As given in the ASA Standards.

Term	Meaning
Site Incident Management Plan (or SIMP)	A Sydney Trains document designed to provide an easy to follow process for staff to respond to any incident that may occur on the site until the appropriate emergency service agency arrives to assume control.
So Far As Is Reasonably Practicable (SFAIRP)	The risk management principle whereby the degree of risk in a particular situation can be balanced against the time, trouble, cost and physical difficulty of taking measures to avoid the risk.
South Concourse	The existing concourse at the south end of Central Station which extends from the Unpaid ESR Concourse to the ESR concourse, Southern Suburban Baggage Tunnel and Southern Suburban Interchange Subway.
Southern Intercity Interchange Tunnel	The existing pedestrian tunnel which connects Intercity Platforms 4/5, 6/7, 8/9 and 10/11 to the Southern Suburban Interchange Tunnel.
Southern Suburban Baggage Tunnel	The existing pedestrian tunnel which connects platforms 16/17, 18/19, 20/21 and 22/23 to the South Concourse.
Southern Suburban Interchange Tunnel	The existing pedestrian tunnel which connects the Southern Intercity Interchange Tunnel to the South Concourse near the South Concourse and platforms 12/13, 14/15, 16/17, 18/19, 20/21 and 22/23.
Special Event	As given in section 5.20 of the SWTC.
Station Precinct	Central Station and it's contextual surroundings.
Stray Current	The current produced by the Traction Power Supply system that follows paths other than the Traction Return circuit.
Suburban Platforms	The existing platforms 16/17, 18/19, 20/21, 22/23 and 24/25, including adjustments required by the Contract.
Sustainability Manager	The manager of that name appointed to that role in accordance with the requirements of Appendix B07 to the SWTC.
SWTC Drawings	The drawings included in Appendix D01 to the SWTC.
Sydney Transformer Rooms No1 and No2	The substations generally known by that name.
Sydney Metro OCC	The operations and control centre for the Sydney Metro, which is located at Cudgegon.
SYAB Traffic Management and Safety Plan	The management plan of that name to be prepared and implemented by the CSM Contractor in accordance with the MR-PA (Annexure D, Table 1)

Term	Meaning
Technical Maintenance Plan	As given in Annexure A in Appendix B12 to the SWTC.
Tolerable	A descriptor of a risk level as defined in the TfNSW North West Rail Link Integrated Management System (IMS) Project Safety Management Plan (PSMP) Safety Risk Management Standard
Traction Power Supply	A power supply system containing substations with rectification equipment to convert high voltage AC power to DC including all protection, control and isolation equipment. The Traction Power Supply provides power to the trains via electrification equipment.
Traction Return	A circuit forming the return leg of traction current from Rolling Stock to the Traction Power Supply. The circuit includes the main traction return bar at a traction substation and the cable connection to the running rails.
Transport Management Centre (or TMC)	The department within TfNSW responsible for the monitoring and management of the NSW State road network, and the monitoring and coordination of Sydney's public transport operations across trains, buses, ferries and light rail.
TSE Contractor	The contractor engaged by the Principal to deliver the TSE Works.
TSE Works	The tunnels and stations excavations works package included in the Sydney Metro City & Southwest.
Up	The direction of trains towards Central Station.
Vertical Transport (or VT)	Lifts, escalators, stairs and ramps, and banks of each.
Water Efficiency Labelling and Standards (or WELS)	A mandatory labelling scheme identifying the water efficiency of all tapware and water consuming equipment.
Water Servicing Coordinator (or WSC)	A person or firm authorised by Sydney Water Corporation to provide a service or perform work in relation to Sydney Water Corporation's infrastructure.
West Concourse	A proposed future concourse which would link the North South Concourse to the .Western Forecourt.
Western Connection	means the West Concourse and the Western Connection together.
Western Entrance	A proposed future entrance to Central Station from the Western Forecourt.

Term	Meaning
Western Forecourt	The existing forecourt on the western side of Central Station and adjacent to Pitt Street.

Table 2 – Acronyms

Term	Meaning
ABWF	architectural builder's works and finishes
AFA	automatic fire alarm
AFFL	above finished floor level
AFILS	audio frequency induction loop system
AC	alternating current
ACCB	AC circuit breaker
AGS	Association of Geotechnical and Geo-environmental Specialists.
AHD	Australian Height Datum
AHU	air handling unit
AI	analogue input
AIS	Asset Information System
ALIM	audio line isolation module
ALARP	as low as reasonably practical
AMI	asset management system
AO	analogue output
ARI	average recurrence interval.
ATRICKS	advances train running and information control system
BMS	building management system
CALD	culturally and linguistically diverse
CBMS	condition based monitoring system
CCR	central control room.
CCS	central control system
CCTV	closed circuit television system
CLD	cash load device.

Term	Meaning
COM	communication system
CPTED	crime prevention through environmental design.
CSD	combined services drawings
CSM	central station main works
CSR	combined services route
DAS	distributed antenna system
DC	direct current
DCCB	DC circuit breaker
DI	digital input
DLA	dynamic load allowance.
DO	digital output
DP switch	double pole switch
E&M	electrical and mechanical
EAC	electronic access control
EACS	electronic access control systems
ECS	environmental control system
EMC	electromagnetic compatibility
EMI	electromagnetic interference
ERP	end return panel
ESS	essential supply / emergency stop switch
ETS	electronic ticketing system
EWD	end walkway door
FCR	fire control room
FIP	fire indicator panel
FFL	finished floor level

Term	Meaning
FLS	fire and life safety
FP	fixed panel
FRL	fire life rating
FTE	full time equivalent
GDA	Geocentric Datum of Australia
GPO	general purpose outlet.
HIA	heritage impact assessment
HMI	human machine interface
HV	high voltage
HVAC	heating, ventilation and air-conditioning
IBP	integrated backup panel
IDS	intrusion detection system
IRS	interface requirements specification
I/O	input output
IP	internet protocol
KE	kinematic envelope
LAN	local area network
LED	light emitting diode
LMCP	local motor control panel
LV	low voltage
MCB	miniature circuit board
MCC	motor control centre
MGF	mechanical gap filler
MIV	motorised isolation valve
NMA	network amplifier module

Term	Meaning
Non-ESS	non-essential supply
NTI	next train indicator
OA LAN	office automation
OCC	operations control centre
OCDN	operational critical data network
OHW	overhead wiring
OHWS	overhead wiring structures
OSD	over site development
PA	public address
PAS	public address system
PCS	power control system
PEB	platform edge barrier (three quarter height platform screen door)
PI	platform indicator screen
PIDS	passenger information display system
PIR	passive infrared sensor
PLC	programmable logic controller
PIN	personal identification number
PgMT	programming and maintenance terminal
PMF	probable maximum flood.
PSD	platform screen doors
PTW	permit –to-work
PV	photovoltaic
RAD	radio system
RAMS	reliability, availability, maintainability and safety.
RC	rolled channel

Term	Meaning
RCCB	residual current circuit breaker
RI/O	remote input/output unit
RMC	Rail Management Centre
RT	reverberation time
RTU	remote terminal unit
SCADA	supervisory control and data acquisition
SCR	station control room
SCpR	station computer room
SEM	structural electrical and mechanical drawings
SER	signalling equipment room
SMCS	station management control system
S/O	socket outlet
SPI	station passenger information system
SPN	single pole and neutral
SSC	southwest station and corridor
SSJ	Sydenham Station & Junction
SSISEP	sound system and intercom system for emergency purposes
SSR	station security radio
SW	switch
TB	terminal block
TCP/IP	transmission control protocol/internet protocol
TMC	traffic management centre
TP	traction power
TPN switch	triple pole and neutral
TLS	train location system

Term	Meaning
TVF	tunnel ventilation fan
TVS	tunnel ventilation system
UHF	ultra-high frequency.
UPS	uninterruptible power supply
UV	ultra violet
VAC	ventilation and air conditioning
VDU	visual display unit
VMS	variable message sign
VTS	vertical transport system
VVVF	variable voltage variable frequency

Sydney Metro City & Southwest

Central Station Main Works

Schedule C1

Scope of Works and Technical Criteria
Appendix B01
Civil and Structural Works

PROJECT	Central Station Main Works	DATE	20 February 2018
GROUP	Sydney Metro City & Southwest	STATUS	Final
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1. Overview

- (a) This Appendix B01 addresses civil and structural works included in the Project Works and the Temporary Works.
- (b) This Appendix B01 is structured as follows:
 - (i) general civil and structural requirements;
 - (ii) design loadings;
 - (iii) structural requirements for:
 - A. boxes, shafts, tunnels, concourses, platforms and entrances;
 - B. retaining structures including soil nail and rock bolt walls, reinforced soil walls, gravity walls, cantilever walls, abutment walls and piled walls;
 - C. steel structures including overhead wire structures, temporary services bridges and canopy structures;
 - D. building works including provision for Eastern Entrance OSD; and
 - E. structural works associated with services installations;
 - (iv) civil requirements for:
 - A. hydrology and drainage works, including Track drainage, road drainage, overland flow, platform canopy drainage, onsite detention storage, temporary watercourse diversions, retaining wall drainage, water quality facilities, and augmentation of the existing drainage systems to suit the new works;
 - B. earthworks, including cuttings, fill embankments, and formation works;
 - C. access roads;
 - D. roadwork, footpath, cycleway, parking and pavement;
 - E. fences and gates;
 - F. civil works associated with Utility Services installation and modification to existing; and
 - G. civil works associated with combined services route and local cable route.

2 Performance and Technical Requirements

2.1 General

- (a) Building structures must be designed to satisfy the structural robustness performance requirements of the Building Code of Australia Part B1 Structural Provisions clause BP1.1 (a) including provision of redundancy, minimum resistance and protective measures and prevention of progressive collapse.
- (b) All civil and structural elements must be designed and constructed to ensure that all planned maintenance can be carried out outside Normal Operation or can be carried out without affecting the operation of trains during Normal Operation.
- (c) The CSM Contractor must allow for loads, fixtures and fitments arising from maintenance access requirements including access equipment, gantries, fall arrest roof fittings and rope access fittings.
- (d) Permanent structural elements including ground anchors, rock bolts, soil nails, and batters are not permitted to extend outside of the Site.
- (e) Permanent structural elements are not permitted within the structure gauge. Where any permanent structural element is proposed adjacent to, above or below the structure gauge, the structure gauge must be submitted by the CSM Contractor as part of the Design Stage 1 Design Documentation.
- (f) Structures must be designed such that settlement and heave during all stages of construction and throughout the Design Life of the structure is kept to the design limits.
- (g) Fatigue design assessments must be considered for all structures subjected to oscillating and/or traffic loads in accordance with the applicable Codes and Standards.
- (h) Epoxy anchors, or other forms of structural anchorage which are reliant on adhesion, must not be used to support tensile loads imposed by structural elements where the failure of the structural element may result in a risk to life or reduction in operational performance.
- (i) All temporary ground anchors installed to support station box and station shaft excavations must be destressed by the CSM Contractor.
- (j) The design of concrete structures with a Design Life of 100 years or more must be in accordance with durability requirements of AS5100.5:2017. For structures with a Design Life of 50 years or less the durability requirements of AS3600 may be adopted.
- (k) The CSM Contractor must comply with the following concrete durability requirements:
 - (i) all concrete must have a peak temperature of not greater than 70°C during initial curing to limit the potential detrimental effects of delayed ettringite formation (DEF);

- (ii) to limit the potential for early-age cracking, the temperature differential across the cross-section of the concrete member being constructed must not exceed 28°C during the curing period; and
 - (iii) all concrete elements with a least dimension exceeding 600 mm must be modelled to ensure that the estimated crack width does not exceed 0.2 mm for water retaining elements and 0.3 mm for others.
- (l) Concrete used in all civil and structural works must meet the requirements of AS5100.5:2017 or RMS Specification D&C B80 whichever is the more onerous and the requirements set out in Table 1.

Table 1 Maximum Cementitious Content

Concrete Strength Grade	Maximum Cementitious Content (mass in kg per cubic metre of concrete)
20 MPa	280
25 MPa	310
32 MPa	360
40MPa and 50 MPa	450
65 MPa and 80MPa	500

- (m) The cement content in all concrete used in the Project Works and the Temporary Works must contain fly ash or ground granulated blast furnace slag, in compliance with the following requirements:
- (i) for concrete elements that are nominally thicker than 600 mm, excluding local discrete thickening, and where the design water/cementitious ratio is less than 0.40, the cementitious content must contain at least 50% flyash or 70% slag;
 - (ii) for concrete elements less than or equal to 600 mm in thickness, the cementitious content must contain at least 25% flyash or 50% slag; and
 - (iii) concrete elements that have a fly ash content which is greater than or equal to 50% of the total cementitious content and/or a slag content which is greater than or equal to 70% of the total cementitious content must receive a minimum of 7 days of continuous moist curing after casting.
- (n) Concrete finishes for formed surfaces must meet the requirements of AS 3610.1 Formwork for concrete. Classes of finish for formed concrete surfaces must be in accordance with Appendix B03.
- (o) A table summarising the design findings of the main structural elements must be included in the Design Documentation. The design findings for each of the main structural elements must identify the critical design effects (including shear, bending moments) and their locations together with the associated governing load case. The design findings must also include a comparison of the critical design effects with the structural capacity for each of the main structural elements as well as any comments that may be relevant.

■	[REDACTED] [REDACTED]
■	[REDACTED] [REDACTED] [REDACTED]
■	[REDACTED]
■	[REDACTED] [REDACTED] [REDACTED] [REDACTED]
■	[REDACTED]
■	[REDACTED] [REDACTED]
■	[REDACTED]
■	[REDACTED] [REDACTED] [REDACTED]
■	[REDACTED] [REDACTED]
■	[REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]
■	[REDACTED]
■	[REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]
■	[REDACTED] [REDACTED] [REDACTED]
■	[REDACTED] [REDACTED] [REDACTED]
■	[REDACTED]

2.3 Boxes, shafts, tunnels, concourses and entrances

2.3.1 General

- (a) The Metro Station, North South Concourse and Central Walk Works structures may be designed as drained or undrained (tanked). If drained, the drainage system must be designed to comply with the requirements in section 2.8.

2.3.2 Waterproofing

- (a) Sheet waterproofing membrane systems must include a geotextile fleece, or other such suitable drainage / protection layer, fixed to the lining substrate and a sheet waterproofing membrane fastened to the geotextile fleece.
- (b) The geotextile fleece must be fixed onto the lining substrate with non-projecting disks or other approved fixings. The disks must be secured through the geotextile fleece and into the lining substrate. The disks must be made of a compound that allows the sheet waterproofing membrane to be fully welded to the surface of the disk.
- (c) Sheet waterproof membranes must consist of a continuous impermeable heat-welded sheet formed from one of the following materials:
 - (i) soft polyvinyl chloride (PVC) unreinforced;
 - (ii) flexible polyolefin (FPO/TPO) unreinforced;
 - (iii) high-density polyethylene (HDPE);
 - (iv) ethylene copolymer bitumen (ECB); or
 - (v) very low density polyethylene (VLDPE).
- (d) Sheet waterproof membranes as supplied must be of such dimensions and shape that will result in a minimum of on-site seam welds.
- (e) The lining substrate surface must be prepared for fixing of the geotextile fleece in accordance with geotextile fleece manufacturer's instructions. All fixtures must be removed from the lining substrate prior to application of the geotextile fleece. Any core holes must be backfilled with mortar to be flush with the surface of the lining substrate.
- (f) All sheet waterproof membrane overlaps must be welded in accordance with the sheet waterproof membrane manufacturer's instructions. Two lines of weld must be used on each joint, forming a double seam.
- (g) Where protrusions through the sheet waterproof membrane are required, they must be fitted with collars to maintain the watertightness of the sheet waterproof membrane systems.
- (h) Field trials must be undertaken to demonstrate the capability of the equipment, workmanship, materials and application methods of the sheet waterproof membrane systems under field conditions.
- (i) Specific quality control and assurance procedures must be established to ensure the integrity, durability and capacity of the sheet waterproofing membrane systems. Any sheet waterproof membrane not meeting specified requirements must be removed, including any associated water management measures or smoothing layer, and replaced. The cause of the non-conformance must be rectified before placing any further sheet waterproof membranes.

- (j) Joints between structure types, including between new and existing structures, must achieve the required watertightness at the joint as described in Table 2 below.

2.3.3 Watertightness of structures

- (a) The Project Works must achieve the watertightness grades specified in Table 2 below.

Table 2 Watertightness Grades

Element	Watertightness Grade
Roofs	A
Walls in BOH rooms	A
Walls in public spaces including concourse walls	A
Metro Station box wall –tunnel interface	A
Base slabs	A
Ventilation plenums	B
Retaining walls in open cutting(s)	B
Sumps	C
Joints between existing and new structures	A
Other areas not stated above	A

- (b) The watertightness grades referred to in Table 2 above are defined by the acceptable indications of water on the concrete surface as follows:
- (i) **Grade A:** watertight with the complete absence of any leakage, seepage and damp patches;
 - (ii) **Grade B:** water indications limited to minor damp patches with no visible flow of water or water drips; and
 - (iii) **Grade C:** water indications limited to damp patches on the faces of interior surfaces and to some minor weeping.
- (c) The CSM Contractor's Activities must limit the effect on the groundwater regime during construction, maintenance and operation such that there is no adverse effect on the natural or built environment beyond that permitted by the Contract.

2.3.4 Direct drilling requirements

- (a) Where applicable, the Project Works must allow for fixing of services, finishes or the support of other structures using anchors.
- (b) Anchors must not be "shot" (fired) or post-drilled into the structures.
- (c) The embedded depth of anchors must have no adverse impact on structural integrity, durability or watertightness.

2.3.5 Column locations

- (a) The location and spacing of columns must be in accordance with Appendix B03.

2.3.6 Provision for future west concourse

- (a) The CSM Contractor must make structural provision for the future connection of the West Concourse in accordance with Appendices B03 and B15.

2.3.7 Tunnel Portals of the Metro Station

- (a) The CSM Contractor must construct and integrate the tunnel portal structures with RT01 and RT02 in accordance with SWTC Drawing TSE-JHO-TUN-TS-DRG-5002 (Revision 01).
- (b) The work in paragraph (a) must include incorporating the tunnel portal structures with the supply, installation and ongoing operation of:
 - (i) ventilation shafts, nozzles and structural supports in accordance with section 3.2 of SWTC Appendix B04b and the Metro Station Room Schedules and Room Data Sheets in SWTC Appendices F1 and F3;
 - (ii) tunnel, rail and FLS systems;
 - (iii) the emergency egress walkways as per SWTC Appendix B03; and
 - (iv) tunnel and track drainage systems as per SWTC Appendix B04b.

2.4 Retaining structures

- (a) Soil supporting structures for the excavations must comply with the requirements in AS 5100.3:2017 Bridge Design - Part 3: Foundations and soil-supporting structures and AS4678 Earth Retaining Structures as a supplement to the AS5100.3.
- (b) Ground anchors used to provide excavation support must comply with the requirements of RMS Specification D&C B114 Ground Anchors, except that:
 - (i) the requirements of clauses 7.4.3, 9.4 and 12.3 of RMS Specification D&C B114 Ground Anchors do not apply;
 - (ii) the Design Life requirements identified in section 4.2 of the SWTC apply; and
 - (iii) references to "Project Verifier" are to be read as a reference to the Independent Certifier.
- (c) Soil nails used to provide excavation support must comply with the requirements of RMS Specification D&C R64 Soil Nailing, except that:
 - (i) the requirements in clauses 2.2.4 and 5.2.1 of RMS Specification D&C R64 Soil Nailing and any requirements relating to obtaining approval from the RMS Representative do not apply;
 - (ii) the Design Life requirements identified in section 4.2 of the SWTC apply; and
 - (iii) references to "Project Verifier" are to be read as a reference to the Independent Certifier.
- (d) Retaining structures must be designed and constructed to be free draining.

- (e) Retaining structures must be designed and constructed to make allowance for water pressure behind the wall due to a blocked drain scenario.
- (f) Weepholes and bored drains must be designed and constructed so that water from the weepholes and bored drains does not discharge on to the face of the retaining structure.
- (g) Where applicable retaining structures must allow for fixing of rail services and equipment using anchors with a maximum embedded depth of 125 mm with no adverse impact on structural integrity or watertightness.
- (h) The design of retaining structures must consider all adverse groundwater and surface water conditions that may occur during the Design Life.

2.5 Steel structures

2.5.1 Overhead wiring support structures

- (a) OHWS must comply with the requirements specified in the relevant ASA Standards including ASA Standard: THR CL 12040 ST – Overhead Wiring Structures and Signal Gantries.

2.5.2 Temporary services bridges

- (a) Temporary service bridges must be designed and constructed in accordance with the AS 5100 (Set) Bridge Design.

2.5.3 Canopy structures

- (a) Canopy structures must comply with the relevant Australian Standards including AS4100 and AS1170.
- (b) Canopy columns that are integral with OHWS must comply with section 2.5.1 above.
- (c) Canopies must be designed to resist hail loads in accordance with section 2.2 q)(ii) above.

2.6 Provision for Eastern Entrance Over Site Development (OSD)

- (a) The Eastern Entrance must be designed to make provision for future development over the site. Provision must be made for a commercial, office or residential building, whichever is more onerous, of the same height as the adjacent Dental Hospital.
- (b) The CSM Contractor's design must enable a future developer to build the OSD without interruption to the normal operation of the Eastern Entrance.
- (c) The roof slab must be designed, as a minimum, to accommodate the floor loading imposed by the future OSD development. The CSM Contractor must allow for a superimposed dead load of 1kPa UDL plus a live load of 4 kPa UDL or concentrated live load of 4.5 kN whichever is more onerous.
- (d) Any future OSD over the Eastern Entrance will be accessed and serviced from an adjacent property. Provision for escape stairs must be included in accordance with SWTC Appendix B03.
- (e) Passive provision for a future connection into the basement of the adjacent sites 1-7 Randle Street is to be included with a minimum width of 5m being required for a public passageway. Passive provision for a future station entrance from Randle Lane with access to lifts and for stairs to the Chalmers Street level concourse is also to be included.

- (f) The Eastern Entrance building foundations, columns and structural walls must meet the loading requirements for a commercial, office or residential building, whichever is more onerous, of the same height as the adjacent Dental Hospital. Walls and columns are to extend as stubs above roof level, with the stubs cast in weak concrete. The weak concrete must be able to be removed in the future to extend the structure upwards.
- (g) The CSM Contractor is to investigate the existing building stormwater attenuation features as part of a future OSD, during the detailed design stage. Provision must be made for new attenuation / on-site detention features if required, in order to ensure no net increase in discharge rates from existing discharge locations into the downstream drainage system for all storm events.
- (h) The CSM Contractor must provide a structural and constructability report that demonstrates the constructability approach a future developer may use to build above the roof level of the Eastern Entrance, without interruption to normal station operations including provision of all structural supports and constructability provisions.

2.7 Fire requirements

- (a) Structures must be designed to minimise the risk SFAIRP of structural failure from a fire event causing injury or fatality to passengers, staff, Emergency Services, unauthorised occupants, neighbours or general public in the vicinity.
- (b) Structures must be designed to minimise the risk SFAIRP of structural failure from a fire event resulting in significant property damage to Rolling Stock, rail infrastructure (irrespective of the operator) and neighbouring buildings, property and infrastructure.
- (c) The CSM Contractor must demonstrate and provide evidence in Design Documentation of how the design fire resistance requirements will be achieved for structures included in the Project Works. This demonstration must include results and certification from fire testing:
 - (i) undertaken by the CSM Contractor; or
 - (ii) undertaken by third parties of equivalent installations and configurations.
- (d) All new structures must comply with the fire safety provisions of AS5100.1:2017, AS5100.2:2017 and the BCA.
- (e) The existing ESR Concourse roof structure must be upgraded as part of the ESR Concourse works described in section 3.6.5 of Appendix B03, to achieve a minimum Fire Resistance Level (FRL) of 120/120/ to AS1530.4.
- (f) Metro Station box load-bearing structures that can be exposed to a train fire must meet the following design fire resistance requirements:

Criteria: the RABT-ZTV (rail) fire characteristics detailed in

- (i) **Table 3** below; and
- (ii) Performance: for concrete linings the depth of any spalling associated with a fire event (at any location) should not exceed a depth that results in the loss of structural integrity of the remaining structure exposed to a fire.

Table 3 RABT-ZTV (rail) Fire Characteristics

Time (Minutes)	Air/Gas Temperature (°C)	Temperature Modifier
0	15	Linear increase to t=5min
5	1200	Constant to t=60min
60	1200	Linear cool down from t=60min to t=170min
170	15	Constant
240	15	Constant

- (g) Structures referred to in clause (f) include as a minimum:
- (i) Metro Station box outer retaining walls below basement level B2 floor slab;
 - (ii) basement level B2 floor slab;
 - (iii) basement level B2 floor beams;
 - (iv) fire stair shaft below basement level B2; and
 - (v) escalator support beams.
- (h) Structures referred to in section 2.7(f) above do not include the platform structure.
- (i) All other structures in the Metro Station not included in section 2.7(f) and 2.7(g) must comply as a minimum with BCA requirements.

2.8 Hydrology and drainage

2.8.1 General

- (a) The hydrology and drainage for Central Walk Works and Central Station Works include:
- (i) trunk drainage pipes for track, canopies and platforms excluding any upgrades to drainage beneath roads 1 to 12;
 - (ii) track drainage including pipes, pits and impermeable surfaces;
 - (iii) water quality treatment facilities and/or modification to existing facilities, as required;
 - (iv) on site detention, pump sumps and attenuation storage or modification to existing;
 - (v) connections into downstream drainage systems, as required;
 - (vi) integration of water sensitive urban design elements;
 - (vii) drainage of walkways, concourses, footpaths, platforms roofs and canopies;
 - (viii) subsurface drainage systems for all new structures and buildings including strip drains, dimpled sheets, niches, slotted pipes and pits;
 - (ix) automatic flood barriers including sensors, controls and signals as required;

- (x) augmentation of the existing drainage system to suit the Project Works and Temporary Works including modifications to subsurface drainage due to the Metro Station box interface with Devonshire Street Tunnel and East Concourse interface with ESR Concourse;
 - (xi) identification, protection, relocation and/or adjustment of all existing drainage services, chartered or unchartered, which may conflict with the Project Works;
 - (xii) Eastern Entrance roof drainage, including attenuation features as required;
 - (xiii) pumps, sumps and rising mains including sensors, controls and signals are described in the 'Hydraulics' section of Appendix B04b; and
 - (xiv) drainage of escalators and lift pits are described in the 'Hydraulics' section of Appendix B04b.
- (b) The hydrology and drainage works for the Metro Station include:
- (i) Track drainage;
 - (ii) drainage of walkways, concourses, footpaths, platforms, roofs and canopies;
 - (iii) subsurface drainage systems for all new structures and buildings including strip drains, dimpled sheets, niches, slotted pipes and pits;
 - (iv) pumps, sumps and rising mains including sensors, controls and signals are described in the 'Hydraulics' section of Appendix B04b; and
 - (v) drainage of escalators and lift pits are described in the 'Hydraulics' section of Appendix B04b.
- (c) The drainage design must comply with:
- (i) Australian Rainfall and Runoff (2016);
 - (ii) Transport for New South Wales Sustainable Design Guidelines;
 - (iii) Sydney Water On-site Stormwater Detention Guide;
 - (iv) Sydney Water Stormwater Quality Targets Policy;
 - (v) City of Sydney Council Standards; and
 - (vi) Australian Standard AS3500.
- (d) The CSM Contractor must provide a drainage system for the Project Works which complies with the requirements of the Planning Approvals and avoids or minimises any potential damage or loss that may result from, or be contributed to, water discharge from the Site.
- (e) The following climate change requirements must be included in the flood assessment and drainage design:
- (i) increase the design rainfall intensities by a minimum of 10% for events up to the 100 year ARI;
 - (ii) proposed attenuation must incorporate allowance for a 10% increase to the proposed flow rate scenario. Assessment of existing flow rates should not include or apply any increase; and

- (iii) document the impact of increasing the design rainfall intensities by 20% and 30%.
- (f) The climate change requirements in section 2.8.1(e) apply to:
 - (i) all Metro Station drainage infrastructure;
 - (ii) Central Walk Works infrastructure that interconnects with the Metro Station;
 - (iii) Central Station Works infrastructure that interconnects with the Metro Station; and
 - (iv) existing Central Station infrastructure that interconnects with the Metro Station.
- (g) Discharge into external drainage systems must have no net flow rate increase for all storm events up to and including the design storm in Table 4 unless it can be demonstrated that increased flow rates would not increase downstream flood risk.
- (h) The Design Documentation must document an assessment of the broader impacts for PMF storm events.
- (i) Where there is an increase in discharges into external networks as a result of the CSM Contractor's Activities, the CSM Contractor must obtain approvals from relevant Authorities and asset owners.
- (j) Spillways to basins including appropriate scour protection, must be designed to provide controlled discharge of flows for events up to and including the design storm in Table 4.
- (k) The drainage works must be compatible and comply with the requirements of the 'Hydraulics' section of Appendix B04b.
- (l) The drainage systems must be designed for vehicular and/or imposed loading, including from Rolling Stock, where appropriate.
- (m) All drainage grates in pedestrian areas must be non-slip and heel-safe types.
- (n) Drainage from the canopy, roof or platform areas must not discharge onto the ballast.
- (o) Roof and canopy drainage must incorporate overflow provisions to minimise additional weight due to rainwater ponding on the roof / canopy structure.
- (p) A rainfall fetch of 35 degrees must be allowed for in the Central Walk Works and Central Station Works drainage design at platform level. Drainage grates (if provided) must be away from areas not affected by the rainfall fetch to minimise nuisance water.
- (q) The CSM Contractor must interface and consider the designs of relevant stakeholders, including Sydney Light Rail and Interface Contractor(s) for hydrology and drainage works.
- (r) The drainage services from the following areas – surface tracks, N-S and East concourses, surface platforms, Metro Station platforms, canopies and roofs; must not discharge into the subsurface drainage system.

2.8.2 Average Recurrence Intervals

- (a) Drainage infrastructure elements must be designed to comply, as a minimum, with the design storm events as specified in **Table 4**.

Table 4 Design Average Recurrence Intervals

Item	Drainage Infrastructure	Design ARI
1	Drainage formation for the Rail Corridor, including on grade sections of Track- no surcharge above formation level	50 year
2	Drainage of Central Station platforms - no overtopping of channel grates	50 year
3	Drainage at Central Station Track slab areas- flood height to not exceed the underside of rail mortar pad or top of Track slab	50 year
4	Roof and canopy drainage- no overflow onto platform or tracks	100 year
5	Rainfall fetch and runoff- no entry into concourse and escalators	PMF
6	Flood immunity of station entrances entrances modified as part of the Project Works.	Greater of 100 year + 0.5m or PMF
7	Above ground rail system facilities	100 year + 0.5m
8	Impact to adjacent properties - no adverse increase	100 year
9	Discharge to external drainage systems- no adverse increase	100 year
10	Existing subsurface drainage intersected by Project Works – no water entry into the Project Works	PMF
11	Spillway to and from basin - controlled discharge and scour protection	100 year
12	Water quality treatment infrastructure	See clause b) below
13	Internal drainage - spoon drains	See clause c) below
14	Internal drainage - Metro Station Track drainage	See clause c) below

Item	Drainage Infrastructure	Design ARI
15	Scour protection	100 year

- (b) Water quality treatment infrastructure must comply with the relevant Authority requirements.
- (c) Items 13 and 14 in Table 4 are required to be designed to cater for inundation, i.e. from spills and localised cleaning.

2.8.3 Flood immunity

- (a) The Project Works must be designed such that the potential for flooding of any property up to the design storm event in Table 4 is not adversely increased by the presence of the Project Works or the Temporary Works in accordance with specific Contract requirements or conditions identified in the Environmental Impact Statement, the NSW Floodplain Development Manual (2005) and the relevant Council of the City of Sydney standards. The Project Works must be designed, where reasonable and feasible, to ensure that the Project Works do not worsen existing flood characteristics during construction and operation.

2.8.4 Drainage design modelling

- (a) The storm duration used for all drainage design must be the storm duration that produces the largest peak flows and levels.
- (b) Drainage design hydrologic / hydraulic modelling must be undertaken using a design program that provides a routed reach outlet hydrograph and models the following:
 - (i) pit / sump entry capacities and blockage factors;
 - (ii) bypass flows to next pits;
 - (iii) pipe and culvert size;
 - (iv) detention basins;
 - (v) overland flow times;
 - (vi) infiltration rates; and
 - (vii) rainfall losses.
- (c) Pipes that will run full must be analysed to determine their hydraulic performance. As a minimum, the analysis must include the identification of flow types and the production of hydraulic grade lines.
- (d) Pit entry and exit losses must be considered and addressed as part of the drainage design hydraulic modelling.
- (e) Catchment drawings must be provided within the Design Documentation and must include details on:
 - (i) existing and designed contours,
 - (ii) pit and pipe network layouts;
 - (iii) catchment areas;

- (iv) pervious and impervious areas and percentages;
- (v) overland flow times;
- (vi) extent of proposed drainage work; and
- (vii) coefficients of runoff.

2.8.5 Water quality

- (a) The drainage system must have pipe outlet inverts at levels that discharge either at or above the existing surrounding natural surface levels or into the surface drainage system. Where the drainage system outlets into a basin, the invert of the outlet must be at or above the basin spillway level.
- (b) Where drainage pipes discharge from an underground structure into the surface system, swan necks must be provided at a level above the PMF level.

2.8.6 Temporary drainage

- (a) Temporary drainage systems used for the CSM Contractor's Activities must be designed to the same criteria specified in this document for a minimum 2 year ARI or twice the anticipated construction period (in years), whichever is the greater.
- (b) All temporary drainage systems must satisfy the requirements of all relevant Authorities.

2.8.7 Subsurface drainage

- (a) The drainage system for the Project Works and Temporary Works must limit the effect on the groundwater regime such that there is no adverse effect on the natural or built environment beyond that permitted by the Planning Approval.
- (b) Groundwater and subsurface water collected from the Metro Station, East Concourse, Eastern Entrance and North South Concourse must discharge to the Sydney Metro Sydenham Water Treatment Plant via the Interface Contractor's Sydney Metro City and Southwest system-wide tunnel drainage system.
- (c) Subsurface drainage of existing infrastructure must not discharge to the Sydney Metro Sydenham Water Treatment Plant.
- (d) The subsurface drainage system must be designed such that surface water does not directly enter the subsurface drainage system.
- (e) Flush points must be provided at the upstream end for all subsurface drainage pipes at easily accessible locations for maintenance.

2.9 Earthworks and formation

- (a) Earthworks activities associated with road works must be in accordance with RMS Specification D&C R44.
- (b) Surcharge loading must be applied in accordance with Australian Standard AS 5100.2:2017 'Bridge Design - Design loads'.
- (c) All formations for retaining walls and cut and fill slopes must be designed to meet the design criteria of AS 5100.3:2017 'Bridge Design – Foundations and soil supporting structures'.
- (d) All earthworks must incorporate the urban design requirements under this Contract.

- (e) Protection of the earthworks from scour and erosion, both during and after construction must be incorporated into the Project Works.
- (f) Cuttings and embankments must be globally and locally stable throughout the Design Life with no foreseeable possibility of a failure involving the whole or part of the cutting or embankment.
- (g) Allowance for a minimum future excavation of 1m at the toe of embankments, and cuttings must be included for all permanent formation earthworks.
- (h) Stability of cut batters and fill embankments must consider long-term static groundwater conditions as well as the potential for extreme groundwater events due to flooding, broken services and the design storm events in Table 4.
- (i) Where batter slopes cannot be used within the limits of the Site, additional support measures such as retaining walls and rock anchors/bolts must be used.
- (j) Batter slopes, which are to be landscaped, must be no steeper than 3H:1V to facilitate maintenance and durability.
- (k) Batter slope designs must detail measures to prevent erosion of material from seams in cuttings that are prone to rapid weathering.
- (l) Earthworks for track formation must provide sufficient widths to accommodate all infrastructure along the Rail Corridor including provisions for future track expansion as required in the Contract.
- (m) Post-construction settlement of all track-supporting rail formation must not put onerous maintenance requirements on the rail operation.
- (n) Earthworks for Track formation must ensure positive drainage is provided to the Rail Corridor drains.
- (o) Earth backfill material must:
 - (i) be virgin excavated natural material;
 - (ii) be free of contamination;
 - (iii) have a maximum particle size of 100mm; and
 - (iv) be compacted to 95% of standard maximum dry density.
- (p) Where concrete is to be used as bulk fill or backfill, the concrete must have a compressive strength of no less than 10MPa determined in accordance with AS1012.9.

2.10 Access roads

- (a) Maintenance access must be provided to facilitate maintenance of Track and other rail infrastructure during Normal Operation and for Emergency Services access.
- (b) The width of the access roads must take into account additional width requirement for NSW Trains maintenance plant and machinery to access HV pole top locations.
- (c) Configuration of the access roads must provide for vehicle entry and exit points, turning circles and standing areas.

2.11 Roadworks

- (a) The CSM Contractor must provide a system of guide, warning and regulatory signs to allow wayfinding and permit enforcement of road speed, traffic movement and parking restrictions.
- (b) Pedestrian areas affected by the Project Works must have a maximum crossfall of 2.5%. Longitudinal fall must meet the requirements of AS 1428:2010 'Design for access and mobility, along disability routes'.
- (c) Cycleways within, surrounding and connecting to Central Station and associated Interchanges, adjoining roads and open spaces shall be designed to accommodate modelled volumes/demands in accordance with Australian Standards and Austroads Guidelines and consider TfNSW modal hierarchy, Sydney's Cycling Future and the Interchange Access Plan.
- (d) The Project Works must incorporate safe access for bicycle riders in accordance with the TfNSW modal hierarchy. This includes external elements such as placement and operation of crossings facilities, cycling connections and access.

2.12 Sydney Trains services search data

- (a) The CSM Contractor must undertake all necessary investigations using non-destructive investigation to identify and mark the locations and depths of all Utility Services prior to any works being carried out in any area within or adjacent to the Utility Services or the Rail Corridor.
- (b) The CSM Contractor must be the primary controller of the Sydney Trains Services Search Data and must engage the services of a registered surveyor from the Sydney Trains Surveyor Panel who has undertaken Sydney Trains Detailed Site Survey Training to undertake all survey activities.
- (c) The CSM Contractor's surveyor must:
 - (i) utilise the MGA (Map Grid of Australia) survey coordination system;
 - (ii) progressively update the Sydney Trains Services Search Data in accordance with Sydney Trains requirements to show installed / amended / removed Utility Services;
 - (iii) issue Sydney Trains Services Search Data field drawings to secondary controllers as and when required; and
 - (iv) prepare a final "as built" detailed site survey showing the final position and levels of all buried or hidden Utility Services in accordance with Sydney Trains detailed site survey requirements.

- Sydney Metro City & Southwest

Central Station Main Works

Schedule C1

- Scope of Works and Technical Criteria
Appendix B02
Rail, Rail Systems and Communications

PROJECT	Central Station Main Works	DATE	22 February 2018
GROUP	Sydney Metro City & Southwest	STATUS	Final
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1 Overview

- (a) This Appendix B02 describes the performance and design requirements for the following elements of the Project Works:
 - (i) Track;
 - (ii) overhead wiring;
 - (iii) signalling and train control;
 - (iv) communication systems; and
 - (v) a combined services route.
- (b) The performance and design requirements for Central Station Works and Central Walk Works rail, rail systems and communications are described in section 2 of this Appendix B02.
- (c) The performance and design requirements for the Metro Station Works rail, rail systems and communications are described in section 3 of this Appendix B02.

2 Central Station Works and Central Walk Rail, Rail Systems and Communications

2.1 General

- (a) The rail, rail systems and communications works for Central Station Works and Central Walk Works must, as a minimum, comply with all relevant Codes and Standards.

2.2 Track

- (a) The CSM Contractor's track works for Central Station Works and Central Walk Works must:
- (i) accommodate as a minimum an 8-car suburban train set for platforms 12 and 13;
 - (ii) maintain the overall length of Intercity Platforms 9, 10, 11 and 14 both during and after the CSM Contractor's Activities be in accordance with the Signalling Function Specification (SFS) described in section 2.4 of this Appendix B02; and
 - (iii) make provision for planned Track Possessions.
- (b) The Contractor must:
- (i) install new energy absorbing buffer stops to platform roads 9, 10, 11, 12, 13 and 14 ;
 - (ii) install new buffer stop track to tracks affected by the Central Station Works if required to comply with Section 12 - Track Requirements in ASA RailCorp Standard ESC 361 – Buffer Stops;
 - (iii) install new plain track as required for the CSM Contractor's Activities, to a minimum track structure classification of 60SW/CM/SL, in accordance with ASA Standards;
 - (iv) install new special trackwork as required by the CSM Contractor's Activities, to a minimum track structure classification of 60HW/CH/SM, in accordance with ASA Standards;
 - (v) install new direct fixed track in platform roads 13-14 above the Metro Station using ASA approved track components;
 - (vi) install new approach slabs at the ends of new track slabs to provide a gradual change in stiffness between ballasted and non-ballasted track;
 - (vii) undertake a noise and vibration assessment of all track affected by the CSM Contractor's Activities and any other existing track which have the potential to cause reverberated noise in the Project Works; and determine required attenuation to ensure compliance with the Contract;

- (viii) install noise and vibration attenuation as identified in the CSM Contractors' noise and vibration assessment;
 - (ix) realign the track and recondition the formation of the existing lines affected by the CSM Contractor's Activities; and
 - (x) remove and dispose of track made redundant by the CSM Contractor's Activities.
- (c) The CSM Contractor must provide a new hi-rail access point in the Sydney Yard Cess Area to replace the existing platform 15 hi-rail access point and must:
- (i) ensure the replacement access point is of a rubber composition;
 - (ii) ensure the replacement access point has a minimum length of 15m;
 - (iii) locate the replacement access point to between points 198 and 240B;
 - (iv) construct the replacement access point across both the Up and Down Bankstown Lines to ensure that it provides direct access from Sydney Yard laydown area to the Up and Down Bankstown Lines from a single point;
 - (v) ensure the replacement access point is commissioned prior to the decommissioning of the existing platform 15 hi-rail access point; and
 - (vi) construct the access point in compliance with ASA Standard ESC 520 and the requirements of Sydney Trains regarding track inspections.
- (d) Adjustments to existing platforms 16/17, 18/19, 20/21 and 22/23 must comply with ASA Standards and Appendix B03.

2.3 Overhead wiring (OHW)

- (a) The CSM Contractor must:
- (i) comply with the Interface Schedules;
 - (ii) provide new OHWSs and support registrations between B0+000 and B0+480 for platform roads 9-15, including crossover and turnouts 192, 193, 194, 195, 198, 203, 204, 205 and 206;
 - (iii) adjust the OHW system including structures between CE0+075 and SW0+212 for platform road 16 (Up suburban & crossover);
 - (iv) preserve the level of service and functionality of the existing OHW system and structures to platform roads 1-8 and 17-23;
 - (v) maintain the existing current carrying capacity for train operations;
 - (vi) ensure all new and modified OHWS resulting from the CSM Contractor's Activities are designed to be suitable for Sydney Yard OHW modernisation conductor systems, specifically structural loadings and configurations;
 - (vii) provide insulation at least 3m before all buffer stops;
 - (viii) remove OHW infrastructure made redundant by the CSM Contractor's Activities;
 - (ix) install fixed anchor free-standing anchor masts within concourse areas;

- (x) install secondary insulation to prevent any Traction Power Supply current entering the concourse and platform areas, with this current being diverted to rail; and
 - (xi) provide OHW supports for each track with independent mechanical registration suitable for use for the future Sydney Yard OHW modernisation project, including System 9 requirements. Polygon (head span) support systems must not be used.
- (b) In addition to the Design Documentation requirements specified in the MRs, the Design Documentation must include:
- (i) interim 1500V sectioning diagrams to suit construction staging; and
 - (ii) final 1500V sectioning diagrams.

2.4 Signalling and train control

- (a) The CSM Contractor must:
- (i) design and execute the CSM Contractor's Activities to comply with the Interface Schedules and the Signalling Functional Specification (SFS) contained in Attachment 1 of this Appendix B02 with the exception of the construction staging methodology which can be modified to suit the CSM Contractor's Activities;
 - (ii) complete and document a site survey of the Rail Corridor within the Site for the wayside signal equipment, signalling cable routes and pneumatic air system lines. Relocate impacted Assets as required to comply with ASA signalling standards;
 - (iii) where possible, avoid or minimise any impact on the existing signalling infrastructure;
 - (iv) form a Signal Sighting Committee and undertake signal sighting for the signals impacted by the CSM Contractor's Activities, in accordance with ASA signalling standards;
 - (v) implement the recommendations of the Signal Sighting Committee where the CSM Contractor's Activities impact on the signal sighting;
 - (vi) assess the requirement for warning lights and impacts on existing safe places, or the requirement to provide new safe places, as a result of the CSM Contractor's Activities; and
 - (vii) remove signalling infrastructure made redundant by the CSM Contractor's Activities.

2.5 Communications

2.5.1 General

- (a) The CSM Contractor must provide communication systems that:
- (i) is in accordance with the Interface Schedules;
 - (ii) provide secure voice, data and video communication;

- (iii) integrate and connect to third party communication system networks as required;
 - (iv) integrate into the existing communication system networks without causing Degraded Operation or Emergency Operation;
 - (v) can be upgraded without causing Degraded Operation or Emergency Operation;
 - (vi) support the CSM Contractor's Security Management Plan and the CSM Contractor's FLS Strategy;
 - (vii) are resilient and fault tolerant to ensure there is no loss of system functionality due to the failure of any individual component;
 - (viii) include protocols based on open standards and protocols or as required by Sydney Trains for specific systems; and
 - (ix) have suitable ingress protection ratings for the environment in which the communication systems are located.
- (b) The CSM Contractor must:
- (i) ensure all communication systems comply with the applicable electromagnetic compatibility (EMC) standards;
 - (ii) source all required information, analyse and mitigate EMC issues to demonstrate EMC of all new, adjusted or affected communication systems whilst performing the CSM Contractors' Activities;
 - (iii) terminate within patch panels, trays or enclosures and provide patch cord management; and
 - (iv) label and record documentation as defined within AS 3085.1.

2.5.2 Communication spaces

- (a) The CSM Contractor must:
- (i) make spatial, containment, mechanical and electrical system provisions for all temporary and permanent space requirements for new and relocated communication systems and third party communication systems in accordance with the Interface Schedules and the Room Schedules;
 - (ii) ensure communication rooms, communication equipment cupboard(s), and containment spaces for Sydney Trains communication systems are segregated from those required for Sydney Metro City & Southwest communication systems;
 - (iii) ensure that at Completion the trunk cable routes have a minimum of 50% unused capacity for future expansion;
 - (iv) ensure communications spaces comply with the requirements of ASA Standard T-MU-TE-21001-ST; and
 - (v) provide diverse cable routes for the communication systems requiring a redundant configuration, in accordance with ASA Standard T-MU-TE-21001-ST and T-MU-MD-20002-ST.

2.5.3 System Interfaces

- (a) The communication systems must be designed in accordance with the requirements of the Interface Schedules.
- (b) Sydney Trains' existing management of the Sydney Trains communications systems must be able to be extended to cover the new Sydney Trains managed areas that result from the Project Works.

2.5.4 Equipment rooms

- (a) The CSM Contractor must provide, in accordance with the Room Schedules, for Sydney Trains use:
 - (i) a new communications equipment room and equipment a new communications equipment cupboard;
 - (ii) a relocated communications equipment room CENA5, currently located within the ESR Concourse; and
- (b) The CSM Contractor must provide for third party communications providers use;
 - (i) a new communications equipment cupboard located in accordance with Sydney Metro City & Southwest requirements and cable length limitations for copper ethernet as defined in AS3080; and
 - (ii) a relocated communications equipment room CENA2, currently located within the ESR Concourse, in accordance with the Room Schedules.
- (c) The CSM Contractor must provide equipment room layouts and equipment room space requirements in the Design Stage 1 Design Documentation.
- (d) The equipment rooms must be environmentally controlled in accordance with ASA Standard T MU TE 21001 ST. Wherever forced-air ventilation or air-conditioning is used, the ECS must be designed with Redundancy in accordance with Appendix B04b.
- (e) The CSM Contractor must provide stand-by power sources to comply with Appendix B04b for all equipment rooms, classified as consequence rated C5 and C4 equipment rooms as defined in Transport Enterprise Risk Management (TERM).
- (f) The equipment rooms must be located as per the Australian Government Physical Security Management Guidelines – Security Zones and Risk Mitigation Controls.
- (g) Lighting levels must be provided by the CSM Contractor in accordance with Appendix B04a.
- (h) The CSM Contractor must provide a communications earth terminal (CET) and communications earth bar (CEB) in each communications room.

2.5.5 Local Area Networks (LAN) and local OCDN

- (a) The CSM Contractor must provide local area networks (LANs) that:
 - (i) support the required expansion or modification of Sydney Trains systems required by the Project Works; and
 - (ii) interface and are compatible with Sydney Trains operations critical data network (OCDN) where applicable.

2.5.6 Ultra High Frequency (UHF) radio systems

- (a) The CSM Contractor must provide new or adjust existing UHF radio systems as listed below:
 - (i) Sydney Trains station security radio (SSR);
 - (ii) Government Radio Network (GRN); and
 - (iii) NSW Police Service radio network.
- (b) The CSM Contractor must ensure that Sydney Trains station coverage for these systems is provided by the Central Station UHF DAS required in 2.5.7.

2.5.7 UHF distributed antenna system (UHF DAS)

- (a) The CSM Contractor must modify and/or extend the existing Central Station UHF DAS to provide UHF Radio systems coverage to all areas of the Central Station Works and Central Walk Works.
- (b) The Central Station UHF DAS must be separate to the UHF DAS that will be used by the future Operator of Sydney City and Southwest in areas of the Metro Station. The UHF DAS for the Operator of Sydney Metro City and Southwest is provided by others and detailed in Appendix B02 Section 3.5.6.
- (c) The Central Station UHF DAS coverage provided or modified by the CSM Contractor must meet the requirements of the following documents.
 - (i) Sydney Trains SSR:
 - A. Sydney Trains Engineering Specification SPM 0212 Version 1.1;
 - (ii) Government Radio Network:
 - A. Telco Authority Indoor Radio Services Design Guideline Version 1.0;
 - B. Telco Authority Public Safety Radio Coverage in Private Buildings and Public Spaces V1.0;
 - (iii) NSW Police Service radio network:
 - A. Customer Requirements Brief – Radio Facilities for NSW Police-NWRLOTS-NRT-SWD-RD-RPT-100464 Rev D (as applicable to the Sydney Trains environment);
- (d) The CSM Contractor must reinstate existing coverage to make it compliant if the CSM Contractors Activities negatively impact upon the existing coverage of the UHF DAS at Central Station and cause the coverage quality or area to no longer comply with the requirements in point b) above.
- (e) The CSM Contractor must ensure that the completed Central Station UHF DAS continues to provide above-ground coverage for SSR (as required in SPM 0212), but does not provide above ground coverage for the GRN and NSW Police beyond that required for successful hand-over to existing surface coverage. Note that the existing Central Station UHF DAS was designed only for SSR coverage and it does not meet this objective.
- (f) The CSM Contractor must also:
 - (i) perform all UHF DAS works in accordance with the Interface Schedules; and

- (ii) provide spatial provision and cable containment for all UHF DAS equipment in the nominated equipment room(s) in accordance with the Interface Schedules, including all spatial requirements, cable trays, cable racks, service risers, electrical requirements, fire suppression, ECS and fixtures and finishes.
- (g) The CSM Contractor must provide spatial provision and cable containment for all equipment required to support the UHF systems outlined in section 2.5.6 of this Appendix B02.
- (h) The CSM Contractor must, as a minimum, utilise the following equipment as part of the extended Central Station UHF DAS:
 - (i) coaxial and fibre optic cabling;
 - (ii) antennas;
 - (iii) amplifiers and fibre-fed repeaters;
 - (iv) combining units and splitters;
 - (v) feeder cables and other miscellaneous cabling;
 - (vi) isolating devices; and
 - (vii) cable containment.
- (i) The CSM Contractor must ensure the existing Central Station UHF DAS coverage is maintained during construction of the Project Works to the satisfaction of Sydney Trains and third parties.

2.5.8 Mobile telephone services

- (a) Existing underground mobile telephone coverage at Central Station is part of City Circle/ESR coverage and is managed by Optus on behalf of all carriers. Coverage of this system must be expanded to all areas within the Project Works.
- (b) The CSM Contractor must:
 - (i) design and implement, in accordance to the Mobile Carriers Forum (MCF) DAS specification 2014, extension and modification of the Public Telecommunications Operator's (PTO) existing underground mobile telephone coverage at Central Station to provide coverage for the Project Works;
 - (ii) ensure that existing Central Station and ESR coverage performance is be unaffected by the CSM Contractors Activities, or if affected must comply with the requirements of the MCF DAS specification 2014;
 - (iii) coordinate all design and implementation works with the lead carrier (Optus);
 - (iv) coordinate the mobile telephone coverage design with the Metro Station mobile telephone coverage design (by others) to ensure reliable handover between these separate systems is achieved;
 - (v) interface and coordinate all mobile telephone services works in accordance with the Interface Schedules and applicable third party requirements for all public telecommunications works;

- (vi) in consultation with the Interface Contractor, provide communication equipment rooms in accordance with the Room Schedules, including all spatial requirements, containment, mechanical and electrical systems, ECS and fixtures and finishes;
- (vii) provide dedicated space for public telecommunications operator equipment in consultation with the Interface Contractor; and
- (viii) ensure the existing Central Station underground mobile phone coverage is maintained to existing levels of service during the CSM Contractors Activities.

2.5.9 Telephone systems

- (a) The CSM Contractor must:
 - (i) extend telephone systems in accordance with the Interface Schedules and in consultation with the Interface Contractor; and
 - (ii) extend the high quality two-way telephony system for operational staff, emergency services personnel and maintenance personnel, with connectivity to the public telephone network (via existing systems).
- (b) The CSM Contractor must provide telephone services to the following locations:
 - (i) new or altered operational and maintenance rooms including but not limited to communication equipment rooms, substation plant rooms, ancillary buildings and substations;
 - (ii) administration facilities;
 - (iii) fire indication panels (FIPs);
 - (iv) lift intercoms; and
 - (v) Platform and concourse Hubs.
- (c) The CSM Contractor's telephone service provisions for sub-stations must be Voice over Internet Protocol (VoIP) services with connections via optic fibre, in accordance with the Interface Contractor's requirements.

2.5.10 Closed circuit television (CCTV) system and Help Points system

- (a) The CSM Contractor must:
 - (i) provide facilities for enhanced pedestrian safety, safety for rail passengers and efficient operation of Central Station and deter assets from being vandalised;
 - (ii) ensure CCTV coverage in the following areas, as a minimum:
 - A. station entrances – entry and exit direction;
 - B. stairs and elevators – both directions;
 - C. lifts – both internal and landing/door areas;
 - D. ticket gates – both directions;
 - E. Opal self-service machines;

- F. cash delivery routes;
 - G. platform areas;
 - H. emergency escape doors
 - I. egress points;
 - J. Help Points;
 - K. BOH areas;
 - L. ancillary buildings including perimeter fences, sub-stations and tunnel portals; and
 - M. risk sensitive areas.
- (iii) adjust and extend the existing Central Station CCTV system to cover areas created by the Central Station Works and Central Walk Works;
 - (iv) provide CCTV systems in accordance with the Interface Schedules;
 - (v) extend the existing Help Point system to areas created by the Central Station Works and Central Walk Works;
 - (vi) provide Help Points in accordance with the Interface Schedules;
 - (vii) design the CCTV system in accordance with AS 4806 Close Circuit Television and ASA T-MU-SY-10001-ST Public Transport Closed Circuit Television (CCTV) Functional Requirements Standard and Indra's specification requirements included in Appendix C04;
 - (viii) complete a security risk assessment in conjunction with Central Station and TfNSW's security divisions. The CCTV and Help Point designs must be undertaken by a Sydney Trains-approved electronic security contractor. The design of the CCTV cameras coverage must be undertaken by a consultant holding a Class 2A Security License under the Security Industry Act 1997 (NSW);
 - (ix) install the CCTV and Help Point networking and UPS equipment in racks provided by the CSM Contactor in the Sydney Trains communications equipment room provided in accordance with the Room Schedules;
 - (x) locate Help Points for Sydney Trains in accordance with Sydney Trains standard ESB 004 Station design standard – station services and systems;
 - (xi) provide a Help Point system for Central Station Works and Central Walk Works areas that complies with Sydney Trains Standard ESB 004 and Indra's specifications;
 - (xii) consult and agree with the Principal's Representative the location of the CCTV and Help Points;
 - (xiii) provide CCTV cameras and equipment that are vandal resistant;
 - (xiv) position CCTV cameras and equipment to minimise the risk of them being vandalised; and
 - (xv) provide all BOH CCTV and Help Point equipment in the equipment rooms(s) nominated in the Room Schedules, including provision for all

spatial requirements, cable trays, cable racks, service risers, electrical requirements, fire suppression, ECS and fixtures and finishes.

2.5.11 Public Address (PA) System

- (a) The CSM Contractor must extend public address (PA) systems:
 - (i) in accordance with the Interface Schedules;
 - (ii) in accordance with ASA Standards, requirements and specifications; and
 - (iii) that enable Central Station staff to communicate live or pre-recorded audio messages regarding train service running, descriptions, adjustments and security/emergency messages to customers, from the Sydney Trains control centre and from handheld devices; that comply with ASA Standard T-MU-TE-61005-ST and AS1670:2015 'Fire detection, warning, control and intercom systems – System design, installation and commissioning Part 4 – Emergency warning and intercom systems'.
- (b) The CSM Contractor's PA system works must:
 - (i) include cabling that:
 - A. carries EWIS evacuation tones;
 - B. is fire rated to AS3013 WS51W when traversing fire zones;
 - C. complies with AS1670.4 in accordance with sketch "SKETCH_Alt_design_TN038" in Contract Schedule C2 (refer to RFC 4422); and
 - D. ASA concessions must be provided by the CSM Contractor in relation to the PA system works as required;
 - (ii) interface with the existing Central Station PA system to enable Sydney Trains staff to make announcements from either a control position or microphones, from ancillary buildings, from roving staff, and support local or remote control of locally stored Digital Voice Announcements (DVA) in addition to remote inputs providing Long Line Public Address (LLPA) functionality; and that provide coverage for all public areas (including retail areas), emergency egress routes, tunnel cross passages and ancillary buildings.
- (c) The CSM Contractor must undertake acoustic modelling for Central Walk Works and Central Station Works to confirm system coverage for general public and emergency announcements. The CSM Contractor must design the PA system based on the outcome(s) of the acoustic modelling. The PA design must minimise nuisance overspill of PA noise.
- (d) The PA system must provide audio customer information volume levels that automatically adjust to ambient noise levels.
- (e) The CSM Contractor must extend Central Station passenger information Wi-Fi coverage into all Project Works areas including the public areas of Metro Station.
- (f) The CSM Contractor must ensure the PA system interfaces with the Central Station and Metro Station fire master emergency control panel (MECP) to provide sound systems and intercom systems for emergency purposes (SSISEP) functionality from both Central Station and Metro Station.

- (g) The CSM Contractor must provide all BOH PA equipment in the equipment rooms(s) nominated in the Room Schedules, including provision for all spatial requirements, cable trays, cable racks, service risers, electrical requirements, fire suppression, ESC and fixtures and finishes.

2.5.12 Audio frequency induction loop (AFIL) system

- (a) The audio frequency induction loop (AFIL) system provided by the CSM Contractor must be in accordance with:
 - (i) Disability Standards for Accessible Public Transport (DSAPT) ; and
 - (ii) ASA Standard T MU TE 61005 ST Customer Information Systems for Public Transport Buildings and Conveyances.
- (b) The AFIL system must be provided within new Central Station Works areas including re-levelled platforms.
- (c) The CSM Contractor must provide AFIL signage in the coverage areas in accordance with AS 1428.2.
- (d) The CSM Contractor must ensure AFIL zones match PA zones with spill between zones to be controlled as far as is practically achievable.

2.5.13 Passenger Information Display System (PIDS)

- (a) The Interface Contractor's PIDS must display train running, station operations, disruption, safety and emergency related information.
- (b) The CSM Contractor must deploy PIDS in new or altered station areas to the Interface Contractor's requirements and in accordance with the Interface Schedules. New or altered display locations will include:
 - (i) Sydney Trains VMSs – near to station entrances
 - (ii) Sydney Trains concourse indicators (CI) – in paid and unpaid concourse areas; and
 - (iii) Sydney Trains platform indicators (PI) – located on Suburban Platforms.
- (c) The installed location of the PIDS displays, as determined by the CSM Contractor, must avoid interference/glare from direct sunlight during the day or relative to the lighting grid, including ensuring smooth public flows are maintained and avoid any obstructions.
- (d) The installed PIDS displays must meet the requirements of Sydney Trains and comply with ASA Standard T MU TE 61005 ST 'Customer Information Systems for Public Transport Buildings and Conveyances.
- (e) The CSM Contractor must provide spatial, fixtures, fittings and containment for Metro Station PIDS displays.
- (f) The PIDS displays must be located such that customers are able to view the content of the digital information screens irrespective of their standing or seating location on platforms, at the interchange or concourses under LoS C conditions.

2.5.14 Precise Clocks

- (a) The CSM Contractor must provide new precise clocks in accordance with applicable Codes and Standards.
- (b) The new precise clocks must be provided at:

- (i) the new/modified Central Station Gatelines;
 - (ii) the new/modified Suburban Platforms;
 - (iii) the new/modified Central Station entrances; and
 - (iv) the new/modified Central Station concourses.
- (c) The precise clocks must ensure accurate time reference for customers, operational staff and rail communications and control systems.
- (d) The CSM Contractor must integrate new and adjusted precise clocks with the existing Central Station precise clocks system.

2.5.15 Electronic Access Control System (EACS)

- (a) The CSM Contractor must coordinate with the Principal's Representative to determine access control requirements across Central Station whilst undertaking the CSM Contractor's Activities.
- (b) There must be no interface between Central Station and Metro Station EACS. Card readers from both systems must be installed on doors where access is required by staff from both Central Station and Metro Station.
- (c) The CSM Contractor must provide an EACS that:
- (i) allows free egress for all doors and/or points equipped with EACS;
 - (ii) provides key accessible doors to main facilities, such as equipment rooms, as a secondary access method in the event of a power supply/access system failure;
 - (iii) checks for validity of access rights, access area, access times, and any other criteria associated with a presented access authority, stored in intelligent field controllers;
 - (iv) provides a means to control access through doors having electric locking-door status, monitoring and access readers;
 - (v) grants or denies access depending on the access authority presented to the reader;
 - (vi) is installed on all doors and gates accessing the Rail Corridor, workshop, ancillary and administration buildings and all doors to equipment rooms, control rooms, offices and any other areas as identified by applicable security management plans;
 - (vii) is interfaced with the existing Sydney Trains EACS;
 - (viii) comprises an intelligent master controller package, control workstation and power distribution panels with UPS battery backup. The master controller packages must be installed in wall mounted enclosures provided inside the communications equipment room. The master controller must have dedicated connection to the network switch located in the LAN rack via a DSX LAN module;
 - (ix) includes cabling in a dedicated and concealed conduit;
 - (x) controls access to non-public areas; and

- (xi) raises an alarm through to the Sydney Trains security management facility should any protected entry/exit be forcibly opened.
- (d) The CSM Contractor must provide all BOH EACS equipment in the required equipment rooms(s) in accordance with the Interface Schedules, including provision for all containment, mechanical and electrical systems, ECS and fixtures and finishes.

2.5.16 Electronic Security Systems

- (a) The CSM's Contractor's security planning must follow the directives and standards of Transport for NSW, the Emergency Services and other relevant regulatory bodies.
- (b) The electronic security systems (ESS) for Central Station and Metro Station are separate systems which interface in order to exchange alarms.
- (c) The CSM Contractor must provide ESS that:
 - (i) prevent and detect unauthorised access to facilities and assets and protect staff against assaults and threats;
 - (ii) monitor station facilities, plant, equipment and control rooms;
 - (iii) include multiple alarms zones to permit staff to access staff rooms after hours without the need to disarm the ESS; and
 - (iv) interface with the current Sydney Trains ESS; and
 - (v) are compatible with the current Sydney Trains ESS.
- (d) The CSM Contractor must:
 - (i) consult with the Principal's Representative during the detailed design stage to agree and implement a set of functional requirements as to how each ESS interfaces with Sydney Trains; and
 - (ii) consult with the Principal's Representative to agree and implement the ESS remote monitoring requirements.
- (e) The CSM Contractor must provide all BOH ESS equipment in the equipment rooms(s) nominated in the Room Schedules, including provision for all containment, mechanical and electrical systems, ECS, fixtures and finishes.

2.5.17 Electronic Ticketing System (ETS)

- (a) The CSM Contractor must:
 - (i) provide an ETS in accordance with the Interface Schedules;
 - (ii) provide all footings for the new Eastern Entrance Gateline and relocated existing Northern Entrance Gateline.
 - (iii) provide containment, cabling and connections for LV power, including GPO's, to the Gateline and associated equipment, local LV distribution and switch boards and the ETS communications room.
 - (iv) provide containment, cabling and racks that allow communications connections to be made by others from the Gateline and associated equipment to the Sydney Trains OCDN.

- (v) comply with the requirements of the TfNSW network wide integrated ticketing strategy (OPAL system);
- (vi) provide containment, cabling and connections to ensure that the Central Station Fire Indicator Panel (FIP) is connected to all adjusted and new Gatelines and associated equipment.
- (vii) supply and install the emergency gate opening panel (EGOP) and break glass button
- (viii) integrate and conceal all cable routes to the self-service machines and automatic ticket gate.

2.5.18 Uninterruptable Power Supply (UPS)

- (a) The CSM Contractor must provide an Uninterruptable Power Supply (UPS) system in the Central Station equipment rooms, including equipment cupboards, in accordance with Sydney Trains requirements and the Room Schedules.

2.5.19 Fibre and copper backbone

- (a) The CSM Contractor must provide fibre and copper backbone works in accordance with the Sydney Trains Interface Schedule.
- (b) Copper backbone and tie cables must be terminated, patched and managed on dedicated insulation displacement connector (IDC) distribution frames within equipment rooms specified in the Room Schedules, to applicable Codes & Standards.
- (c) Fibre optic backbone and tie cables must be terminated, patched and managed on dedicated fibre optic distribution frames within equipment rooms specified in Room Schedules, to applicable Codes & Standards.
- (d) Copper and fibre optic backbone cable installations must be protected against mechanical damage, vandalism and theft by being installed within constructed cable routes.
- (e) Surge protection must be provided on all copper backbone circuits which have the potential to carry damaging direct or induced surge currents to protect connected equipment in accordance with applicable Codes and Standards.
- (f) The CSM Contractor must provide trunk fibre optic and copper cables to meet all communication system requirements as a result of the CSM Contractor's Activities.
- (g) The CSM Contractor must install new cabling in the rail corridor beyond Central Station to the next termination point, maintaining the existing attenuation loss, to meet all communication system requirements.
- (h) The CSM Contractor must supply cables that are low smoke zero halogen with fire retardant sheaths in accordance with applicable Codes and Standards.
- (i) All trunk cabling must be insect and rodent resistant in accordance with applicable Codes and Standards.
- (j) All new and relocated cables and equipment installed by the CSM Contractor must not interfere with the operation of any existing communication systems including existing signals, data, electrical or communication services.
- (k) All new cabling by the CSM Contractor must be continuous with no breaks or joints.

- (l) For existing Central Station cabling to be relocated by the CSM Contractor, any joints and spacing between joints must be in accordance with ASA Standards, guidelines and manuals.

2.6 Combined services route (CSR)

- (a) The CSM Contractor must:
 - (i) relocate and provide new combined services routes (CSR) for services including cabling, trenches, containment systems, pits and under-track crossings as necessary to perform the CSM Contractor's Activities;
 - (ii) size all CSR infrastructure to accommodate installation of all required services including for Interface Contractors, Sub Contractors, Third Parties, CSM Contractor supplied systems, any other party utilising the CSR;
 - (iii) co-ordinate all systems to rationalise containment and achieve minimum requirements for route diversity, segregation of services, reliability, protection, operation and maintenance; and
 - (iv) design and install the CSR to be sympathetic with all heritage fabric where applicable.
- (b) If the CSM Contractor's Activities require an existing CSR to be altered, the CSM Contractor must upgrade the CSR to the extent that it is required to be altered to accommodate the CSM Contractor's Activities, to meet applicable Codes and Standards.

3 Metro Station rail, rail systems and communications

3.1 General

- (a) The CSM Contractor's Activities for the Metro Station Works must, as a minimum, comply with applicable Codes and Standards.
- (b) The CSM Contractor must as a minimum comply with the Interface Schedules.

3.2 Track

- (a) The CSM Contractor must:
 - (i) make spatial provision in the Metro Station Works for the Sydney Metro City & Southwest track slab below the Metro Station design low rail level; and
 - (ii) make spatial provision within the Metro Station platform extents for the Metro Station platform kinematic envelope (KE) dimensions and tolerances as shown on SWTC Drawing NWRLOTS-NRT-SWD-PW-DRG-550850.

3.3 Overhead wiring and Traction Power Supply

- (a) The CSM Contractor must provide:
 - (i) spatial provision, fixtures, fittings, containment, earthing, bonding and other infrastructure for overhead wiring and Traction Power Supply for the Metro Station.

3.4 Signalling and train control systems

- (a) The CSM Contractor must provide the following:
 - (i) spatial provision, fixtures, fittings, containment, mechanical and electrical systems and other infrastructure for signalling and train control systems for the Metro Station; and
 - (ii) a new signalling equipment room equipment room in accordance with the Room Schedules.

3.5 Communication systems

3.5.1 Space requirements

- (a) The CSM Contractor must provide:
 - (i) spatial provisions for all temporary and permanent infrastructure required to support the new communications systems for the Metro Station;
 - (ii) spatial provisions for all temporary and permanent infrastructure required to support the new and/or relocated third party communications systems;

- (iii) ensure spaces for Metro Station and Sydney Metro City & Southwest line-wide communication systems are segregated from those required for Central Station communication systems;
 - (iv) ensure the trunk cable routes have at Completion a minimum of 50% unused capacity for future expansion; and
 - (v) provide diverse cable routes for the communication systems requiring a redundant configuration.
- (b) Communications spaces must comply with the requirements of ASA Standard T-MU-TE-21001-ST.

3.5.2 System interfaces

- (a) The following Metro Station communications systems will be interfaced to the equivalent Sydney Trains systems by the Interface Contractor:
- (i) CCTV system;
 - (ii) PA system;
 - (iii) Passenger Information system;
 - (iv) Electronic Security System;
 - (v) Data Communications Network;
 - (vi) Central Control System; and
 - (vii) O&M Radio System.
- (b) While these system interfaces will be implemented by the Interface Contractor, the CSM Contractor must:
- (i) provide for the spatial, cable containment and LV distribution requirements of the interface equipment; and
 - (ii) cooperate as required to permit TSOM to implement the interface.
- (c) The following systems have non-physical interfaces:
- (i) The Central Station UHF DAS (Sydney Trains coverage area) and Sydney Metro UHF DAS (Sydney Metro station areas) must have controlled coverage overlap to ensure consistent and reliable handover of GRN and NSW Police radio users between these separate radio systems.
 - (ii) Mobile Telephone DAS within Sydney Trains areas of Central Station (Optus managed) and within Metro Station areas (Telstra managed) must have controlled coverage overlap to ensure consistent and reliable handover of mobile telephone users between these separate radio systems and to ensure users within given areas are accessing the correct base-stations.
- (d) The CSM Contractor, when designing and implementing the extension of both the Central Station UHF DAS and Mobile Telephone DAS within Sydney Trains areas must consider the requirements of these radio interfaces and cooperate with other designers and the system owners to achieve reliable handovers.

3.5.3 Equipment rooms

- (a) The CSM Contractor must provide new communications equipment rooms and cupboards in accordance with the Room Schedules.
- (b) The CSM Contractor must provide for third party use new public communications operators equipment room in accordance with the Room Schedules.
- (c) The CSM Contractor must provide a communications earth terminal (CET) and communications earth bar (CEB) in accordance with Appendix B04a.

3.5.4 Local Area Networks (LAN)

- (a) The CSM Contractor must provide spatial provision and cable containment for local area networks (LANs) that:
 - (i) comply with the Interface Schedules; and
 - (ii) provide connectivity between Central Station systems and Metro Station systems where required, enabling secure and efficient exchange of information.

3.5.5 Ultra High Frequency (UHF) radio systems

- (a) The Metro Station Works include the provision of the following systems:
 - (i) Metro Station operations and maintenance (O&M) Radio;
 - (ii) Government radio network (GRN); and
 - (iii) NSW Police radio network.
- (b) The CSM Contractor must provide accommodation for the UHF Radio Systems and cabling within Metro Station rooms, including spatial requirements, cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes.
- (c) The CSM Contractor must make spatial provision and provide containment and other infrastructure required to interface the Central Station UHF radio systems identified in section 2.5.5, with the systems within the Metro Station Works.
- (d) The CSM Contractor must provide infrastructure to support the UHF Radio Systems coverage via the UHF DAS described below, as outlined in the Interface Schedules.

3.5.6 UHF Distributed Antenna System (DAS)

- (a) The CSM Contractor must:
 - (i) coordinate and interface all Metro Station UHF DAS works with Interface Contractors, as outlined in the Interface Schedules;
 - (ii) provide spatial provision and cable containment for all UHF DAS equipment in the rooms(s) identified in the Room Schedules, including all spatial requirements, cable trays, cable racks, service risers, electrical requirements, fire suppression, ECS and fixtures and finishes;
 - (iii) provide spatial provision and cable containment for all equipment required to support the UHF systems including as a minimum;
 - A. leaky coaxial and fibre optic cabling;
 - B. antennas;

- C. amplifiers and fibre-fed repeaters;
- D. combining units and splitters;
- E. feeder cables and other miscellaneous cabling;
- F. isolating devices;
- G. cable containment; and
- H. all supporting hardware.

3.5.7 Mobile telephone services

- (a) New underground mobile telephone coverage is required in the Metro Station areas of Central Station. In future this will be managed by Telstra on behalf of all carriers. This system will be separate to the Optus managed system in Central Station and is part of the Sydney Metro City and Southwest line coverage solution.
- (b) For Metro Station the CSM Contractor must:
 - (i) comply with the Interface Schedules;
 - (ii) provide communication equipment rooms in accordance with the Room Schedules, including all spatial requirements, cable trays, cable racks, service risers, electrical requirements, fire suppression, ECS and fixtures and finishes; and
 - (iii) provide spatial provision and cable containment and antenna mounting hardware for a Mobile telephone DAS that provides mobile telephone coverage throughout the Metro Station public and back-of-house areas.

3.5.8 Telephone systems

- (a) The CSM Contractor must:
 - (i) comply with the Interface Schedules;
 - (ii) provide accommodation for Metro Station telephone exchange systems in accordance with the Room Schedules, including all spatial requirements, cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes;
 - (iii) provide spatial provision and cable containment for telephone systems in the following Metro Station locations:
 - A. Station Control Rooms, including workstations;
 - B. operational and maintenance rooms, including signalling and communication equipment rooms, substation plant rooms, ancillary buildings and power supply substations;
 - C. administration facilities;
 - D. fire intervention panels (FIPs);
 - E. lift intercoms; and
 - F. Help Points;
 - (iv) provide spatial provision, fixtures, fittings for all telephone systems in Metro Station areas.

3.5.9 Closed circuit television (CCTV) system and Help Points system

- (a) The CSM Contractor must:
- (i) in consultation with the Interface Contractors, provide accommodation for Metro Station CCTV and Help Point systems in rooms identified in the Room Schedules, including provision for all spatial requirements, cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes; and
 - (ii) provide spatial provision, fixtures, fittings and cable containment for CCTV and Help Point services throughout the station in accordance with the Interface Schedule and in accordance with the Interface Contractor's design.

3.5.10 Public Address (PA) System

- (a) The CSM Contractor must:
- (i) provide all requirements for PA systems within Metro Station in accordance with the Interface Schedules;
 - (ii) in consultation with the Interface Contractor, provide accommodation for Metro Station PA systems in rooms identified in the Room Schedules, including all spatial requirements, cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes;
 - (iii) provide spatial provision and cable containment for Metro Station PA systems in all public areas, emergency egress routes, and ancillary buildings;
 - (iv) provide spatial provision and cable containment for all switches, patches, and cabling, containment systems as part of the PA systems in Metro Station areas; and
 - (v) provide Sound Systems and Intercom Systems (SSISEP) (otherwise known as Emergency Warning and Intercommunication System (EWIS)) functionality by interfacing the Metro Station fire detection system to the Metro Station PA system in accordance with the Interface Schedules.

3.5.11 Audio Frequency Induction Loop (AFIL) System

- (a) The CSM Contractor must provide the Metro Station AFIL system in accordance with the Interface Schedules.
- (b) The CSM Contractor's AFIL system must:
- (i) interface with the Interface Contractor's PA system in accordance with the Interface Schedules;
 - (ii) comply with the relevant requirements of ASA Standard T-MU-TE-61005-ST; and
 - (iii) provide coverage that geographically aligns with PA zones to ensure hearing impaired customers receive the same message as other customers.

3.5.12 Passenger Information Display System (PIDS)

- (a) The CSM Contractor must provide specified requirements for Passenger Information Display Systems within Metro Station, in accordance with the Interface Schedules.
- (b) The CSM Contractor must provide accommodation for Metro Station passenger information systems in rooms identified in the Room Schedules, in accordance with the Interface Contractor's design on platforms, concourses and station entry points, including all spatial requirements, cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes.

3.5.13 Precise clocks

- (a) The CSM Contractor must provide for all spatial requirements, cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes specified for precise clock systems within Metro Station, in accordance with the Interface Schedules.

3.5.14 Electronic Access Control System (EACS)

- (a) The CSM Contractor must provide accommodation, spatial requirements, cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes for Metro Station Electronic Access Control System equipment throughout the Metro Station in accordance with the Room Schedules and the Interface Schedules.
- (b) The CSM Contractor must provide, install and test EACS field equipment to the Interface Contractor's design in accordance with the Interface Schedules.
- (c) The CSM Contractor's security cabling must be concealed.

3.5.15 Electronic Security System (ESS)

- (a) The CSM Contractor must provide accommodation, spatial requirements, cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes for Metro Station Electronic Security System equipment throughout the Metro Station in accordance with the Room Schedules and the Interface Schedules
- (b) The CSM Contractor must provide, install and test ESS field equipment to the Interface Contractor's design in accordance with the Interface Schedules
- (c) The CSM Contractor's security cabling must be concealed.

3.5.16 Uninterruptable Power supply

- (a) The CSM Contractor must provide centralised UPS within Metro Station, in accordance with SWTC Appendix B04a, the Interface Schedules and to the Interface Contractor's requirements.
- (b) The CSM Contractor must provide accommodation for all UPS in rooms identified in the Room Schedules, including all spatial requirements, cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes.

3.5.17 Fibre and copper backbone

- (a) The CSM Contractor must comply with the Sydney Metro City & Southwest – communications system in the Interface Schedules.
- (b) The CSM Contractor must provide spatial provision and cable containment for fibre and copper backbone Works, including provision for cable trays, cable racks,

service risers, electrical requirements, fire suppression, ECS and fixtures and finishes.

- (c) The CSM Contractor must ensure spatial provision and cable containment for fibre and copper backbone cable installations can be protected against mechanical damage, vandalism and theft.

3.5.18 Data Communications Network

- (a) The Sydney Metro City & Southwest Data Communications Network (DCN) provides fixed data backbone connectivity for Sydney Metro City and Southwest systems and utilises the Sydney Metro City and Southwest fibre backbone. Local data connectivity within Sydney Station Metro is provided by LAN elements (Section 3.5.4).
- (b) The CSM Contractor must provide specified requirements for the Data Communications Network elements installed within the Metro Station, in accordance with the Interface Schedules.
- (c) The CSM Contractor must provide accommodation for the Data Communications Network and cabling within and between the Metro Station rooms and tunnel portals, including spatial provisions for cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes.

3.5.19 Central Control System

- (a) Sydney Metro City & Southwest Central Control System (CCS) monitors and controls Sydney Metro City & Southwest systems.
- (b) The CSM Contractor must provide specified requirements for the Central Control System elements installed within the Metro Station, in accordance with the Interface Schedules. This includes provision of the Building Management System (BMS) for the Metro Station as defined in SWTC Appendix B04b.
- (c) The CSM Contractor must provide accommodation for the Central Control System elements and cabling within and between Metro Station rooms and tunnel portals, including spatial requirements, cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes.
- (d) The interface between the CSM Contractor's BMS and the CCS must be via an Ethernet connection. The connection between the CSM Contractor's BMS and the CCS connection point (CSM.CCS.1 in Interface Schedule E.1.7) must use a Category 5e/6/6A Ethernet cable.
- (e) The interface between the CSM Contractor's BMS and the Integrated Back-up Panel (IBP) must be via voltage free contacts. The connection between the CSM Contractor's BMS and the IBP connection point (CSM.CCS.2 in Interface Schedule E.1.7) must use a multi-core copper cable.

3.5.20 Train Radio Communications Systems

- (a) Sydney Metro City & Southwest Train Radio Communications systems provide train control, voice, video and data communications between Sydney Metro shore systems and Sydney Metro rolling stock.
- (b) The CSM Contractor must provide specified requirements for the Train Radio Communication Systems elements installed within Metro Station, in accordance with the Interface Schedules.

- (c) The CSM Contractor must provide accommodation for the Train Radio Communication Systems elements and cabling within and between Metro Station rooms and tunnel portals, including spatial requirements, cable trays, cable racks, risers, electrical requirements, fire suppression, ECS and fixtures and finishes.

3.6 Combined services route

- (d) The CSM Contractor must provide spatial provision, fixtures, fittings, containment, earthing, bonding and other infrastructure within the Metro Station to comply with requirements of the Interface Schedules.

Attachment 1 Signalling Functional Specification



Transport
for NSW



city & southwest

Transport for NSW

Sydney Metro – City & Southwest – Technical Services

Signalling Functional Specification

Sydney Yard Platforms and Track Modification

Reference Design

12 April 2017

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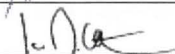
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1. Introduction

Sydney Metro - City & Southwest project is the subsequent stage of Sydney Metro – Northwest project. The Northwest project will address all scope from Cudgegong to Chatswood. The City & Southwest project addresses all scope of works between Chatswood and Bankstown.

The project comprises of three key components as follows:

- Sydney Metro – City – 16.5 km City Extension from Chatswood, under North Sydney and Sydney Harbour and then beneath the Sydney CBD to Central and Sydenham.
- Sydney Metro – Southwest – 13.4 km Southwest Extension – Sydenham to Bankstown.
- Sydney Metro Train Facility-South – train stabling and maintenance facility in Marrickville

The signalling for the Sydney Metro – City & Southwest will be a Communications Based Train Control (CBTC) system, employing integrated Automatic Train Protection (ATP) and Automatic Train Operation (ATO) with Unattended or Driverless Train Operation (UTO or DTO). The new interlocking commissioned as part of the Sydney Metro – Northwest project will be extended to control the area from Chatswood to Bankstown with the Operations and Control Centre (OCC) to be located at Tallawong with a backup at Bella Vista.

Under the greater Central station complex, the existing Sydney Yard consists of various terminal platforms to accommodate different types of train services. To accommodate the new Central Metro station infrastructure, it will be necessary to modify some of the existing platform and track arrangements in Sydney Yard. The following modifications will be completed in the area:

- ▶ Platform 9 – the platform will be shortened at the northern end by 11m and extended at the southern end by 11m, the platform length will remain at 202m with an operational length of 196m to service intercity trains. The buffer face to the end wall will be 6m;
- ▶ Platform 10 – the platform will be shortened at the northern end by 11m and extended at the southern end by 10m, the platform length will be reduced from 203m to 202m and it will have an operational length of 196m to service intercity trains. The buffer face to the end wall will be 6m;
- ▶ Platform 11 – the platform will be shortened at the northern end by 7.7m and extended at the southern end by 10m, the platform length will be increased from 200m to 202m and it will have an operational length of 196m to service intercity trains. The buffer face to the end wall will be 6m ;
- ▶ Platform 12 – the platform will be shortened at the northern end by 7.7m, the platform length will be reduced from 187m to 179m and it will have an operational length of 173m to service suburban trains. The buffer face to the end wall will be 6m. ;
- ▶ Platform 13 – the platform will be shortened at the northern end by 9.4m, the platform length will be reduced from 185m to 176m, and it will have an operational length of 170m to service suburban trains. The buffer face to the end wall will be 6m ;
- Platform 14 – the platform will be rebuilt as part of these works, it will be shortened at the Northern end by 9.4m and extended at the Southern end by 6m, the platform length will be reduced from 203m to 200m, and it will have an operational length of 196m to service intercity trains. The buffer face to the end wall will be reduced to 4m. The proposed platform extensions will not cater for 205m long New Intercity Fleet trains.
- Intercity platform 15 and its associated track circuits including the Down Shunting Neck will be permanently removed. These modifications will lead to the removal of 208 crossovers, 211 & 212 turnouts, 213 catch points, and the removal of signals SY21, SY21 train stop, SY53 and SY60. Also, the signal routes 18(S)A, 20(S)A, 51(S)C and 74(M)G will be permanently removed.

Due to the above proposed changes there will be modifications to the existing West Yard NX Relay Interlocking controlling Sydney Yard to reflect the platforms and Down Shunting Neck modifications. The ATRICS system which is due to be commissioned on May 2018 will also need to be modified.

This Signalling Functional Specification (SFS) forms one of the two SFSs, which describe the changes to the Sydney Trains network around Central station resulting from the implementation of the Sydney Metro – City & Southwest project at Sydney Yard. The SFSs are divided as follows:

- NWRLSRT-PBA-SCS-SI-SPC-000001 – Sydney Yard Access Bridge SFS
- NWRLSRT-PBA-SCS-SI-SPC-000003 – Sydney Yard Platform and Track Modifications SFS (this document)

1.1 Reference Documents

The following documents are referred in preparation of this document:

- Existing Signalling Plan: SYD_YARD_SP (dated: 15 Dec 2014)
- CB RR Sydney Relay Room Book 1A of 9 (dated: 15 April 2015)
- CB RR Sydney Relay Room Book 1B of 9 (dated: 15 April 2015)
- Sydney Signal Box West Yard Book A (dated: 11 Sep 2009)
- Sydney Signal Box West Yard Book B (dated: 21 Sep 2009)
- Sydney Yard Pneumatic System Book 3 of 6 (dated 30 April 2007)
- Goulburn St (Inl) to Redfern Pneumatic System Book 1 of 6 (dated 21 March 2007)
- Intercity Platform Lengthening Paper -NWRLSRT-PBA-EN-REP-000008 Rev A (dated 24/03/2016)
- Central Station Rail Horizontal Track Alignment – Draft Concept Design Drawings – NWRLSRT-PBA-SCS-RD-DWG-338022 Rev A
- Sydney Yard Early Works B0+000km – B0+296km Staging Diagrams, Concept Design – NWRLSRT-PBA-SCS-PL-DWG-389917 Rev B
- Metro Box Platform 13/14 Return to Operations & Western Concourse B0+000km – B0+296km Staging Diagrams, Concept Design – NWRLSRT-PBA-SCS-PL-DWG-389918 Rev B
- ASA Signalling Standards
- Other sources Interface meeting minutes

The production of this Signalling Functional Specification is based on the 'Base Option' outlined in 'Intercity Platform Lengthening Paper - NWRLSRT-PBA-EN-REP-000008 Rev A (dated 24/03/2016).

2. Operational requirements

As part of Sydney Metro – City & Southwest project, and the development of the new Central metro station, the objective of this configuration is to provide as much passenger circulation space as possible at the north City end of the platforms whilst still maintaining the same functionality as the existing platforms. The revised platform lengths result in a consistent operational platform length from buffer stop to platform end for all intercity platforms except platforms 12 and 13, which will have shorter operational platform lengths upon completion of the works.

Platform 15 will be permanently decommissioned as part of the new Sydney Metro underground platform and concourse works. The envisaged construction sequence in this report is as follows:

- Platform 15 permanently decommissioned,
- Platforms 12 and 13 will then be removed to allow Sydney Metro works to commence. Platform 14 will remain operational at this stage
- Platform 12 will then be reinstated before platform 14 is removed.
- Platforms 13 and 14 will return to operation after the completion of Sydney Metro Open box construction.

Modification works to platforms 9, 10, and 11 will be carried out in parallel with the above works.

The relevant signalling infrastructure changes to support these construction works have been outlined in the proposed staged works described in section 10 of this report. During the construction stage it will also be a requirement for some signalling movements to be temporarily booked out of use, however this arrangement will have to be agreed and accepted by Sydney Trains prior to the commencement of detailed design.

It is envisaged at this time that there will be no operational impacts to the movements within Sydney yard and it will be possible to operate the 2018 timetable with a minimum of 12 operational platforms. To deliver passenger demands it will be necessary to continue the train operations whilst Sydney Metro construction works are in progress.

In the final arrangement, after completion of these works, trains coming on Up and Down Bankstown lines will terminate on platforms 12-14. The shunting movements entering and exiting the Down Shunting Neck will no longer be available. For signalled routes that will no longer be operational after these works, they will be 'Booked out of use' during the construction works and then permanently removed from the interlocking once the works are completed. It is proposed that subsequent signalled routes will not be renamed. This proposal is subject to agreement from Sydney Trains.

For further details on the Sydney trains operations, refer to Appendix AA - Operational modelling. It is to note that the Concept of Operation (CONOPS) document for Sydney Yard is being developed by TfNSW (Sydney Metro) and any changes to the above arrangement as a result of the CONOPS development will be detailed in later versions of this document.

3. Track layout changes

A part of the Sydney Metro – City & Southwest project, there will be some track layout changes and these changes are shown in the Drivers Diagrams. The scope of works has been split into two parts:

Early Works:

- the decommissioning of platform 15
- the temporary removal of platforms 12 and 13,
- reinstatement of platform 12,
- temporary removal of platform 14 and
- the revised platform lengths of platforms 9 -11.

Metro Box Platform 13/14 Return to operations and Western concourse works:

- Reinstatement of platforms 13 and 14 on top of the new Sydney Metro Central Station box

The proposed track changes for these works is described in more detail in the following sections.

3.1 Sydney Yard Early works

- Permanent closure of platform 15 and Down Shunting Siding;
- Removal of the existing 208A/B crossover;
- Removal of the existing 203A/B crossover;
- Installation of new 203A/B crossover with 160:8.25 tangential turnouts, shifting 203A Points 0.708m towards city and 203B Points 0.708m towards country;
- Removal of the Buffer stop on the existing Down Shunting Neck;
- Removal of the existing 211 and 212 turnouts;
- Removal of the 213 Catch point;
- Removal of the existing Down Shunting Neck tracks;
- Removal of the Platform 15 tracks;
- Signalling Temporary closure of platforms 12 and 13;
- Removal of the 205B and 206B derailleurs
- Removal of the 200 and 207 catchpoints;
- Removal of the platform 12/13 diamond;
- Removal of the track for platforms 12 and 13;
- Slew tracks into platform road 9 and 10 middle road to new alignment
- 195A Pts turnout to move 3m towards country
- Installation of platform11 road to new alignment;
- Removal of the 206A turnout;
- Relocation of the New 200 catchpoints in new position;
- Installation of the platform12 road to new alignment;

- Removal of the existing buffer stops for platform 12;
- Provision of new energy absorbing buffer stops on track at Platform 12;
- Relocation of insulated rail joints as at the buffer stop end of Platform 12 associated with moving buffer stop positions
- Adjustment of platform copers on Platform 9 and 10 to suit the revised alignments
- Removal of the existing buffer stops for platforms 9, 10 and 9/10 middle road;
- Provision of new energy absorbing buffer stops on tracks between Platforms 9,10 and 9/10 middle road;
- Relocation of insulated rail joints as at the buffer stop end of Platforms 9, 10 and 9/10 middle road associated with moving buffer stop positions.
- Removal of the existing buffer stops for platform 11;
- Provision of new energy absorbing buffer stops on tracks between Platforms 11;
- Removal of the existing track city end of platform 11 (10m);
- Relocation of insulated rail joints as at the buffer stop end of Platform 11 associated with moving buffer stop positions.
- Re-opening of platform 12;
- Temporary closure of platform 14;
- Removal of the tracks for platforms 14;
- Removal of the 205A turnout;

3.2 Metro Box Platform 13/14 Return to operations and Western concourse works

- Realign Platform 13 Road and Platform 14 Road by continuing the straight elements of 203A/B towards city; associated with construction of Sydney Metro station box.
- Installation of new 206B derailer and 207 catch points
- New platform 12/13 diamond;
- Installation of new 205A 160:6.6 tangential turnout with respaced end infill, points shifted 4.292m towards country. Points to be clipped, locked and detected 'Reverse';
- Installation of new 205B derailer, to be clipped, locked and detected 'Reverse'.
- Provision of new energy absorbing buffer stops on tracks between Platforms 13 and 14;
- Installation of new 206A 190:7 tangential turnout with respaced end infill, points shifted 14.995m towards country;
- Relocation of insulated rail joints associated with extending country end of Platforms 13 and 14;
- Completion of platforms 12 and 13 track works

Additional to the track changes that impact the signalling infrastructure there will be further stages for track works relating to piling and track slab construction.

4. Line speeds

4.1 Existing Line Speeds

Existing line speeds obtained from TS TOC.2 dated 19 December 2016 for the Sydney Yard area. Up and Down directions are as shown in Table 4.1. The turnouts/points which do not have speed listed in TOC are shown as default (25km/h) as per TOC manual;

Table 4.1 Existing speeds – down direction

Line	Train Type	Line Speed (Km/h)	Kilometrages	
			From (km)	To (km)
Road 9, 154 points to Road 9	Normal	X15	0.275	-
Road 15, 208 points to Up/Down Bankstown	Normal	X15	0.300	-
Road 9, 195 points to Road 9	Normal	X40	0.305	-
Up Bankstown, 203 points to Down Bankstown	Normal	X40	0.365	-
Down Bankstown, 240 points to Down Suburban Yard	Normal	X40	0.465	-
Up Suburban Yard, 239 points to Up Bankstown	Normal	X40	0.575	-

Table 4.2 Existing speeds – Up direction

Line	Train Type	Line Speed (Km/h)	Kilometrages	
			From (km)	To (km)
Down Bankstown, 203 points to Up Bankstown	Normal	X40	0.300	-
Road 9, 192 points to Road 10	Normal	X40	0.335	-
Road 10, 193 points to Up Bankstown	Normal	X15	0.390	-
Up Bankstown, 193 points to Road 10	Normal	X40	0.425	-
Up Suburban Yard, 242 points to Up Bankstown	Normal	X15	0.670	-

4.2 Proposed Line Speeds

There are no proposed new speeds in this area as part of Sydney Metro – City & Southwest project.

5. Existing signalling equipment and interfaces

The Sydney Yard Interlocking was commissioned in 1980, as a relay NX route setting signalling system. The relay based interlocking has no facility for remote control. It is currently controlled from a TD push button Mimic Control Panel located at Sydney Signal Box.

5.1 Existing Equipment

The existing signalling equipment for Sydney West Yard is listed on the table below:

Table 5.1 Existing equipment – Sydney Yard

Item	Type
Signals	Incandescent single light – Westinghouse SL35 lamps LED Signals
Train Stops	Pneumatic, Air Operated, Westinghouse JA Trainstop
Track Circuits	Single Rail AC track circuit
Points	Pneumatic, Style A, 'ES' and 'S' (turnouts) and style 'E' (catch points)
Interlocking	NX Route Relay Interlocking
Train Control	Local Control from Sydney Box (There is currently a project upgrading the control to ATRICS scheduled to be commissioned in May 2018).

5.2 Existing Interfaces

There are no external interfaces that will be considered as part of the scope of works.

6. Proposed signalling works

6.1 Overview

The proposed signalling works to be completed in two main stages, 'Sydney Yard Early Works' and 'Metro Box Platform 13/14 Return to operations and Western concourse'.

6.1.1 Sydney Yard Early Works

The scope of works for Sydney Yard early works is: the decommissioning of platform 15 and the Down Shunting Neck; the temporary removal of platforms 12, 13; reinstatement of platform 12 in its final position; temporary removal of platform 14; and modifications to the platform lengths of platforms 9 -11 to relocate the buffer stops towards the country.

For the Sydney Yard Early works the proposed signalling works include:

- Removal of SY21 (Including train stops), SY53 and SY60 signals and associated equipment;
- Removal Platform 15 Guards indicator and TRTS;
- Removal of platform 15 and Down shunting neck track circuits P15AT, P15BT, DSNBT;
- Removal of 208 Crossover;
- Removal and relocation of 203 crossover;
- Removal of Platform 15 buffer stop, fixed train stop and lights;
- Removal of redundant routes 18(S)A, 20(S)A, 51C and 74(M)G.
- Relocation of signalling distribution box DB1/6;
- Removal of 211, 212 turnout and 213 catch point,
- Removal of signal SY19, SY19 indicator, SY18 and SY18 indicator signals, train stops and track circuits;
- Removal of existing Platform 12 and 13 Guards indicators and TRTS;
- Removal of existing Platform 12 and 13 buffer stop and lights;
- Removal of 200 catch point, 205B derailer, 206B derailer, 207 catch point and associated equipment;
- Temporary 205A points 'Clipped, locked and detected' normal for routes into platform 14 only;
- Temporary 206A points 'Clipped, locked and detected' normal for routes into platform 11 only;
- Temporary book out of use of routes 34B, 35A, 74(M)D and 74(M)E.
- Relocation of signal SY14 and train stops, signal SY32 and associated track circuits;
- Removal of 195A turnout and provision of new 195A turnout in new alignment;
- Modification to the compressed air pipe, manifold M234.
- Relocation of signal SY16, SY16 indication, train stops and associated track circuits;
- Relocation of existing Platform 9 Guards indicators;
- Relocation of signal SY17, SY17 indicator, train stops and associated track circuits.
- Reinstatement of 200 catch point to the new position;
- Removal of 206A points;
- Reinstatement of platform 12

- Relocation of existing Platform 10 Guards indicators.
- Removal of existing Platform 9, 10 and 9/10 middle road buffer stop and lights;
- Provision of new Platform 9, 10 and 9/10 middle road buffer stop and lights;
- Relocation of signalling DB1/1A and DB1/1B distribution boxes.
- Removal and reinstatement of Platform 11 buffer stop and light
- Relocation of existing Platform 11 Guards indicators;
- Provision of SY18 on a new signal post, relocation of SY8 indication;
- Removal of Platform 14 buffer stop and lights;
- Removal Platform 14 Guards indicators;
- Provision of new Platform 12 Guards indicators;
- Provision of new Platform 12 buffer stop and lights
- Removal of 205A points;
- Removal of signal SY20 (Including train stops),
- Removal of Yard Master Telephone;
- Temporary book out of use routes 74(M)F, 75B.

The works outlined in the stages above will also require modification of the following:

- Modification to the compressed air pipe, provision of new pneumatic air supply to platforms 9, 10, 11, 12, 13 and 14
- Relocation of cable routes (temporary or permanent) and removal of redundant cables;
- Modification of Sydney Box West Yard Relay Interlocking.
- Modification of the ATRICS system (arrangements to be confirmed by Sydney Train)

6.1.2 Metro Box Platform 13/14 Return to operations and Western concourse

The 'Metro Box Platform 13/14 Return to operations and Western concourse' phase reinstates platforms 13 and 14 with the associated point and signal relocation. When Platforms 13 and 14 are rebuilt they will be modified, including a new rail alignment to accommodate the platform extensions.

For the Metro Box Platform 13/14 Return to operations and Western concourse, the proposed signalling works include;

- Relocation of SY35 signal;
- Provision of 205A turnout and 205B derailleurs, to be clipped, locked and detected 'Reverse';
- Modification to the air system;
- Relocation of P114BT and P14CT track circuits.
- Provision of 206A turnout, to be clipped, locked and detected 'Normal';
- Relocation of SY34 signal;
- Modification to the air system;
- Relocation of P11BT and P11CT track circuits;
- Relocation of cable routes (temporary or permanent) and removal of redundant cables;
- Provision of new buffer stop and lights for platforms 13 and 14;
- Provision of new Guards indicators on platforms 13 and 14;
- Reopening of platforms 13 and 14;

- New signal SY19, SY19 indicator and SY20 signals, train stops and associated track circuits commissioned back into service;
- New 206B derailer and 207 catch points commissioned back into service;
- Compressed air system commissioned back into service;
- Modification of Sydney Box West Yard Relay Interlocking for final design arrangement;
- Modification to the ATRICS system (arrangements to be confirmed by Sydney Train)

6.2 Train Control System

6.2.1 ATRICS

Sydney West Yard interlocking is controlled via a tiled push-button Local Control panel and separate indication diagram located at Sydney Signal Box. Sydney Trains is in the process of rolling out Advanced Train Running Information Control System (ATRICS) to be located at Homebush Control Centre to control Sydney Yard to be commissioned in May 2018. It is anticipated that this signalling design scope of works for Sydney Metro will assume that ATRICS has been commissioned. Hence the required signal design will be based on the assumption that the Sydney West Yard Interlocking will be controlled by ATRICS from Homebush Control Centre. However, this does not imply that the design will not be started until the ATRICS has been commissioned

As part of design strategy, it is proposed the works will be completed in two main phases - "Sydney Yard Early works" and "Metro Box Platform 13/14 return to operations and Western concourse" works. Modification updates will be carried out in ATRICS for both these phases at different stages within the duration of the project; however this arrangement will require agreement and acceptance by Sydney Trains.

6.3 Signalling Interlocking Configuration and Equipment

The Sydney West Yard relay interlocking will be modified to reflect removal of platform 15, its associated track and the Down Shunting Neck. The signalling scope will include the removal of signals, points, trainstops, and track circuits.

The sections below outline the final signalling scope of works that is to be completed as part of the recovery of platform 15, and the changes to the platforms 9 to 14. This scope of works will be delivered in the stages as described in Section 10.

Due to the complexity of Sydney Yard interlocking, the proposed removal of points and signals will have a substantial impact on changes required in the interlocking circuitry. The removal of 208 points and SY21 signal impacts multiple signalled routes up to the boundary for signal SY75 signal and SY89C signal. The removal of the other proposed turnouts and ground signals will have a similar major impact within the interlocking. Consideration must also be given to the site testing during the possessions for all of these interlocking changes that will be required.

6.3.1 Sydney Signal Box – West Yard Interlocking

The platform extensions and the removal of platform 15 and Down Shunting Neck will require the following signalling interlocking modifications. Sydney Box which houses the West Yard interlocking will be modified as follows, these include but are not limited to:

- Modification of SY18 interlocking circuits to remove 18(S)A route;
- Removal of SY21 interlocking circuits;
- Removal of SY21 train stop circuits from the interlocking;
- Modification of SY20 interlocking circuits to remove 20(S)A route;

- Modification of SY51 interlocking circuits to removed 51C route;
- Removal of SY53 interlocking circuits;
- Removal of SY60 interlocking circuits;
- Modification of SY74 interlocking circuits to remove 74(M)G route;
- Removal of 208 points interlocking circuits;
- Removal of 211 points interlocking circuits;
- Removal of 212 points interlocking circuits;
- Removal of 213 points interlocking circuits;
- Removal of P15AT, P15BT, DSNBT track circuits from the interlocking ;
- Removal of the P15 train ready to start push button circuit from the interlocking;

6.3.2 Sydney Signal Box - Relay Room 1

The platform extensions and the removal of platform 15 and Down Shunting Neck will require the following signalling interlocking modifications in Relay Room 1, these includes but are not limited to:

- Modify the lighting circuits for signal SY18 to remove 18(S)A route and associated relays;
- Modify the lighting circuits for signal SY18 Indicator to remove 18(S)A route and associated relays;
- Removal of the control and lighting circuits for signal SY21 and associated relays;
- Removal of SY21 train stop circuits;
- Modify the control lighting circuits for signal SY20 to remove 20(S)A route and associated relays;
- Modify the control lighting circuits for signal SY51 to removed 51C route and associated relays;
- Removal of the control and lighting circuits for signal SY53 and associated relays;
- Removal of SY60 shunt signal and associated equipment;
- Modify the control lighting circuit for signal SY74 to remove 74(M)G route and associated relays;
- Removal of 208 points and associated circuitry & equipment;
- Removal of 211 points and associated circuitry & equipment;
- Removal of 212 points and associated circuitry & equipment;
- Removal of 213 points and associated circuitry & equipment;
- Removal of P15AT track circuit relay;
- Removal of P15BT track circuit relay;
- Removal of DSNBT track circuit feed and relay;
- Removal of the P15 train ready to start push button circuitry;
- Removal of P15AT track indication circuit from Yard Master Panel;
- Removal of P15BT track indication circuit from Yard Master Panel;
- Removal of DSNBT track indication circuit from Yard Master Panel;
- Removal of Platform 15 guards indicator circuits.

6.4 Signalling Distribution Boxes

The removal of Platform 15 and the proposed platforms extensions will have an impact on localised signalling equipment which will result in modifications to the input/output cables in some of the distribution boxes as specified below. These works will be delivered in stages as described in Section 10.

6.4.1 DB1/1A and DB1/1B

Relocate both DB1/1A and DB1/1B distribution cases to make way for the platform 9 and 10 shortening at the northern end, these cases will be relocated during the Sydney Yard Early works stage 7 (possession 9), It is proposed the disconnection box to be relocated on a 'like for like basis' and the required design changes will be implemented after the relocation is completed.

The following modifications will be required at DB1A and DB1B:

- Renew cable – DB1/1-1 TO RRI;
- Renew cable – DB1/1-2 TO RRI;
- Renew cable – DB1/1-3 TO RRI
- Renew the local tail cables entering the DB1/1A and DB1/1B boxes;
- Renew Communication cable;
- Relocation of Sig Box Yard Master Telephone. Existing cable to be renewed;
- Removal of P15AT track circuit feed and associated cabling and equipment;
- Removal of P9AT and P9BT track circuit feeds. The track circuits are currently booked out of use;
- Relocation of P9A/B/CT track circuit feed at least 10m towards country end. Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of P10A/B/CT track circuit feed at least 10m towards country end. Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of M9.10AT track circuit feed at least 10m towards country end. Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of P11AT track circuit feed at least 7m towards country end. Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of P12AT track circuit feed at least 7m towards country end. Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of P13AT track circuit feed at least 9m towards country end. Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of P14AT track circuit feed at least 9m towards country end. Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Removal of platform 15 buffer stop lights and associated cabling;
- Removal of platform 15 guards indicators and associated cabling ;
- Relocation of the Yard Master telephone for the platform reduction and associated cabling;
- Removal of 'Platform 15 train ready to start push button' and associated cabling.

6.4.2 DB1/6

During the Sydney Yard early works stage 1 (possession 3) construction of the new metro station, for accessibility reasons DB1/6 will be relocated for the provision of a temporary access crossing and then will be re-instated in its original position upon completion. The cable route for this location will be moved, including the local tail cables and also main signalling cables. The following modifications will be required at DB1/6 for the final design:

- Relocate DB1/6 distribution case; It is the proposal for the DB/6 to be relocated during possession 2 (see Driver Diagram, stage 1 – Possession 3) the required design changes will be implemented after the relocation is completed.
- Renew cable - DB1/6-1 TO RR1;
- Renew cable - DB1/6-2 TO RR1;
- Renew cable - DB1/6-3 TO RR1;
- Renew cable - DB1/6-4 TO RR1;
- Renew cable - DB1/6-5 TO RR1;
- Renew cable to Platform 12 and 13 Guards Indicators;
- Re-terminate the local tail cables entering the DB1/6 box;
- Modification of the SY18 signal shunt route indicator remove 18(S)A indication; cable core name change only.
- Relocation of SY20 signal and SY20 train stop and associated equipment;
- Renew cable 20 BJB-1 to signal SY20 and train stop
- Modification of the SY20 signal shunt route indicator remove 20(S)A indication, cable core name change only;
- Removal of SY21 signal; removal of cable to 21 BJB-1
- Removal of SY21 Train stop, removal of cable to 21 BJB-1
- Removal of P15BT track circuit feed and recovery of cable to 15BT disconnection box
- Relocation of P14BT track circuit feed, Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of P14CT track circuit feed, Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of P11CT track circuit feed, Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of P13BT track circuit feed, Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks
- Relocation of 207 points 3.7m towards country end; Renew cable to 207 points Disconnection box
- Relocation of 206A points 15m towards country end; Renew cable to 206A points and 206B points Disconnection box;
- Relocation of 205A points 4m towards country end; Renew cable to 205A points and 205B points Disconnection box.

6.4.3 DB1/9

For the extension of platforms 10 and 11 on the country side, it is envisaged there will be sufficient space from the end position of the new platform to the DB, however the local tail cables and the cables cores entering the DB1/9 box in the vicinity of the construction site will have to be re-laid and re-terminated. The following modification will be required at DB1/9:

- Relocation of Sig Box Yard Master Telephone;
- Relocation of P11BT track circuit feed, Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of P11BT track circuit relay, Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of 200 catch points 18m towards country end, terminate new cable to points disconnection box;
- Relocation of SY16 (including indicator) and SY16 Train stop, Renew cable to signal SY16 and train stop;
- Relocation of SY17 (including indicator) and SY17 Train stop, Renew cable to signal SY17 and train stop;
- Site survey required to confirm of the status of track circuit P10D.

6.4.4 DB1/10

The following modification will be required at DB1/10:

- Relocation of P9DT track circuit feed. Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of P10FT track circuit feed, Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of SY14 signal and SY14 Train stop, Renew cable to signal SY14 and train stop.

6.4.5 DB1/12

The following modifications will be required at DB1/12:

- Relocation of P9GT track circuit feed, Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Relocation of P14FT track circuit feed, Renew cable to disconnection box, Terminate new 2 x 2c hypalon steel cables between the track circuit disconnection box and the tracks;
- Modification of the SY51 signal miniature multi route indicator circuit to change the terminal to remove 15 indication;
- Removal of SY53 signal, removal of cable to 53 Signal;
- Removal of 208A&B points, removal of 25c to 208A points, removal of cable to 208B points;
- Relocation of SY34 signal; Renew cable to signal SY34.
- Relocation of SY35 signal; Renew cable to signal SY35.
- Relocation of SY32 signal; Renew cable to signal SY32.
- Relocation of 203A points 0.708 towards city end, terminate new cable to 203A points disconnection box;
- Relocation of 203B points 0.708m towards country end, Renew cable to 203B points Disconnection box.

6.4.6 DB1/16

The following modification will be required at DB1/16:

- Modification of SY74 signal multi route indicator to change the terminal to remove 74(M)G indication.(Cable core function change only).

6.5 Cabling and Cable Routes

The proposed scope of works will have an impact on the cables and the cabling route around platforms 9 to 14 as shown in the DSS, the existing signalling cables and compressed air pipes are highlighted in Appendix Z.

Main and local signalling cables between platforms 9 -14 will require to be moved and relocated during these works, thus consideration will need to be given to the position of the existing cable route and if a new route is required.

It is envisaged that the main Signalling cables will not be affected by the proposed relocation of the CSR in the Sydney Yard vicinity.

It should be noted that Air pipes and signalling and power cables are mounted within GST on a dividing wall between platforms 15 and 16, adjacent to platform 15. At the time of producing this document it is not foreseen that this wall will be an obstruction during the construction stage of the project and will stay in situ. It is proposed that a cover or shield/cage will be provided to protect the services from potential damage from machinery. However, if there is a need for relocation in the future then these services will be relocated to the rear of the wall, adjacent to platform 16. A site survey will be required to confirm the cables contained within the GST prior to relocation.

The following is the list of signalling cables located in the area of the scope of works;

- Routes of main signalling cables to DB 4/5, DB4/1 and DB 3/8 to be confirmed via site investigation
- Cables mounted between platform 15 and 16;
 - ▶ Signalling equipment tail cables;
 - ▶ DB3/8-1 TO RR3;
 - ▶ DB3/8-1 TO RR3;
 - ▶ 120V Power cable;
- Main signalling cables from RR1 to SB – 28 x 50C;
- Cables from RR1 to distribution boxes; cables affected by these works are outlined in section 6.4 of this document
- Signalling equipment tail cables.

6.6 Signals

As part of the City & Southwest there are no new additional signals proposed however; the following signals will be impacted by the scope of works:

- Due to the southern extension of the platform 9 the relocation of signal SY14 and associated equipment is required. The proposal is for the signal to move 11m towards country from its existing location;
- Due to the southern extension of the platforms 10 and 11 the relocation of signals SY16, SY17, SY17 Indicator and associated equipment is required. The proposal is for SY16 signal to move 10m towards country from its existing location and SY17 signal to move 18m towards country from its existing location;
- It is the intention to provide separate signal posts for signals SY18 and SY19 located on platform 12 and 13.
- Due to the southern extension of platform 14 the relocation of signal SY20 and associated equipment is required. The proposal is for the signal to move 3.7m towards country from its existing location;
- Due to the closure of platform 15 Signals SY21, SY53 and SY60 and their associated equipment will be permanently removed;
- With the relocation of 195A, points SY32 signal will be relocated 3m towards country from its existing location;
- With the relocation of 205A, points SY35 signal will be relocated 4m towards country from its existing location;

- With the relocation of 206A, points SY34 signal will be relocated 14m towards country from its existing location.

Proposed changes to the signal positions will be subject to signal sighting committee assessment.

The requirement to reinstate Indicator signals for SY16, SY17, SY18 and SY19 will be assessed by the signal sighting committee.

6.7 Track Circuits / Train Detection

There is no proposal to change the track circuit configuration except where track circuit end will be relocated; these changes are highlighted in sections 6.3 and 6.4 of this report. The same type of track circuits will be retained and the provision of new tail cables to track circuits will be required if existing cables cannot be used. The following track circuit insulated rail joints will be relocated including the respective track feed and relay equipment.

- P9A/B/CT and P9DT track circuit insulated rail joint (Platform 9), relocated 11m towards country from its existing position;
- P9DT and P9GT track circuit insulated rail joint (Platform 9), relocated 3m towards country from its existing position;
- P10A/B/CT and P10FT track circuit insulated rail joint(Platform 10), relocated 10m towards country from its existing position;
- P11AT and P11BT track circuit insulated rail joint (Platform 11), relocated 18m towards country from its existing position;
- P14AT and P14BT track circuit insulated rail joint (Platform 14), relocated 3.7m towards country from its existing position;
- P14BT and P14CT track circuit insulated rail joint (Down Bankstown), relocated 4.92m towards country from its existing position;
- Removal of P14FT track circuit relay hypalon steel cables between Down Shunting Neck and P14FT Dis Box. Install new track circuit hypalon steel cable for P14FT track circuit between P14FT Dis Box and Down Bankstown;
- P11BT and P11CT track circuit insulated rail joint (Up Bankstown), relocated 14.995m towards country from its existing position.

6.8 Trainstops

The fixed trainstop at the end of platform 15 and SY21 signal trainstop will be permanently removed. The remaining trainstops will be retained and relocated where required; there are no new proposed trainstops.

6.9 Bonding

There is no proposed electrolysis bonding changes. Any modification will be like for like except that pertaining to platform 15 track.

6.10 Traction Feeding Air Gaps

There are no existing traction feed air gaps in the area, it is envisaged that there will be no changes to the existing arrangement.

6.11 Guard Indicators

Platform 15 guard Indicator will be permanently removed.

The guard's indicators for platform 9-14 will be removed as required during construction and then reinstated. The new position of guards indicators are subject to assessment by a signal sighting committee.

6.12 Signalling Power Supply

The power supply at Sydney Yard will be retained in its current configuration.

6.13 Telephones

Where signals and EOLs are removed, the associated telephones will also be removed.

6.14 Pneumatic Air Supply

The air system around Sydney Yard will be modified to reflect the removal of SY21 signal trainstop, 208A&B points, 211, 212 points (to be confirmed during site survey) and 213 points. Provision of new air pipes maybe required to the trains stops associated with the relocated signals SY14, SY16, SY17 and SY20. Site investigation during the detailed design phase will be required to confirm the air pipes impacted and to be relocated.

The route of an existing air supply is mounted between platforms 15 and 16 on a dividing wall. It is foreseen that this wall will not be an obstruction during the construction and will stay in situ; hence a cover or shield/cage will be provided to protect the services from potential damage from machinery.

The construction for the new Metro station will have direct impact on the location of the existing pneumatic air pipes in the vicinity of platforms 10 -15 on the country side of the station. The manifold for some of these air pipes is located at DB1/9, these air pipes will have to be identified and relayed clear of the construction site. A detailed site survey will be required to determine the route of these air pipes.

6.15 Buffer Stops

New friction buffer stops will be installed for platforms 9-14. The buffer stops will be provided with fixed red lights.

A reduced 4m buffer zone is required for Platform 14 to provide adequate space between the train and the new clearance point for the relocated 207 catchpoint and the signalling equipment.

6.16 Signalling Equipment Recoveries

All signalling equipment recovered from Sydney Yard will be disposed by the project in agreement with Sydney Trains.

6.17 Signalling Design Criteria

Due to the low speed operation in Sydney Yard area it is not envisaged that there will be any headway changes as part of this design.

7. New field equipment

7.1 Equipment Type

It is proposed for Sydney Trains as part of the City & Southwest project that new signalling field equipment will be used in accordance to the lasted standard where existing equipment cannot be reinstated. New cables (core or tail cables) will be installed where relocation is required in instances where existing cables cannot be re-used.

Table 7.1 Proposed new equipment – Sydney Yard

Item	Type
Signals	Single light LED Colour Light Signals
Train Stops	Pneumatic, Air Operated, Westinghouse JA Trainstop
Track Circuits	Single Rail AC track circuit
Points	Pneumatic (EP – style A or S)

8. Altered Signal Routes and Points

8.1 Existing and Altered Signal Routes

There are no new routes proposed. The following existing signal routes at Sydney Yard will be altered as part of the Sydney Metro – City & Southwest project:

Table 8.1 Existing signals / routes

Signal	Km	Route	Description	Route Indicator	Remarks
SY18		(M)	Home Down Bankstown	DB	(S)A route removed
		(S)A	Shunt Shunting Neck	SN	
		(S)B	Shunt Down Bankstown	DB	
		(S)C	Shunt Up Bankstown	UB	
SY20		(M)	Home Down Bankstown		(S)A route removed
		(S)A	Shunt Shunting Neck	SN	
		(S)B	Shunt Down Bankstown	DB	
		(S)C	Shunt Up Bankstown	UB	
SY21		(M)	Home Down Bankstown		Signal and trainstop removed Platform 15 guard indicator removed.
		(S)A	Shunt Shunting Neck	SN	
		(S)B	Shunt Down Bankstown	DB	
		(S)C	Shunt Up Bankstown	UB	
SY51		A	Shunt Platform 11	11	(S)C route removed
		B	Shunt Platform 14	14	

Signal	Km	Route	Description	Route Indicator	Remarks
		C	Shunt Platform 15	15	
SY53		(S)	Shunt, Down Shunting Neck		Signal removed.
SY60		A	Shunt Platform 14	14	Signal removed.
		B	Shunt Platform 15	15	
SY74		(M)A	Home, Platform 9	9	(M)G route removed.
		(M)B	Home, Platform 10	10	
		(M)C	Home, Platform 11	11	
		(M)D	Home, Platform 12	12	
		(M)E	Home, Platform 13	13	
		(M)F	Home, Platform 14	14	
		(M)G	Home, Platform 15	15	
		(S)A	Shunt Platform 9	9	
		(S)B	Shunt Platform 10	10	
		(S)C	Shunt Platform 11	11	

8.2 New Signal Routes

There are no new proposed signal routes for the Sydney Trains network as part of the Sydney Metro – City & Southwest project.

8.3 Existing and Altered Points

The following points at Sydney Yard will be altered as part of the Sydney Metro – City & Southwest project.

Table 8.2 Points alteration

Points No	Description	Remarks
208A/208B	Crossover Down Shunting Neck to Up Bankstown	Removed Existing 'A' Master and 'A' Slave clawlock points and associated EOL equipment.
211	Turnout Down Bankstown to Down Shunting Neck	Removed Existing 'ES' conventional points
212	Turnout Down Shunting Neck to Down Bankstown	Removed Existing 'E' conventional points
213	Catch Points Down Shunting Neck	Removed Existing 'E' conventional points
195A	Turnout Platform 9 and platform 10, Middle Road	Renewed (Spherolock with EOL & "A" valve) 195A points to move 3m towards country.
200	Catch points Platform 11	Relocated (Spherolock with EOL & "A" valve) 200 catch points to moved 18m towards country.
203A/B	Crossover Up Bankstown to Down Bankstown	Renewed (Spherolock with EOL & "A" valve) 203A Points moving 0.708m towards city 203B Points moving 0.708m towards country.
205A	Turnout Platform 12	Renewed (Spherolock with EOL & "A" valve) 205A points to be relocated 4.292m towards country and new turnout to be provided.
205B	Derailer Platform 12	Removed an reinstated in original position
206A	Turnout Platform 13	Renewed (Spherolock with EOL & "A" valve) 206A points to be relocated 14.995m towards country and new turnout provided.
206B	Derailer Platform 13	Removed an reinstated in original position
207	Catch points Platform 14	Renewed (Spherolock with EOL & "A" valve) 207B catch points to moved 3.7m towards country,

8.4 Signalling Equipment Rooms and Locations

The removal of Platform 15 and its associated equipment and the platforms extensions will result in modifications in the Relay Rooms and distribution boxes as specified in sections 6.3 and 6.4

However the following locations will be relocated due to these works, further site survey is required to confirm the new proposed location.

- During the Sydney Yard Early Works (stage 1), for accessibility purposes into the construction area between platforms 12, 13 and 14, the provision of a temporary service access crossing will be required. Therefore to

accommodate this, DB1/6 at the end of platform 14 and 15 will have to be temporarily relocated during the stage works.

- The reduction in platform 9 and 10 will require distribution boxes DB1A/1B to be relocated. It is the proposal that these locations are relocated to the edge of the extended concourse, in close proximity to their current location. As the proposed location the area is accessible to the general public, it is proposed the locations to be housed within secure railings. The existing distribution cases will be relocated to the new position during the construction stage, existing local tail cables and the cables cores entering DB1A/1B will be re-terminated.

9. Train Operations

9.1 Interim Sydney Yard Operations

The construction of some of Sydney Metro assets will be completed while Sydney trains is still in operation. Sydney Trains signalling systems will be booked out of use during possession based activities. However to deliver passenger demands it will be necessary to continue the train operation while construction works in the platforms are in progress. Sydney trains operations are discussed in Appendix AA – Operational modelling, however further works are required to outline the 'Sydney Yard Early works', 'Metro Box Platform 13/14 Return to operations and Western concourse' works, and 'Final' train operations. It should be noted that development of CONOPS is currently being undertaken by TfNSW and any changes as a result of the CONOPS will be implemented at a later stage

10. Staging works

10.1 Staging Overview

For the construction of Metro station, the track will be completed in two main phases, 'Sydney Yard Early works' and 'Metro Box Platform 13/14 Return to operations and Western concourse'. The Sydney Yard Early Works will include: the decommissioning of platform 15; temporary removal of platforms 12 and 13; reinstatement of platform 12; temporary removal of platform 14; and the revised platform lengths of platforms 9 -11. The 'Metro Box Platform 13/14 Return to operations and Western concourse' will include the permanent reinstatement of platforms 13 and 14, with the required associated signalling design changes.

The wall between platform 15 and 16 will not be affected by the construction of the cut and cover Sydney Metro. However, it is proposed the signalling core cable route and the air system that are currently mounted on the Platform 15 side of the wall will be provided with additional protection and contained prior to the construction works.

It should be noted that all the stages that have been listed below can be subdivided into smaller stages to cater for the resource restriction and possession times. The proposed possessions are outlined in the 'Sydney Metro City & Southwest Central Station – Sydney yard Early Works, B0+030km – B0+296km, Staging Diagrams, Concept Design, NWRLSRT-PBA-SCS-PL-DWG-389917' and 'Sydney Metro City & Southwest Central Station – Metro Box Platform 13/14 Return to Operations & Western Concourse, B0+030km – B0+296km, Staging Diagrams, Concept Design, NWRLSRT-PBA-SCS-PL-DWG-389918'

10.2 Support Works

Some of the project stage works will require signalling support, such as bonding associated with overhead wiring (OHW) alterations. These stage works will not generally involve any signalling operational changes.

10.3 Sydney Yard Signalling Early Works - Stage Works

The following signalling stages for the Sydney Yard Early Works have been broken down to correspond to the proposed possessions outlined in drawings NWRLSRT-PBA-SCS-PL-DWG-389917 – rev B'. The first stage of the Sydney Yard Early Works will be the decommissioning of platform 15 and the respective tracks including the Down Shunting Neck. This stage will be preparation of the next stages that will be required for the relocation of the services to make way for the construction of the new Sydney Metro platform and concourse including the track slewing and the temporary removal of platforms 12 and 13, reinstatement of platform 12, the temporary removal of platform 14 and the modifications to platforms 9-11. Platforms 13 and 14 will be reinstated in the Metro Box Platform 13/14 Return to operations and Western concourse works.

During the construction of the new Sydney Metro station, it is a requirement to keep 12 platforms operational; therefore platform 14 will not be 'booked at out use' until platform 12 has been reinstated. During this stage it is proposed to reinstate platform 12 in its new form and then demolish platform 14.

The proposed 'Sydney Yard Early Works' are outlined in the drawings attached in Appendix C to Appendix P of this document. The proposed 'Metro Box Platform 13/14 Return to operations and Western concourse' works' are outlined in the drawings attached in Appendix R to Appendix X.

It is assumed that this signalling design scope of works for Sydney Metro will be started after the ATRICS has been commissioned.

10.3.1 Signalling Stage 1 (Construction Possession 2 and 3)

To prepare the way for the construction of the new cut and cover Sydney Metro station, platform 15 will be decommissioned along with its associated equipment. To aid with the accessibility for the removal of the platforms 12 and 13 and the other proposed extensions to platforms 9-11, a temporary service access crossing will be provided, from the open area at the country end of platform 15 into the area to the construction site. The provision of this crossing will require location DB1/6 to be temporarily relocated, and then re-instated on the completion of the works. It is proposed that this crossing is constructed during Possession 1 and 2 (drawings NWRLSRT-PBA-SCS-PL-DWG-389917)

As a result of the decommissioning of platform 15 the following signalling scope of works will be completed:

- Platform 15 Booked out of use;
- Removal of SY18(S)A route from the interlocking;
- Removal SY20(S)A route from the interlocking;
- Removal of SY21 signal and associated equipment;
- Removal of signal SY21 from the M323 air system manifold;
- Modification of SY51 signal route indicator to remove 51C to platform 15;
- Removal of SY53 vertical shunt signal and associated equipment;
- Removal of SY60 shunt signal and associated equipment;
- Modification of SY74 signal route indicator to remove 74(M)G to platform 15, route to be removed from the interlocking;
- Removal of platform 15 Guard Indicator;
- Removal of P15AT track circuit feed and relay;
- Removal of P15BT track circuit feed and relay;
- Removal of DSNBT track circuit feed and relay (decommissioning of Down Shunting Neck);
- Relocation of P14FT track circuit relay from the Down Shunting Neck to share track joint with P14ZT track circuit on Down Bankstown;
- Removal of 203A and 203B points;
- Reinstall 230A and 203B points in the new position;
- Removal of 208A&B points and associated equipment;
- Removal of 208A points from the M321 air system manifold;
- Removal of 208B points from the M322 air system manifold;
- Removal of 211 points and associated equipment
- Removal of 212 points and associated equipment;
- Removal of 213 points and associated equipment;
- Removal 213 points from the M320 air system manifold;
- Modify the compressed air system for the removed points and SY21 signal trainstop;
- Modify the interlocking circuitry at Relay Room 1 and Sydney Box;
- Remove the stop board for electric trains into the Down Shunting Neck;
- Removal of platform 15 buffer stop lights;
- Removal of 'Platform 15 train ready to start push button';

- Modifications will be required to be made to ATRICS on completion of these stage works, however the arrangement to be consulted with Sydney Train.

10.3.2 Signalling Stage 2 (Construction Possession 4A)

During this possession platform 15 will be demolished. The following signalling scope of works will be completed:

- Relocation of DB1/6, cables terminating at the disconnection box will be renewed; the duration of time between possessions from the removal and reinstalment for the relocation of DB1/6 is outlined in NWRLSRT-PBA-SCS-PL-DWG-389917'. The number and type of cables to be reinstated are detailed in section 6.4.2 of this document.

10.3.3 Signalling Stage 3 (Construction Possession 4)

During this stage signalling equipment and infrastructure relating to Platforms 12 and 13 will be removed, to enable the excavation of Sydney Metro Open box. Following is the signalling scope of works that will be completed during this stage:

- Platform 12 and associated equipment, to be 'Booked out of use' (confirmation required from Sydney Trains);
- Platform 13 and associated equipment, to be 'Booked out of use'(confirmation required from Sydney Trains);
- Removal of SY18 signal and SY18 Indicator (to be reinstated later in stage 9 of the early work stages);
- Removal of SY18 signal train stop (to be reinstated later in stage 9 of the Sydney Yard Early Works stages);
- Removal of SY19 signal and SY19 Indicator (to be reinstated later in stage 1 of the Metro Box Platform 13/14 Return to operations and Western concourse works stages);
- Removal of SY19 signal train stop (to be reinstated later in stage 1 of the Metro Box Platform 13/14 Return to operations and Western concourse works stages);
- Removal of platform 12 Guard Indicators (to be reinstated later in stage 6 of the Sydney Yard Early Work stages);
- Removal of platform 13 Guard Indicators (to be reinstated later in stage 1 of the Metro Box Platform 13/14 Return to operations and Western concourse works stages);
- The removal of the track work for platforms 12 and 13, up to and including the diamond crossing.
- Removal of 207 catch points (to be reinstated later in stage 1 of the Metro Box Platform 13/14 Return to operations and Western concourse works stages);
- Removal of 206B Detailer (to be reinstated later in stage 1 of the Metro Box Platform 13/14 Return to operations and Western concourse works stages);
- Removal of 205B Detailer (to be reinstated later in stage 2 of the Metro Box Platform 13/14 Return to operations and Western concourse works stages);
- Temporary 'Clip, lock and detect' 205A points normal for routes in to Platform 14 only. The circuits within the interlocking that require the points reverse for movements into platform 12 will be temporarily 'Booked out of use' (confirmation required from Sydney Trains);
- Temporary 'Clip, lock and detect' 206A points normal for routes in to Platform 11 only. The circuits within the interlocking that require the points reverse for movements into platform 13 will be temporarily 'Booked out of use' (confirmation required from Sydney Trains);
- Removal of P12AT and P13AT track circuits;
- Temporary disconnection of P13BT track circuit feed to the track leading to platform 13;
- Temporary disconnection of P13BT track circuit relay to the track leading to platform 12;
- Temporary book 74(M)D routes out of use (brought back into use in stage 9 of the early work stages);
- Temporary book and SY34B 74(M)E routes out of use (brought back into use in the final stages works)

- Temporary book and SY35A route out of use (brought back into use in stage 9 of the early work stages); ;
- Modification to the compressed air system, manifold M323 for the points and signal trainstops that are impacted by these works;
- Modifications will be required to be made to ATRICS on completion of these stage works, however the arrangement to be consulted with Sydney Train.
- All the temporary 'Booked out of use' arrangement of the interlocking circuits and equipment are to be agreed and accepted by Sydney Trains.

10.3.4 Signalling Stage 3 (Construction Possession 5)

During this possession Platform 12 and 13 will be demolished.

10.3.5 Signalling Stage 4 (Construction Possession 6)

During this stage 195A points will be removed and re-installed in the new position with the new track slew into platforms 9 and 9/10.

- Relocate SY32 signal, 3m to the country, renew tail cables if existing cable cannot be reused
- Relocation of SY14 signal, SY14 trainstop and P9CT/P9DT track circuit joint for at least 10m towards the south. Renewal of tail cables for the affected equipment where the existing cables cannot be reused;
- Relocate 195A turnout, 3m to the country. Renew tail cables if existing cable cannot be reused;
- Modification to the compressed air system manifold M324 for the points and signal trainstops that are impacted by these works;

10.3.6 Signalling Stage 5 (Construction Possession 7)

- Platform 9 will be extended to the southern end by 11m;
- Relocation of SY16 signal, SY16 trainstop and P10A/B/CT and P10FT track circuit joint 11m towards the south; renew tail cables if existing cable cannot be reused;
- Modification to the compressed air system, M323 signal trainstops impacted by these works;

10.3.7 Signalling Stage 6 (Construction Possession 8)

During this possession Platform 12 will be rebuilt including new track slew up for the road into platform 12.

- Platform 12 to be rebuilt and shortened by moving the concourse end of the platform to the south by 7.7m
- Platform 10 will be extended to the southern end by 11m;
- Relocation of SY17 signal (including the indicator), SY17 trainstop and P11AT/P11BT track joint at least 10m towards the south. Renewal of cables for the affected equipment where the existing cables cannot be reused;
- Each of the following track circuits P11AT and P11BT have feeds connected to the rail via a 2 x 2c Hypalon steel cables. This cables will be renewed or re-terminated where the length permits
- Modification to the compressed air system for the points and signal trainstops impacted by these works;
- Relocate 200 catch points about 18m to the south of the original position. Renewal of cables for the affected equipment where the existing cables cannot be reused;
- Remove 206A points and associated equipment (to be reinstated later in stage 3 of the Metro Box Platform 13/14 Return to operations and Western concourse works);

- Modifications will be required to be made to ATRICS on completion of these stage works, however the arrangement to be consulted with Sydney Train.

10.3.8 Signalling Stage 7 (Construction Possession 9)

During this possession platform 11 will be modified and extend by 10m towards the country. Platform 11 will be shortened by moving the concourse end of the platform to the south by 7.7m and extended to the southern end by 10m.

For the proposed reduction in length for platform 9 and 10, distribution boxes DB1/1A and DB1/1B will be relocated, new position to be confirmed.

- Platform 9 will be shortened at the concourse end of the platform to the south by 11m, this will be the final position and length of the platform;
- Platform 10 will be shortened at the concourse end of the platform to the south by 11m, this will be the final position and length of the platform ;
- Removal of existing buffer stop lights and provision of new buffer stop lights and cables for platforms 9, (relocated 11m towards country). New cables to be installed;
- Removal of existing buffer stop lights and provision of new buffer stop lights and cables for platforms 10, (relocated 11m towards country). New cables to be installed;
- Each of the following track circuits P9A/B/CT, P10A/B/CT, M9.10AT and P11AT have feeds connected to the rail via a 2 x 2c Hypalon steel cables. All of these cables will be renewed if existing cables cannot be renewed;
- P9 for P10 Train Ready to Start Push Button cables to be renewed.
- Provision of guards indicators for platforms 9 and 10, signal sighting required;

10.3.9 Signalling Stage 8 (Construction Possession 10)

- Removal of existing buffer stop and provision of new buffer stop lights and cables for platform 11 (relocated 7.6m towards country). New cables to be installed;
- P11 Train Ready to Start Push Button cables to be renewed.
- Provision of guard's indicator for platform 11, signal sighting required.

10.3.10 Signalling Stage 9 (Construction Possession 11)

This stage comprises the installation of track slew for platform 12 and the installation of platform 12 signalling infrastructure.

- Track circuit P12AT track feed to be connected;
- Track circuit P13BT track feed and relay will need to be reconnected;
- Provision of SY18 signal on a new signal post and SY18 trainstop, and P12AT/P13BT track circuit joint. New tail cables provided to the disconnection box. Removal of temporary design in the interlocking;
- P12 Train Ready to Start Push Button cables to be renewed;
- Provision of new Guards indicator on platform 12. New cables to be installed. Position of the Guard Indicator is subject to signal sighting committee recommendation;
- Provision of new buffer stop lights and cables for platform 12. New cables to be installed.
- Remove 205A points, The points will be temporarily 'Booked out of use' - confirmation required from Sydney Trains (to be reinstated later in stage 2 of the Metro Box Platform 13/14 Return to operations and Western concourse works);

- Platform 14 booked out of use;
- Temporary removal of signal SY20 and associated equipment (to be reinstated later in stage 1 of the main work stages);
- P14BT Track feed to be relocated to share track joint with P13BT track circuit into platform 12.
- Book routes SY35A and 74(M)D back into use;
- Temporary book SY35B, SY51B, SY59B and 74(M)F routes out of use(brought back into use in the final stages works);
- Modifications will be required to be made to ATRICS on completion of these stage works, however the arrangement to be consulted with Sydney Train. All the temporary 'Booked out of use' arrangement of the interlocking circuits and equipment are to be agreed and accepted by Sydney Trains.

10.3.11 Signalling Stage 9 (Construction Possession 12)

Platform 14 will be demolished.

10.4 'Metro Box Platform 13/14 Return to operations and Western concourse'

Upon completion of the Sydney Yard Early Work, the 'Metro Box Platform 13/14 Return to operations and Western concourse' phase will reinstate platforms 13 and 14 with the associated point and signal relocation. When Platforms 13 and 14 are rebuilt they will be modified including a new rail alignment to accommodate the platform extensions.

The proposed scope of works for the 'Metro Box Platform 13/14 Return to operations and Western concourse' works is outlined in the drawings attached in Appendix R, Appendix T and Appendix V of this document. The signalling stages are produced in line with the proposed stages/possessions outlined in NWRLSRT-PBA-SCS-PL-DWG-389918 – Rev B.

10.4.1 Signalling Stage 1 (Construction Possession Configuration Stage 2)

During this possession platforms 13 and 14 will be rebuilt to the new configuration including the new track slews for both roads into the platforms.

As a result of platform extensions and the required track slews, the following signalling scope of works will be completed:

- Platform 14 shortened by moving the concourse end of the platform to the south by 9.4m and extended to the southern end by 6m;
- Platform 13 will be rebuilt, shortened by moving the concourse end of the platform to the south by 9.4m. There will be no extension to the platform, however the platform will be widened at the southern end;
- Provision of new buffer stop lights and cables for platforms 13 and 14. New cables to be installed
- Provision of SY19 signal on a new signal post, SY19 Indication and SY19 trainstop, and P13AT/P13BT track circuit joint. New tail cables provided to the disconnection box. Removal of temporary design in the interlocking;
- Modification to the compressed air system, manifold M323 for the points and signal trainstops that are impacted by these works;
- Modifications will be required to be made to ATRICS on completion of these stage works, however the arrangement to be consulted with Sydney Train.

10.4.2 Signalling Stage 1 (Construction Possession Configuration Stage 3)

- Provision of new 207 catch points about 3.7m to the south of the original position. Remove the temporary design from the interlocking;
- Provision of new 206B derailer at the original position. Remove the temporary design from the interlocking.
- Modifications will be required to be made to ATRICS on completion of these stage works, however the arrangement to be consulted with Sydney Train.

10.4.3 Signalling Stage 2 (Construction Possession Configuration Stage 4)

During this stage a new diamond crossover will be installed on the final alignment to platform 12 and 13 roads.

- Provision of new 205B derailer at the original location, fixed in the 'Reverse' position. Remove temporary design from the interlocking;
- Provision of new 205A points about 7m to the south of the original position. The points will be temporarily 'Clipped, lock and detected' reverse for routes in and out of Platform 12 only;
- Relocation of SY35 signal and P14BT/P14CT track circuit joint at least 7m towards the south;
- Modifications will be required to be made to ATRICS on completion of these stage works, however the arrangement to be consulted with Sydney Train.

10.4.4 Signalling Stage 3 (Construction Possession Configuration Stage 6)

- Provision of new 206A points about 14.5m to the south of the original position. The points will be temporarily 'Clipped, locked and detected' normal for routes in and out of Platform 11 only;
- Relocate SY34 signal, renewal of cables for the affected equipment where the existing cables cannot be reused
- P11BT/P11CT track circuit joint at least 14m towards the south, renewal of cables for the affected equipment where the existing cables cannot be reused;
- Provision of SY20 signal, SY20 trainstop, and P14AT/P14BT track circuit joint at least 6m towards south. New tail cables provided to the disconnection box. Removal of temporary design in the interlocking;
- Modification to the compressed air system for the points impacted by these works;
- Modifications will be required to be made to ATRICS during the stage works it is proposed the 'block' that was placed on the affected infrastructure that's was being temporarily removed, is now removed. In the interlocking the temporary design modification will also be removed. These proposed changes are to be agreed and accepted by Sydney trains.

10.4.5 Final Arrangement (Construction Possession Configuration Stage 8)

- Reinstate platforms 13 and 14 to operational service;
- Provision of new buffer stop lights and cables for platforms 13 and 14. New cables to be installed to DB1/1A;
- Provision on new Guard Indicators for platforms 13 and 14. Position of the Guard Indicators subject to signal sighting committee recommendation;
- Provision of new cables to track circuits P13AT and P14AT from DB1/1A;
- Signalled route SY34B, SY35B, SY51B, SY59B, SY74(M)E and SY74(M)F brought back into use;

In association with the changes required in the scope of works the following modifications will be required:

- Modification to the compressed air system for the points and signal trainstops impacted by these works;
- Modify ATRICS to the modified signalling infrastructure; any Block that was placed on ATRICS for the temporary removal of infrastructure during the stage works will now be removed and infrastructure permanently removed will have to be removed from ATRICS.

On completion of the 'Metro Box Platform 13/14 return to operations and Western concourse' works, any signalling infrastructure that will be permanently removed from the interlocking will require agreement by Sydney trains.

Additional to the track stages for the changes that impact the signalling infrastructure there will further stages for track works relating to piling and track slab construction.

11. Testing and Commissioning

The commissioning strategy has not been finalised at the time of writing this document. It is anticipated that the commissioning will require the same possessions as the staging work outlined in section 6. Since the staging works are not final, the commissioning strategy will be developed when staging works are finalised.

11.1 Site Acceptance Testing

It is envisaged that minimal site acceptance testing can be completed prior to each commissioning stage.

11.2 Commissioning

The commissioning of the new works will include a full correspondence test of all new/alterd track circuits, point machines, trainstops, signalling aspects, and miscellaneous equipment to the interlocking control and control system in Sydney West Yard.

It is anticipated that this signalling design scope of works for Sydney Metro will assume that ATRICS has been commissioned. Hence the required signal design will be based on the assumption that the Sydney West Yard Interlocking will be controlled by ATRICS from Homebush Control Centre. However, this does not imply that the design will not be started until the ATRICS has been commissioned

It will be necessary to carry out any required function testing, deign integrity testing and correspondence testing of the interlocking and interface areas during each commissioning stage.

As part of the commissioning process the changes to the infrastructure will be advertised in the Weekly Notice. Subsequent drivers diagram will be provided as part of the notice. The insertion will be prepared and signed to meet the publication dates.

Appendix A

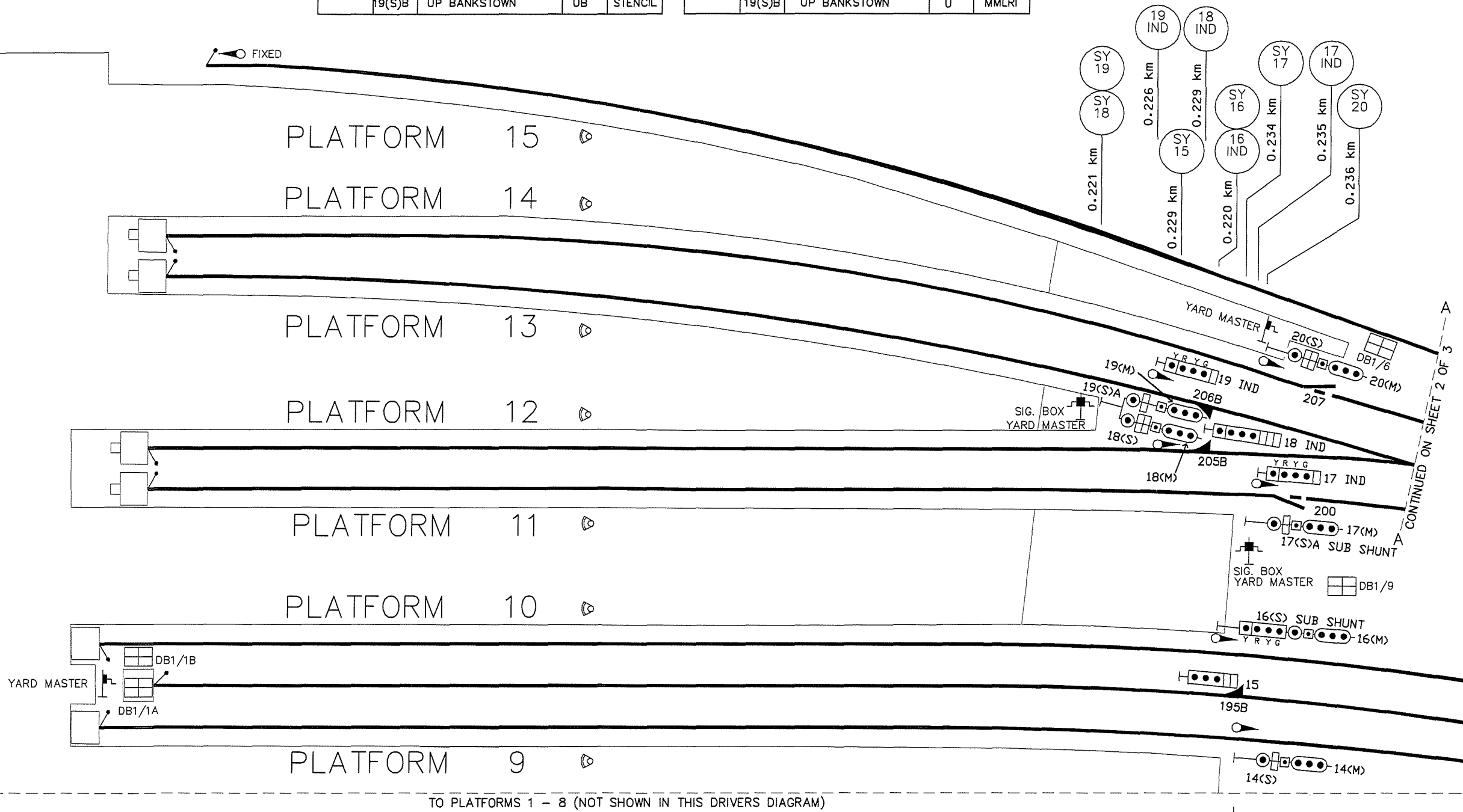
Drivers Diagram – Existing Arrangement

SYDNEY TERMINAL CONCOURSE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19	M	DOWN BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	DB	STENCIL
	19(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19 IND.	M	UP BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	D	MMLRI
	19(S)B	UP BANKSTOWN	U	MMLRI



TO PLATFORMS 1 - 8 (NOT SHOWN IN THIS DRIVERS DIAGRAM)

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18 IND.	M	DOWN BANKSTOWN	-	-
	18(S)A	SHUNTING NECK	SN	STENCIL
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18	M	DOWN BANKSTOWN	-	-
	18(S)A	SHUNTING NECK	SN	STENCIL
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)A	SHUNTING NECK	SN	STENCIL
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL

NSW Transport Sydney Trains

SYDNEY YARD - METRO STATION
EXISTING DRIVERS DIAGRAM
 SIGNALLING ARRANGEMENT SHEET 1 OF 3


PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 23012017

File Plotted DD_SYDNEY YARD_METRO STATION_EXISTING.dwg
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 Plotted by WATTS, STEVE

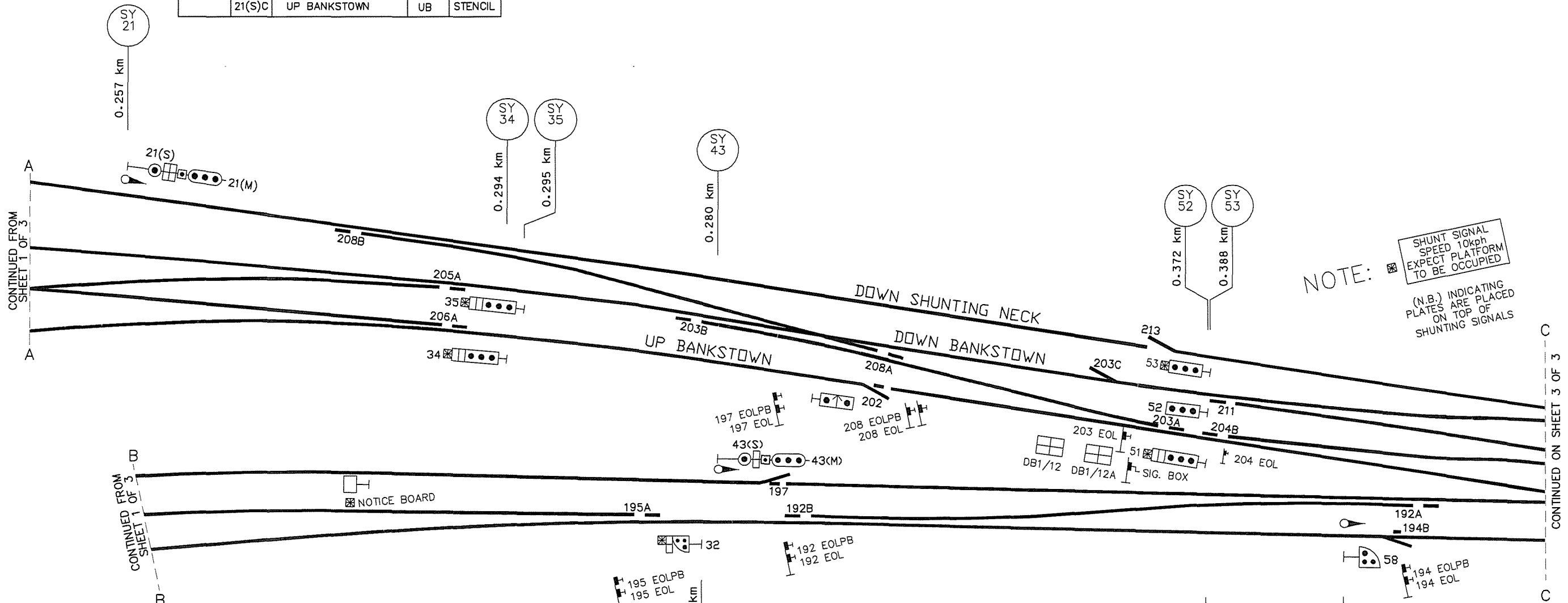
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
21	M	DOWN BANKSTOWN	-	-
	21(S)A	SHUNTING NECK	SN	STENCIL
	21(S)B	DOWN BANKSTOWN	DB	STENCIL
	21(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
34	34A	PLATFORM 11	P11	STENCIL
	34B	PLATFORM 13	P13	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
35	35A	PLATFORM 12	P12	STENCIL
	35B	PLATFORM 14	P14	STENCIL

NOTE:  SHUNT SIGNAL
SPEED 10kph
EXPECT PLATFORM
TO BE OCCUPIED

(N.B.) INDICATING
PLATES ARE PLACED
ON TOP OF
SHUNTING SIGNALS



SIGNAL	ROUTE	DESTINATION	IND.	TYPE
32	32A	PLATFORM 9	P9	STENCIL
	32B	MIDDLE ROAD	MR	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
43	M	DOWN BANKSTOWN	-	-
	43(S)A	DOWN BANKSTOWN	DB	STENCIL
	43(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
51	51A	PLATFORM 11	11	MMLRI
	51B	PLATFORM 14	14	MMLRI
	51C	PLATFORM 15	15	MMLRI



SYDNEY YARD - METRO STATION
EXISTING DRIVERS DIAGRAM
 SIGNALLING ARRANGEMENT SHEET 2 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 17012017

File Plotted DD_SYDNEY YARD_METRO STATION_EXISTING.dwg
 Plot Date & Time 2/13/2017 2:43 PM
 Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
59	59A	PLATFORM 11	11	STENCIL
	59B	PLATFORM 14	14	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
60	60A	PLATFORM 14	14	STENCIL
	60B	PLATFORM 15	15	STENCIL

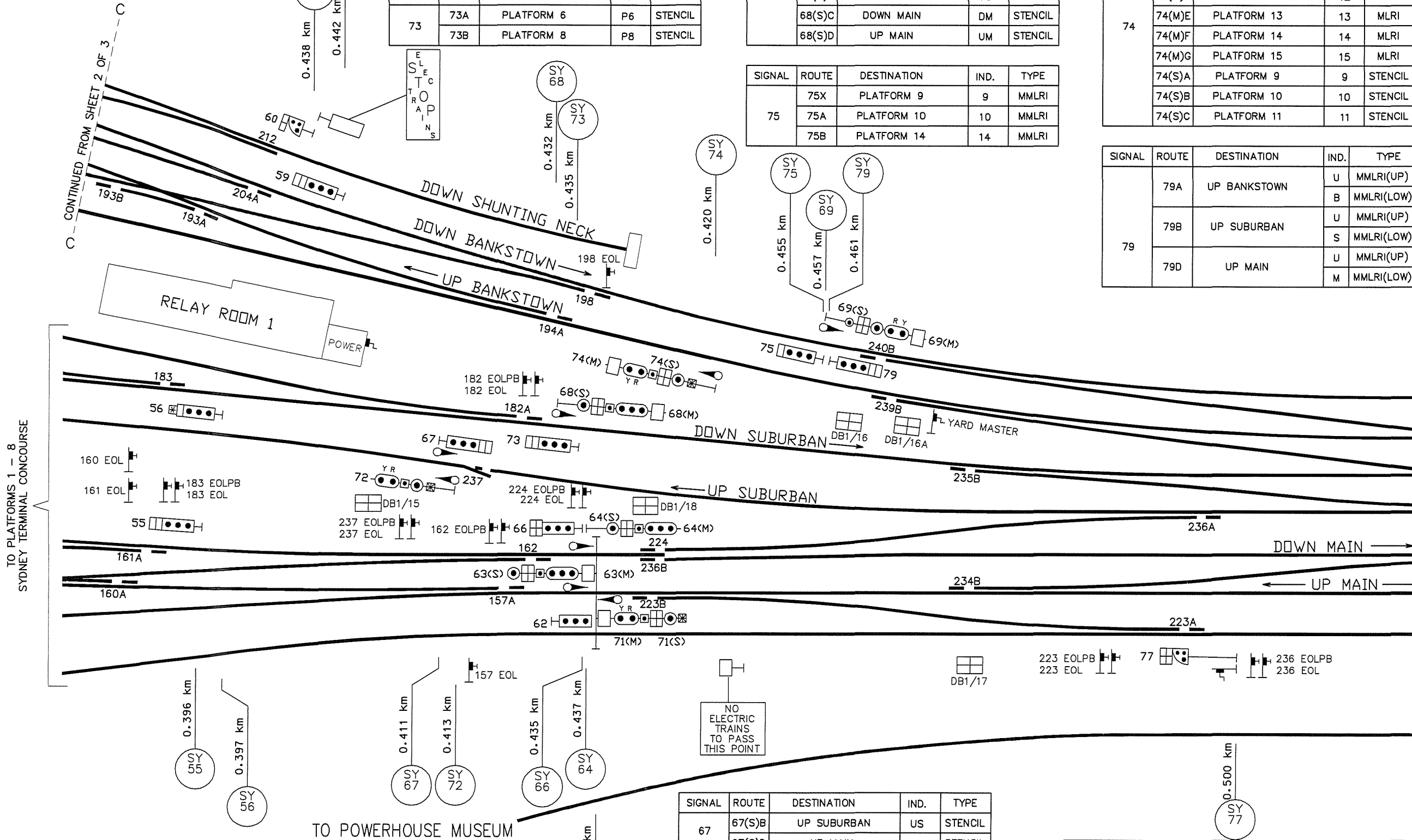
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
68	68(M)A	DOWN SUBURBAN	-	-
	68(M)B	DOWN MAIN	M	MLRI
	68(S)A	DOWN SUBURBAN	DS	STENCIL
	68(S)B	UP SUBURBAN	US	STENCIL
	68(S)C	DOWN MAIN	DM	STENCIL
	68(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
74	74(M)A	PLATFORM 9	9	MLRI
	74(M)B	PLATFORM 10	10	MLRI
	74(M)C	PLATFORM 11	11	MLRI
	74(M)D	PLATFORM 12	12	MLRI
	74(M)E	PLATFORM 13	13	MLRI
	74(M)F	PLATFORM 14	14	MLRI
	74(M)G	PLATFORM 15	15	MLRI
	74(S)A	PLATFORM 9	9	STENCIL
	74(S)B	PLATFORM 10	10	STENCIL
	74(S)C	PLATFORM 11	11	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
73	73A	PLATFORM 6	P6	STENCIL
	73B	PLATFORM 8	P8	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
75	75X	PLATFORM 9	9	MMLRI
	75A	PLATFORM 10	10	MMLRI
	75B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
79	79A	UP BANKSTOWN	U	MMLRI(UP)
			B	MMLRI(LOW)
	79B	UP SUBURBAN	U	MMLRI(UP)
			S	MMLRI(LOW)
	79D	UP MAIN	U	MMLRI(UP)
			M	MMLRI(LOW)



SIGNAL	ROUTE	DESTINATION	IND.	TYPE
63	63(M)A	DOWN MAIN	D	MLRI
	63(M)B	UP MAIN	U	MLRI
	63(S)B	DOWN MAIN	DM	STENCIL
	63(S)C	UP MAIN	UM	STENCIL
	63(S)D	UP SHUNTING NECK	SN	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
69	69(M)B	DOWN MAIN	M	MLRI
	69(S)A	DOWN BANKSTOWN	DB	STENCIL
	69(S)B	DOWN SUBURBAN	DS	STENCIL
	69(S)C	DOWN MAIN	DM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
67	67(S)B	UP SUBURBAN	US	STENCIL
	67(S)D	UP MAIN	UM	STENCIL

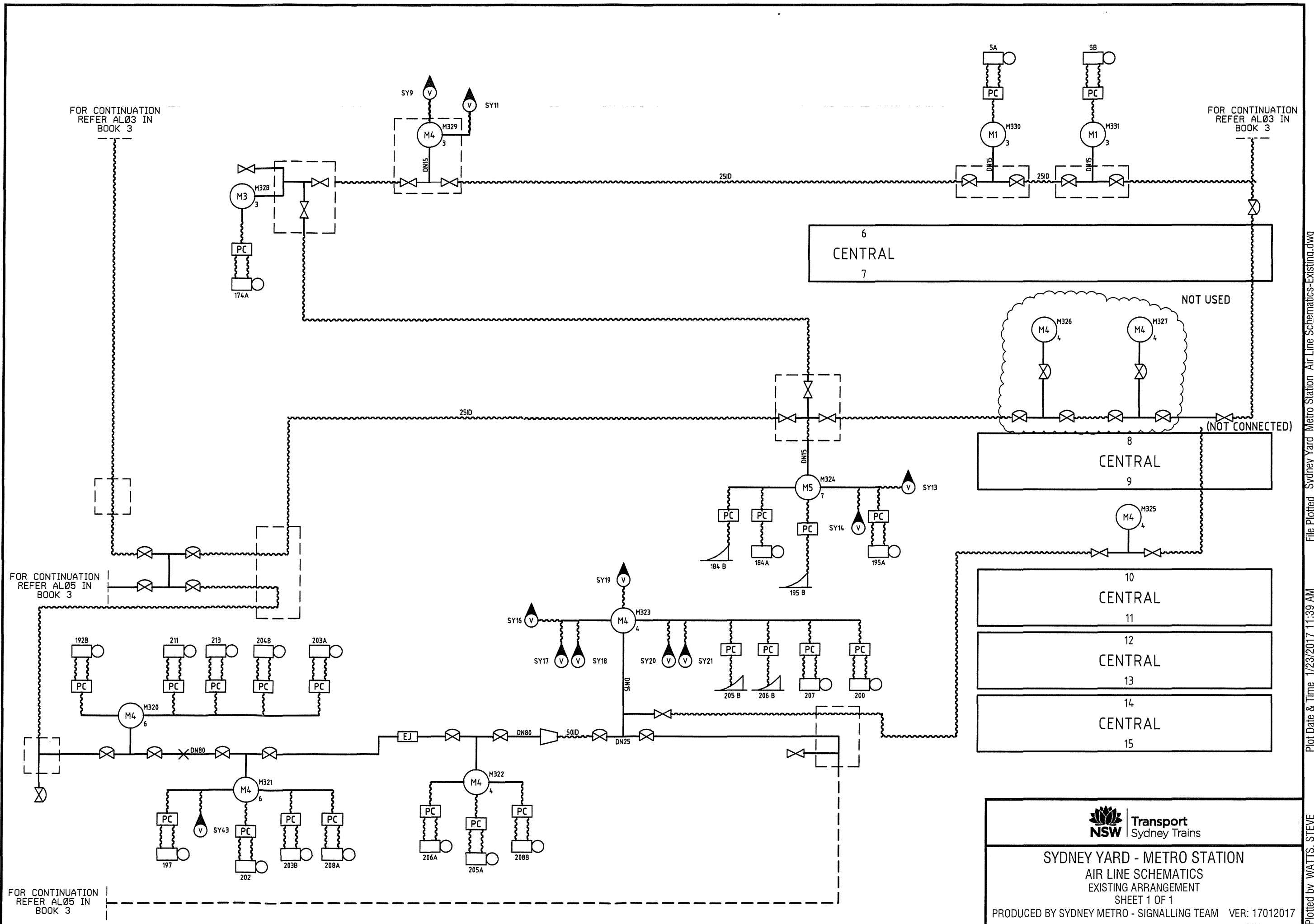
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
64	M	DOWN MAIN	-	-
	64(S)A	BOOKED OUT OF USE	US	STENCIL
	64(S)B	BOOKED OUT OF USE	DM	STENCIL
	64(S)C	BOOKED OUT OF USE	UM	STENCIL


SYDNEY YARD - METRO STATION
EXISTING DRIVERS DIAGRAM
 SIGNALLING ARRANGEMENT SHEET 3 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 17012017

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 FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
 Plotted by WATTS, STEVE

Appendix B

Air Schematics – Existing Arrangement



FOR CONTINUATION
REFER AL03 IN
BOOK 3

FOR CONTINUATION
REFER AL03 IN
BOOK 3

6
CENTRAL
7

8
CENTRAL
9

10
CENTRAL
11

12
CENTRAL
13

14
CENTRAL
15

FOR CONTINUATION
REFER AL05 IN
BOOK 3

FOR CONTINUATION
REFER AL05 IN
BOOK 3



SYDNEY YARD - METRO STATION
AIR LINE SCHEMATICS
EXISTING ARRANGEMENT

SHEET 1 OF 1
PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 17012017

File Plotted - Sydney Yard_Metro Station_Air Line Schematics-Existing.dwg Plot Date & Time 1/23/2017 11:39 AM Plotted by WATTS, STEVE

Appendix C

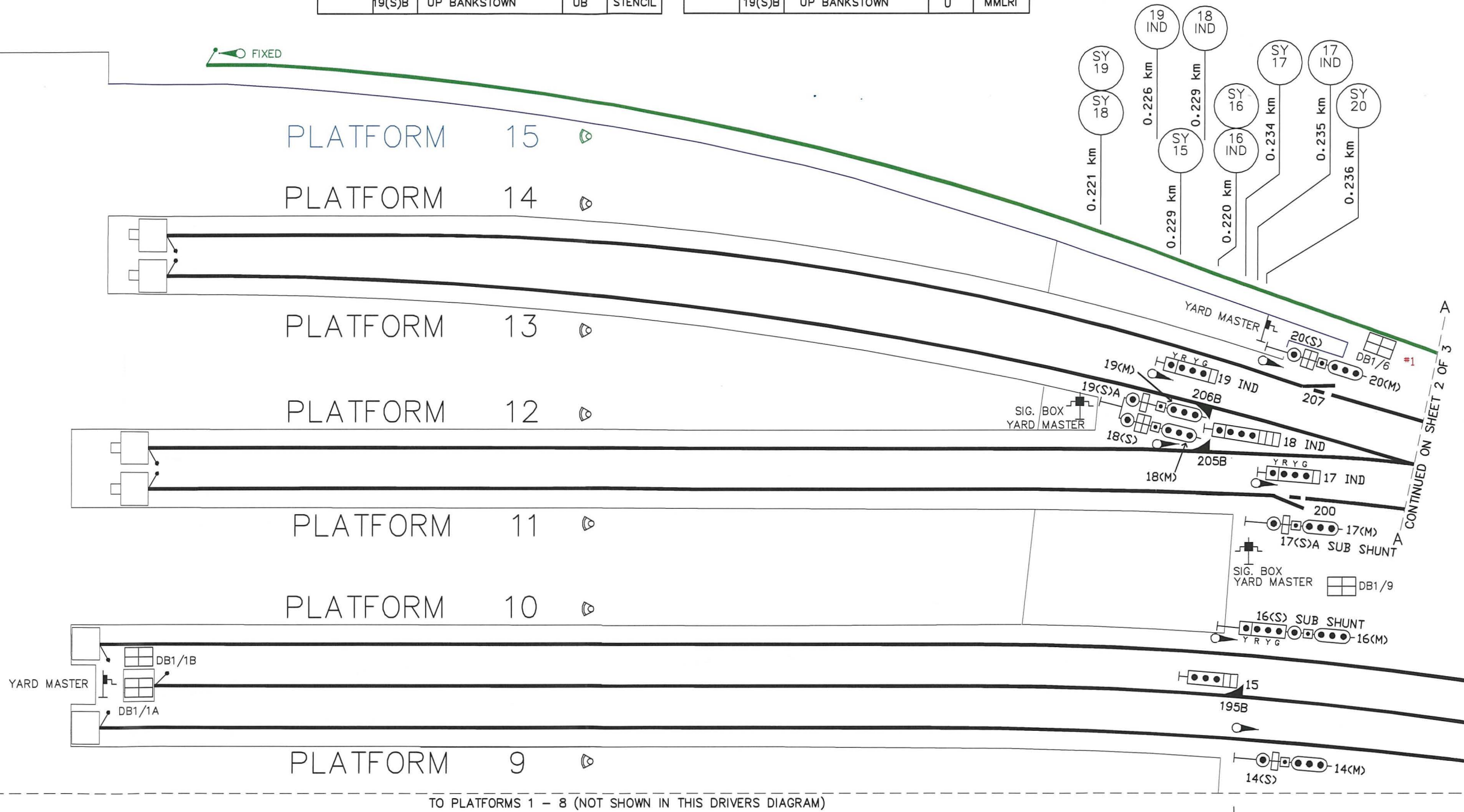
Drivers Diagram - Proposed Sydney Yard Early Works Stage 1 -
Possession 3

SYDNEY TERMINAL CONCOURSE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19	M	DOWN BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	DB	STENCIL
	19(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19 IND.	M	UP BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	D	MMLRI
	19(S)B	UP BANKSTOWN	U	MMLRI



TO PLATFORMS 1 - 8 (NOT SHOWN IN THIS DRIVERS DIAGRAM)

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18 IND.	M	DOWN BANKSTOWN	-	-
	18(S)A	SHUNTING NECK	SN	STENCIL
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18	M	DOWN BANKSTOWN	-	-
	18(S)A	SHUNTING NECK	SN	STENCIL
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)A	SHUNTING NECK	SN	STENCIL
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL

- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

NOTE:
#1 RELOCATED POSITION TO BE CONFIRMED

SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 1 - POSSESSION 3
 SIGNALLING ARRANGEMENT SHEET 1 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

File Plotted DD_SYDNEY YARD_METRO STATION PROPOSED EW_STAGE 1.dwg
 Plot Date & Time 2/13/2017 3:05 PM
 Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
59	59A	PLATFORM 11	11	STENCIL
	59B	PLATFORM 14	14	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
60	60A	PLATFORM 14	14	STENCIL
	60B	PLATFORM 15	15	STENCIL

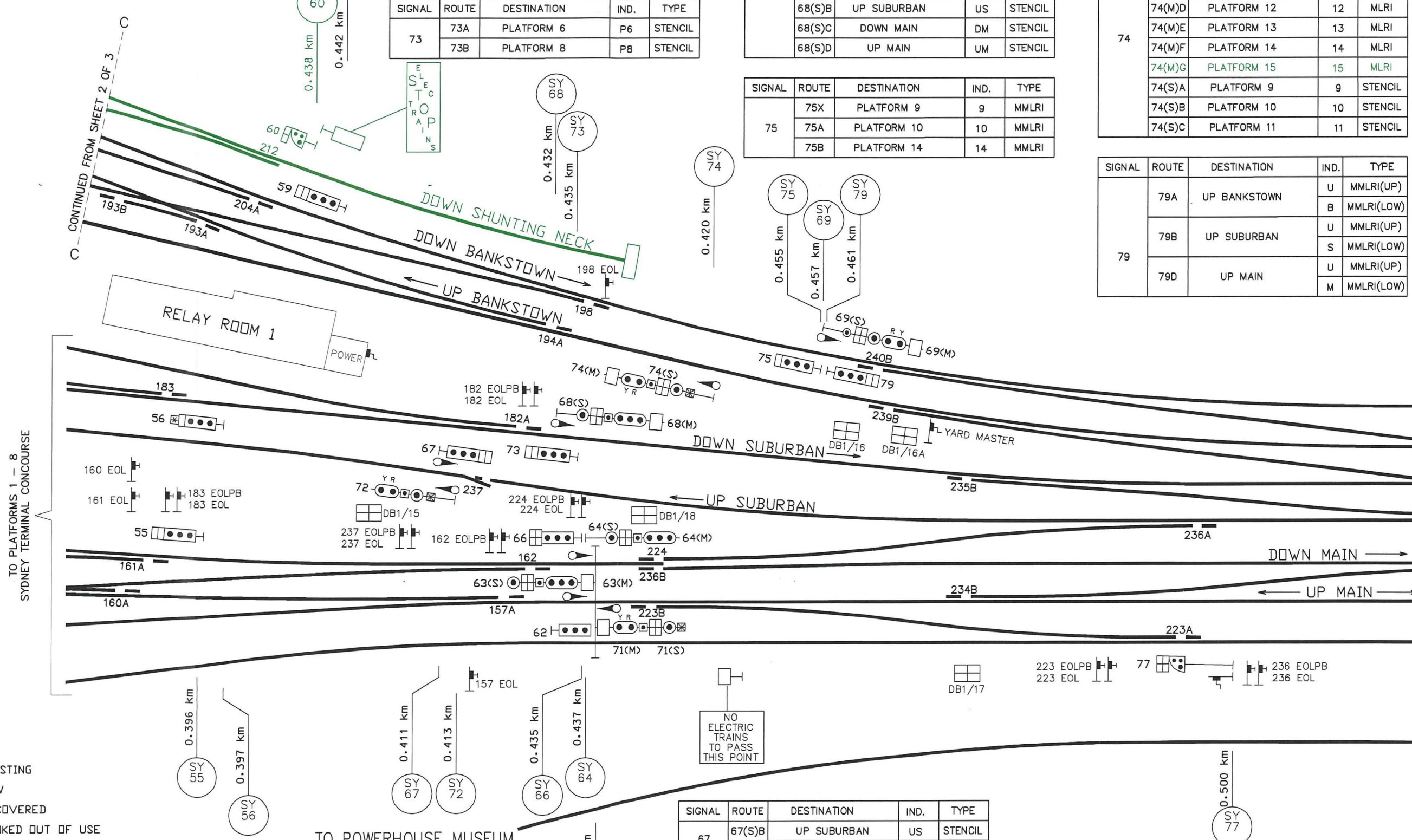
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
68	68(M)A	DOWN SUBURBAN	-	-
	68(M)B	DOWN MAIN	M	MLRI
	68(S)A	DOWN SUBURBAN	DS	STENCIL
	68(S)B	UP SUBURBAN	US	STENCIL
	68(S)C	DOWN MAIN	DM	STENCIL
68(S)D	UP MAIN	UM	STENCIL	

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
74	74(M)A	PLATFORM 9	9	MLRI
	74(M)B	PLATFORM 10	10	MLRI
	74(M)C	PLATFORM 11	11	MLRI
	74(M)D	PLATFORM 12	12	MLRI
	74(M)E	PLATFORM 13	13	MLRI
	74(M)F	PLATFORM 14	14	MLRI
	74(M)G	PLATFORM 15	15	MLRI
	74(S)A	PLATFORM 9	9	STENCIL
	74(S)B	PLATFORM 10	10	STENCIL
	74(S)C	PLATFORM 11	11	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
73	73A	PLATFORM 6	P6	STENCIL
	73B	PLATFORM 8	P8	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
75	75X	PLATFORM 9	9	MMLRI
	75A	PLATFORM 10	10	MMLRI
	75B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
79	79A	UP BANKSTOWN	U	MMLRI(UP)
			B	MMLRI(LOW)
	79B	UP SUBURBAN	U	MMLRI(UP)
			S	MMLRI(LOW)
	79D	UP MAIN	U	MMLRI(UP)
			M	MMLRI(LOW)



LEGEND:
 — EXISTING
 — NEW
 — RECOVERED
 — BOOKED OUT OF USE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
63	63(M)A	DOWN MAIN	D	MLRI
	63(M)B	UP MAIN	U	MLRI
	63(S)B	DOWN MAIN	DM	STENCIL
	63(S)C	UP MAIN	UM	STENCIL
	63(S)D	UP SHUNTING NECK	SN	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
69	69(M)B	DOWN MAIN	M	MLRI
	69(S)A	DOWN BANKSTOWN	DB	STENCIL
	69(S)B	DOWN SUBURBAN	DS	STENCIL
	69(S)C	DOWN MAIN	DM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
67	67(S)B	UP SUBURBAN	US	STENCIL
	67(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
64	M	DOWN MAIN	-	-
	64(S)A	BOOKED OUT OF USE	US	STENCIL
	64(S)B	BOOKED OUT OF USE	DM	STENCIL
	64(S)C	BOOKED OUT OF USE	UM	STENCIL



SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 1 - POSSESSION 3
 SIGNALLING ARRANGEMENT SHEET 3 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

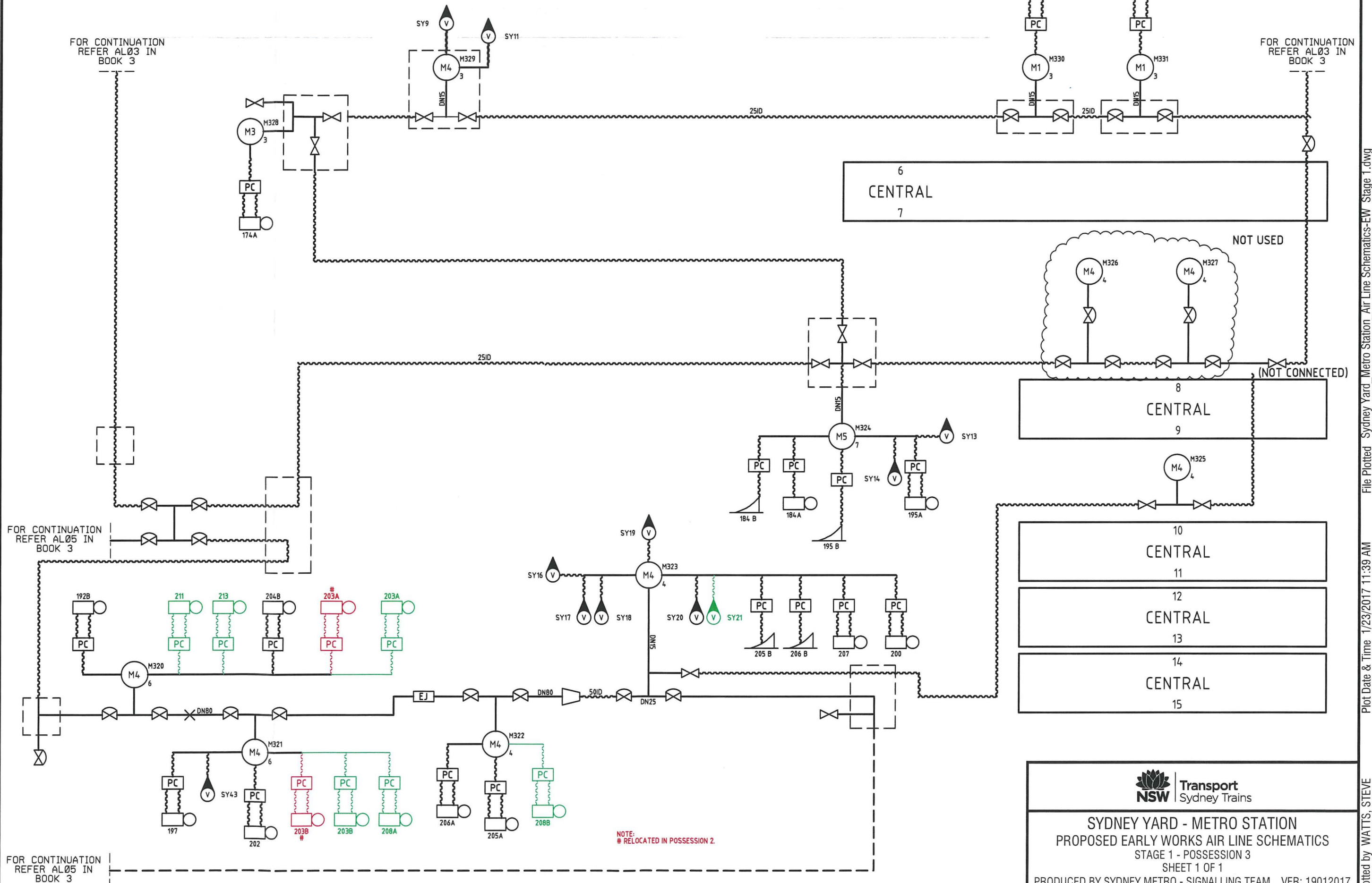
FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
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 Plotted by WATTS, STEVE

Appendix D

Air Line Schematics - Proposed Sydney Yard Early Works Stage 1 -
Possession 3

FOR CONTINUATION
REFER AL03 IN
BOOK 3

FOR CONTINUATION
REFER AL03 IN
BOOK 3



FOR CONTINUATION
REFER AL05 IN
BOOK 3

FOR CONTINUATION
REFER AL05 IN
BOOK 3

NOTE:
RELOCATED IN POSSESSION 2.



SYDNEY YARD - METRO STATION
PROPOSED EARLY WORKS AIR LINE SCHEMATICS
STAGE 1 - POSSESSION 3
SHEET 1 OF 1
PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 19012017

Appendix E

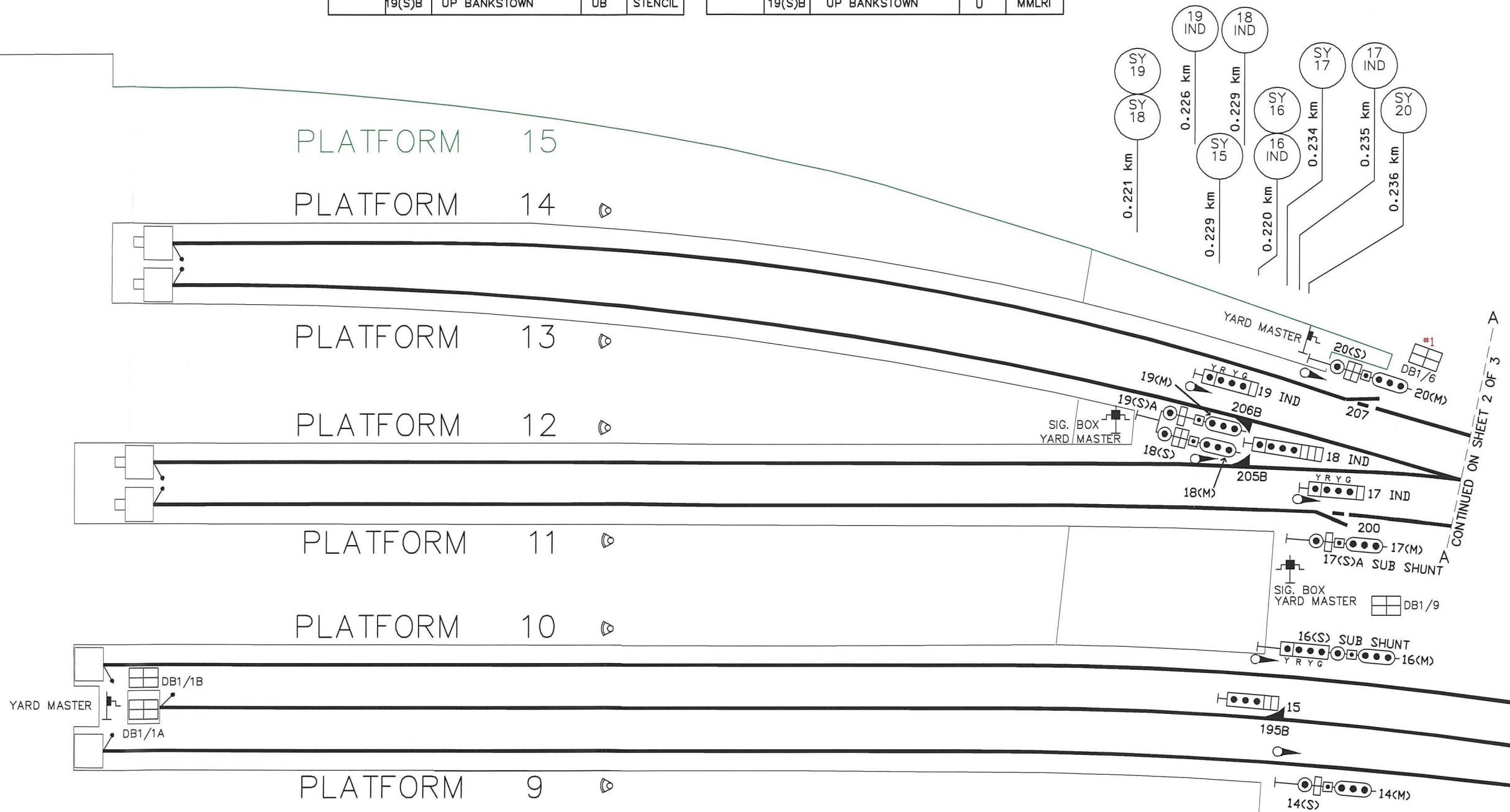
Drivers Diagram - Proposed Sydney Yard Early Works Stage 2 -
Possession 4A

SYDNEY TERMINAL CONCOURSE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19	M	DOWN BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	DB	STENCIL
	19(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19 IND.	M	UP BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	D	MMLRI
	19(S)B	UP BANKSTOWN	U	MMLRI



TO PLATFORMS 1 - 8 (NOT SHOWN IN THIS DRIVERS DIAGRAM)

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18 IND.	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL

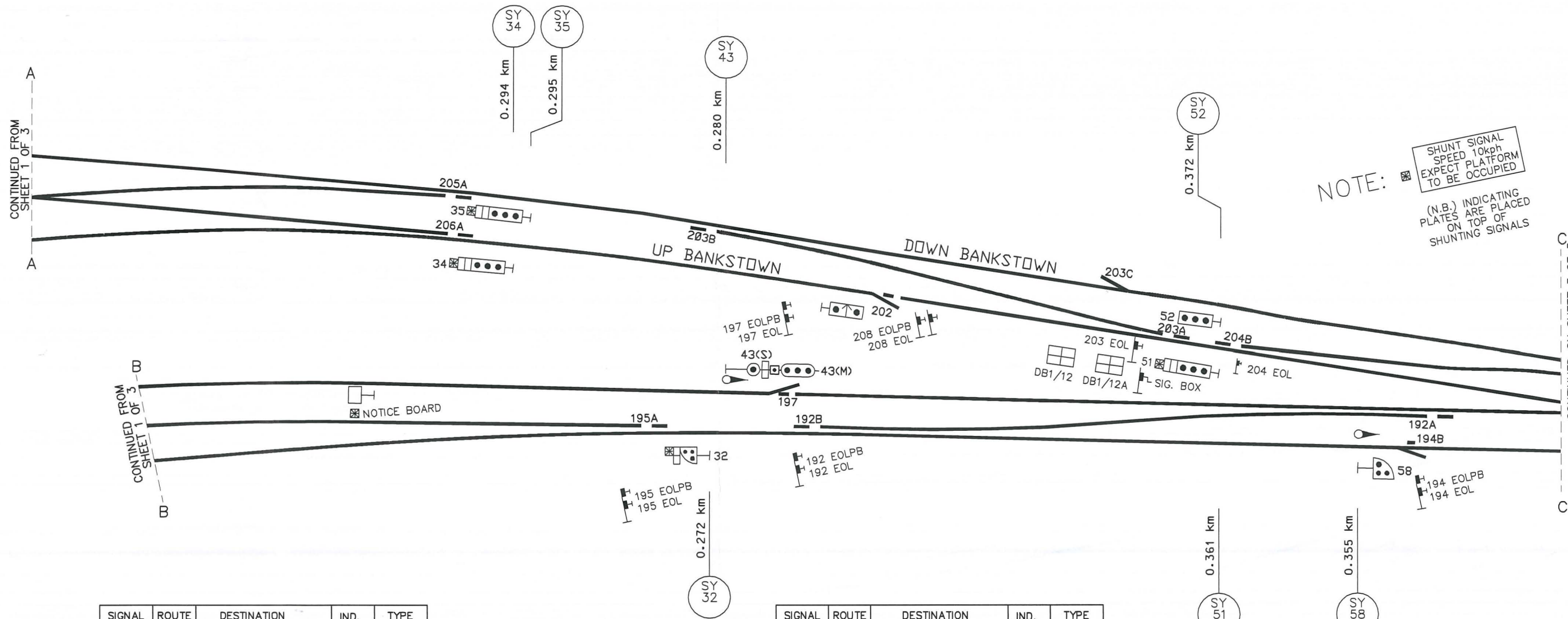
- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

*1 RELOCATED POSITION TO BE CONFIRMED

SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 2 - POSSESSION 4A
 SIGNALLING ARRANGEMENT SHEET 1 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
34	34A	PLATFORM 11	P11	STENCIL
	34B	PLATFORM 13	P13	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
35	35A	PLATFORM 12	P12	STENCIL
	35B	PLATFORM 14	P14	STENCIL



NOTE: SHUNT SIGNAL SPEED 10kph EXPECT PLATFORM TO BE OCCUPIED
 (N.B.) INDICATING PLATES ARE PLACED ON TOP OF SHUNTING SIGNALS

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
32	32A	PLATFORM 9	P9	STENCIL
	32B	MIDDLE ROAD	MR	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
51	51A	PLATFORM 11	11	MMLRI
	51B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
43	M	DOWN BANKSTOWN	-	-
	43(S)A	DOWN BANKSTOWN	DB	STENCIL
	43(S)B	UP BANKSTOWN	UB	STENCIL

- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 2 - POSSESSION 4A
 SIGNALLING ARRANGEMENT SHEET 2 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED EW_STAGE 2.dwg
 Plot Date & Time 2/17/2017 9:11 AM
 Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
59	59A	PLATFORM 11	11	STENCIL
	59B	PLATFORM 14	14	STENCIL

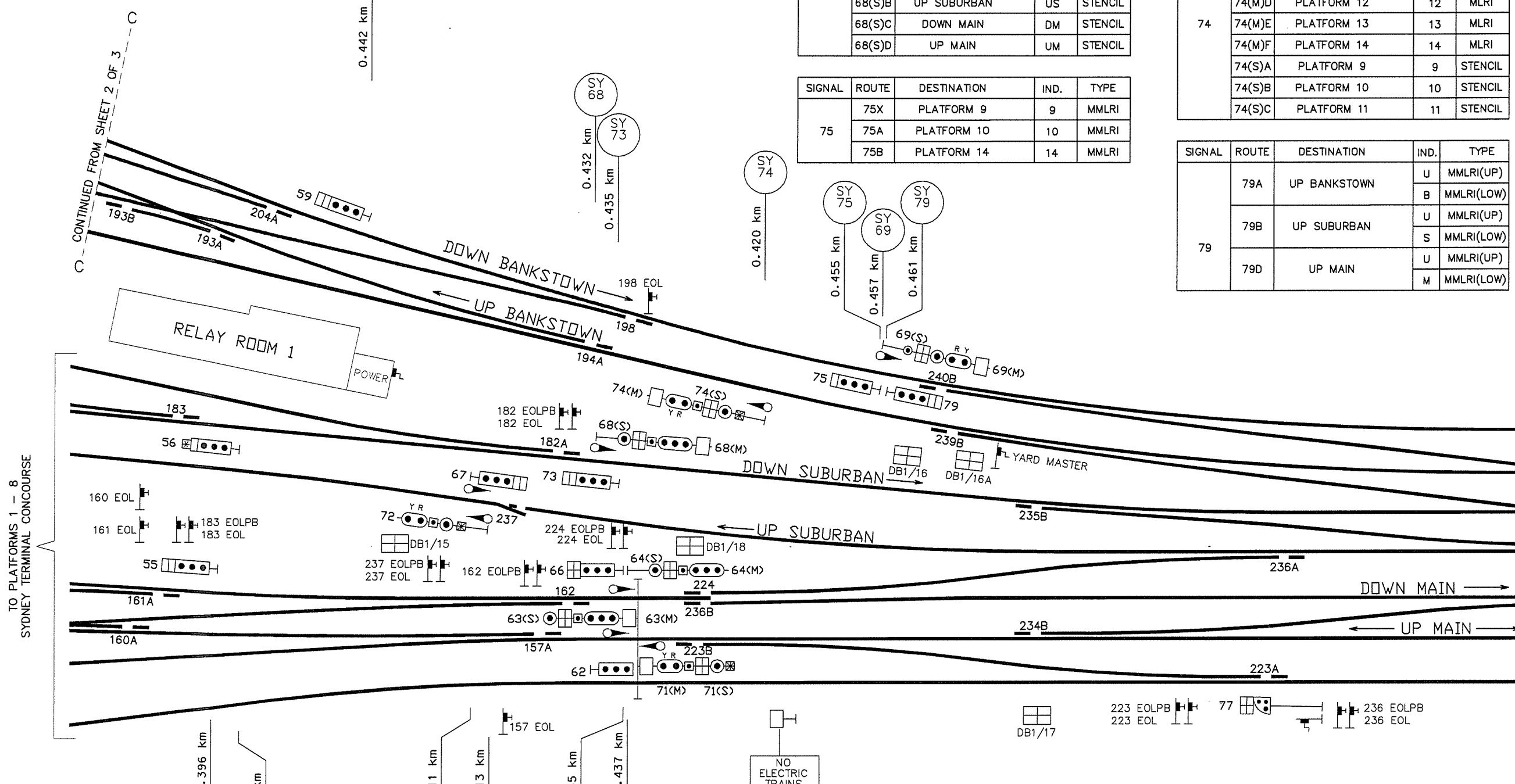
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
73	73A	PLATFORM 6	P6	STENCIL
	73B	PLATFORM 8	P8	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
68	68(M)A	DOWN SUBURBAN	-	-
	68(M)B	DOWN MAIN	M	MLRI
	68(S)A	DOWN SUBURBAN	DS	STENCIL
	68(S)B	UP SUBURBAN	US	STENCIL
	68(S)C	DOWN MAIN	DM	STENCIL
	68(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE	
74	74(M)A	PLATFORM 9	9	MLRI	
	74(M)B	PLATFORM 10	10	MLRI	
	74(M)C	PLATFORM 11	11	MLRI	
	74(M)D	PLATFORM 12	12	MLRI	
	74(M)E	PLATFORM 13	13	MLRI	
	74(M)F	PLATFORM 14	14	MLRI	
	74(S)A	PLATFORM 9	9	STENCIL	
	74(S)B	PLATFORM 10	10	STENCIL	
	74(S)C	PLATFORM 11	11	STENCIL	
	79	79A	UP BANKSTOWN	U	MMLRI(UP)
				B	MMLRI(LOW)
		79B	UP SUBURBAN	U	MMLRI(UP)
S				MMLRI(LOW)	
79D	UP MAIN	U	MMLRI(UP)		
		M	MMLRI(LOW)		

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
75	75X	PLATFORM 9	9	MMLRI
	75A	PLATFORM 10	10	MMLRI
	75B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
79	79A	UP BANKSTOWN	U	MMLRI(UP)
			B	MMLRI(LOW)
	79B	UP SUBURBAN	U	MMLRI(UP)
			S	MMLRI(LOW)
79D	UP MAIN	U	MMLRI(UP)	
		M	MMLRI(LOW)	



TO PLATFORMS 1 - 8
SYDNEY TERMINAL CONCOURSE

TO POWERHOUSE MUSEUM

LEGEND:
 ——— EXISTING
 ——— NEW
 ——— RECOVERED
 ——— BOOKED OUT OF USE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
63	63(M)A	DOWN MAIN	D	MLRI
	63(M)B	UP MAIN	U	MLRI
	63(S)B	DOWN MAIN	DM	STENCIL
	63(S)C	UP MAIN	UM	STENCIL
	63(S)D	UP SHUNTING NECK	SN	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
69	69(M)B	DOWN MAIN	M	MLRI
	69(S)A	DOWN BANKSTOWN	DB	STENCIL
	69(S)B	DOWN SUBURBAN	DS	STENCIL
	69(S)C	DOWN MAIN	DM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
67	67(S)B	UP SUBURBAN	US	STENCIL
	67(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
64	M	DOWN MAIN	-	-
	64(S)A	BOOKED OUT OF USE	US	STENCIL
	64(S)B	BOOKED OUT OF USE	DM	STENCIL
	64(S)C	BOOKED OUT OF USE	UM	STENCIL



SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 2 - POSSESSION 4A
 SIGNALLING ARRANGEMENT SHEET 3 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED EW_STAGE 2.dwg
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 FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
 Plotted by WATTS, STEVE

Appendix F

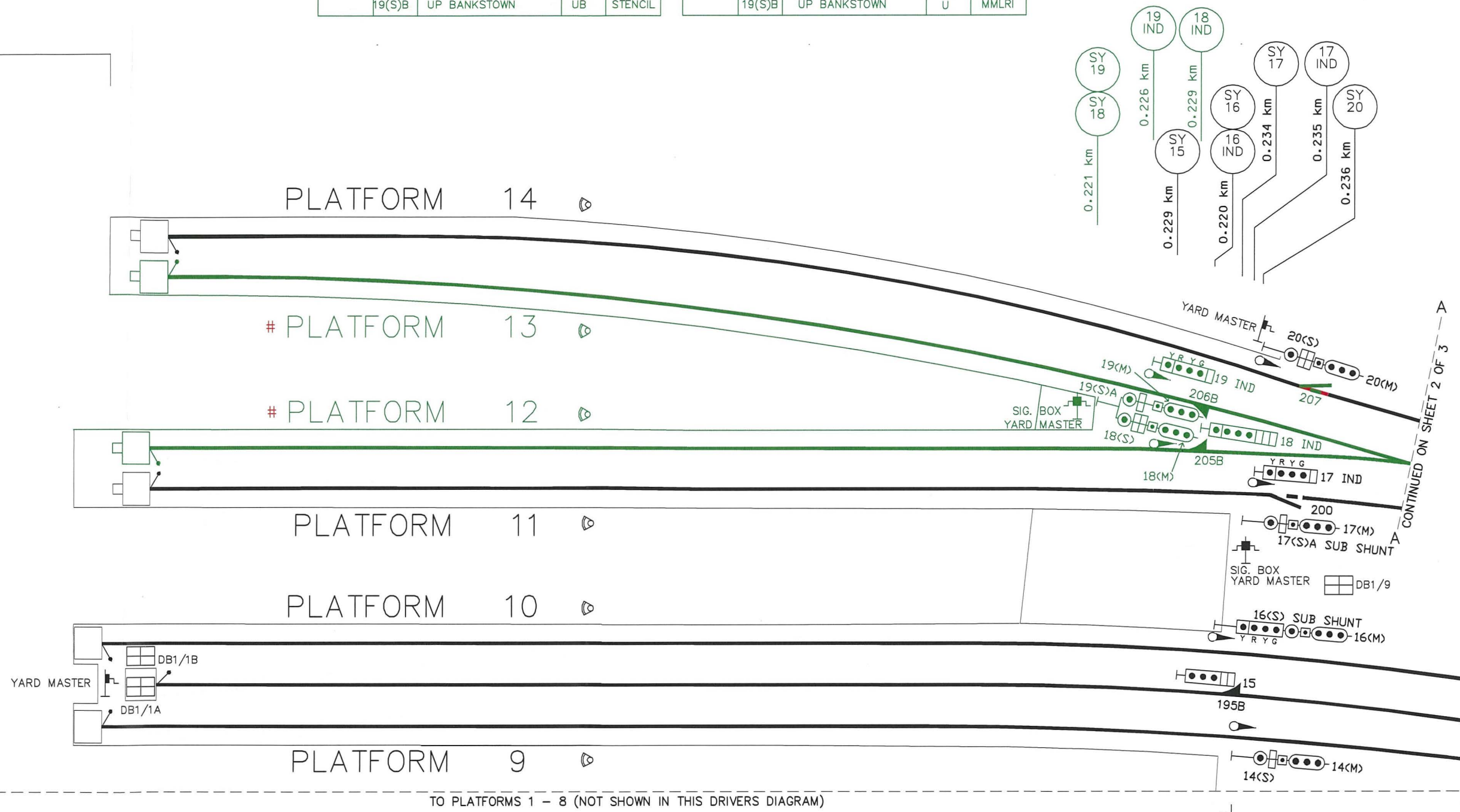
Drivers Diagram - Proposed Sydney Yard Early Works Stage 3 -
Possession 4 & 5

SYDNEY TERMINAL CONCOURSE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19	M	DOWN BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	DB	STENCIL
	19(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19 IND.	M	UP BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	D	MMLRI
	19(S)B	UP BANKSTOWN	U	MMLRI



TO PLATFORMS 1 - 8 (NOT SHOWN IN THIS DRIVERS DIAGRAM)

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18 IND.	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL

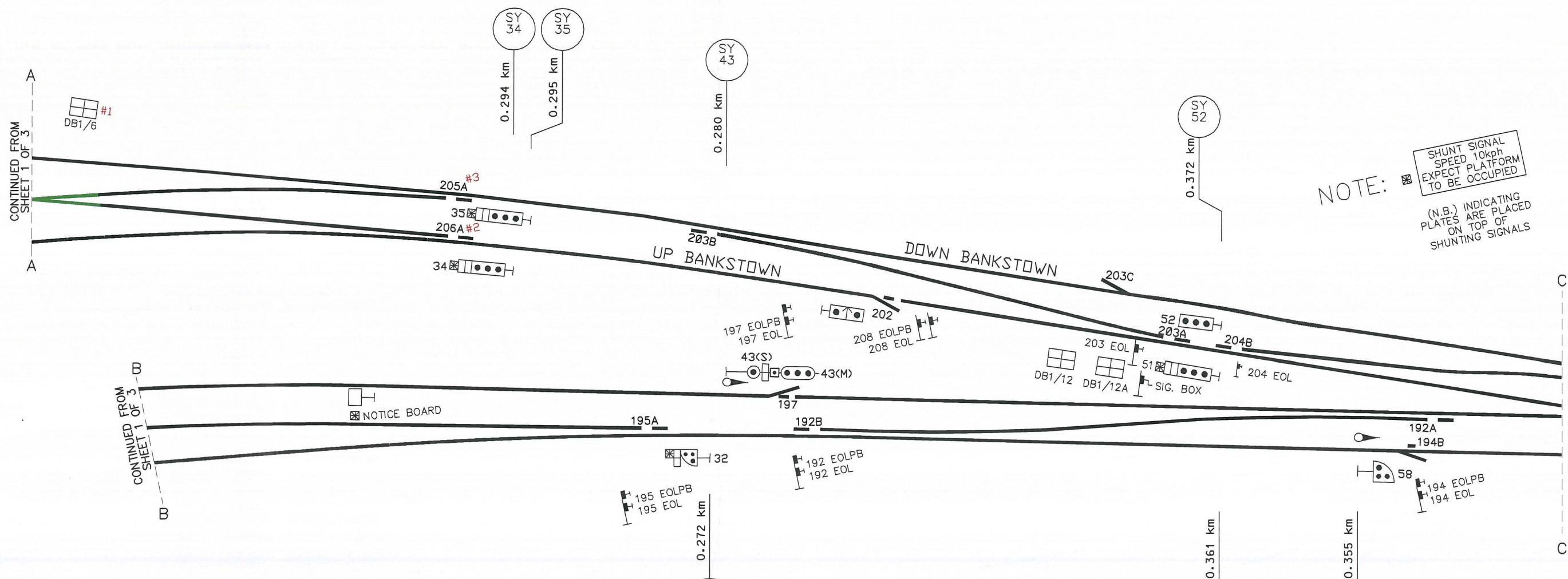
- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

NOTE:
PLATFORM 12 & 13 DEMOLISHED DURING POSSESSION 5

SYDNEY YARD - METRO STATION
PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 3 - POSSESSION 4 & 5
 SIGNALLING ARRANGEMENT SHEET 1 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 14022017

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
34	34A	PLATFORM 11	P11	STENCIL
	34B	PLATFORM 13	P13	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
35	35A	PLATFORM 12	P12	STENCIL
	35B	PLATFORM 14	P14	STENCIL



NOTE: SHUNT SIGNAL SPEED 10kph EXPECT PLATFORM TO BE OCCUPIED
 (N.B.) INDICATING PLATES ARE PLACED ON TOP OF SHUNTING SIGNALS

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
32	32A	PLATFORM 9	P9	STENCIL
	32B	MIDDLE ROAD	MR	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
51	51A	PLATFORM 11	11	MMLRI
	51B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
43	M	DOWN BANKSTOWN	-	-
	43(S)A	DOWN BANKSTOWN	DB	STENCIL
	43(S)B	UP BANKSTOWN	UB	STENCIL

LEGEND:
 EXISTING
 NEW
 RECOVERED
 BOOKED OUT OF USE

NOTE:
 #1 RELOCATED - POSITION TO BE CONFIRMED.
 #2 206A POINT CLIP LOCKED & DETECTED IN NORMAL POSITION FOR ROUTES INTO PLATFORM 11.
 #3 205A POINT CLIP LOCKED & DETECTED IN NORMAL POSITION FOR ROUTES INTO PLATFORM 14.

SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 3 - POSSESSION 4 & 5
 SIGNALLING ARRANGEMENT SHEET 2 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 14022017

Plot Date & Time 2/17/2017 9:15 AM
 File Plotted DD_SYDNEY YARD METRO STATION_PROPOSED EW_STAGE 3.dwg
 Plotted by WATTIS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
59	59A	PLATFORM 11	11	STENCIL
	59B	PLATFORM 14	14	STENCIL

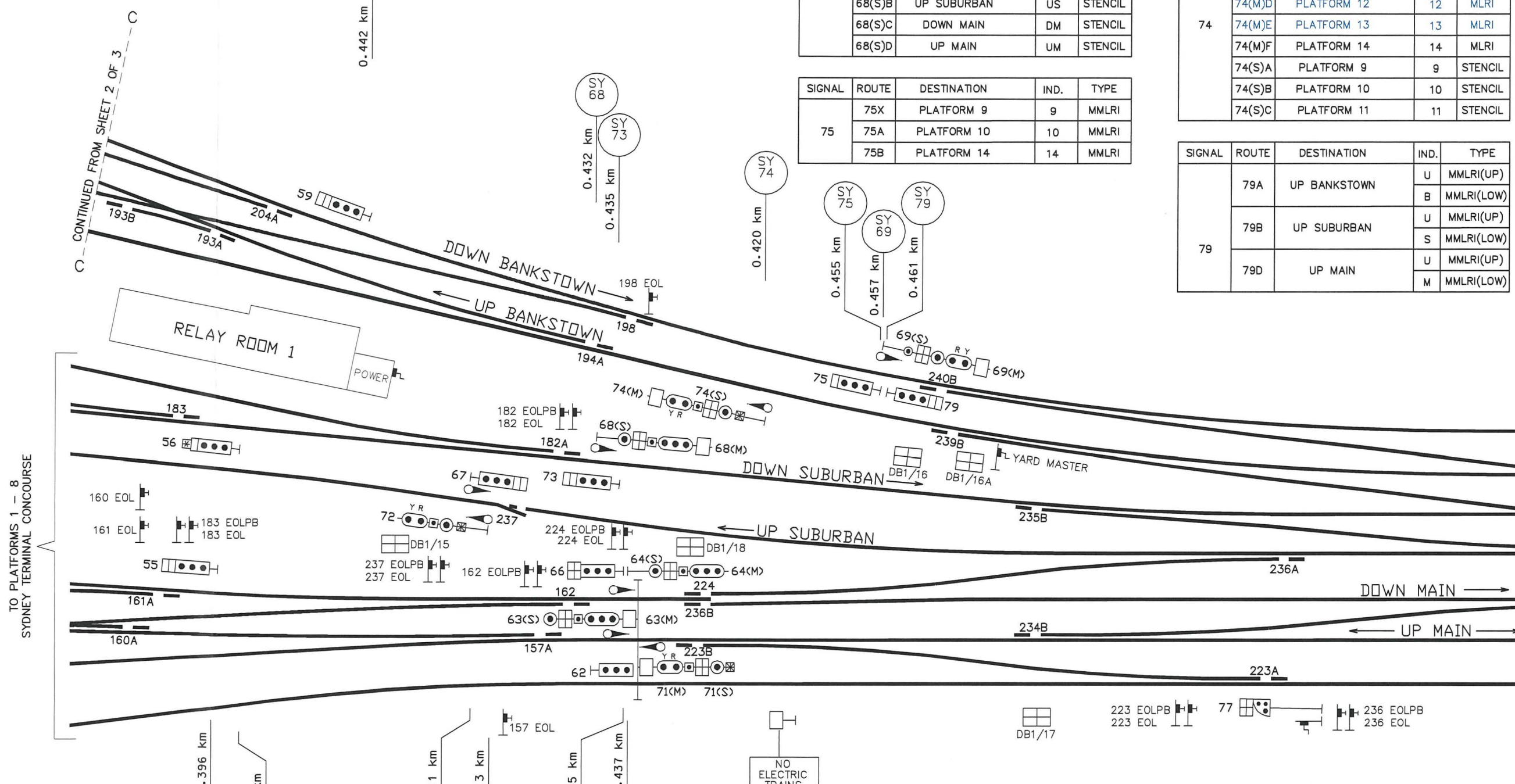
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
73	73A	PLATFORM 6	P6	STENCIL
	73B	PLATFORM 8	P8	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
68	68(M)A	DOWN SUBURBAN	-	-
	68(M)B	DOWN MAIN	M	MLRI
	68(S)A	DOWN SUBURBAN	DS	STENCIL
	68(S)B	UP SUBURBAN	US	STENCIL
	68(S)C	DOWN MAIN	DM	STENCIL
	68(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
74	74(M)A	PLATFORM 9	9	MLRI
	74(M)B	PLATFORM 10	10	MLRI
	74(M)C	PLATFORM 11	11	MLRI
	74(M)D	PLATFORM 12	12	MLRI
	74(M)E	PLATFORM 13	13	MLRI
	74(M)F	PLATFORM 14	14	MLRI
	74(S)A	PLATFORM 9	9	STENCIL
	74(S)B	PLATFORM 10	10	STENCIL
	74(S)C	PLATFORM 11	11	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
75	75X	PLATFORM 9	9	MMLRI
	75A	PLATFORM 10	10	MMLRI
	75B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
79	79A	UP BANKSTOWN	U	MMLRI(UP)
			B	MMLRI(LOW)
	79B	UP SUBURBAN	U	MMLRI(UP)
			S	MMLRI(LOW)
	79D	UP MAIN	U	MMLRI(UP)
			M	MMLRI(LOW)



LEGEND:
 — EXISTING
 — NEW
 — RECOVERED
 — BOOKED OUT OF USE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
63	63(M)A	DOWN MAIN	D	MLRI
	63(M)B	UP MAIN	U	MLRI
	63(S)B	DOWN MAIN	DM	STENCIL
	63(S)C	UP MAIN	UM	STENCIL
	63(S)D	UP SHUNTING NECK	SN	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
69	69(M)B	DOWN MAIN	M	MLRI
	69(S)A	DOWN BANKSTOWN	DB	STENCIL
	69(S)B	DOWN SUBURBAN	DS	STENCIL
	69(S)C	DOWN MAIN	DM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
67	67(S)B	UP SUBURBAN	US	STENCIL
	67(S)D	UP MAIN	UM	STENCIL

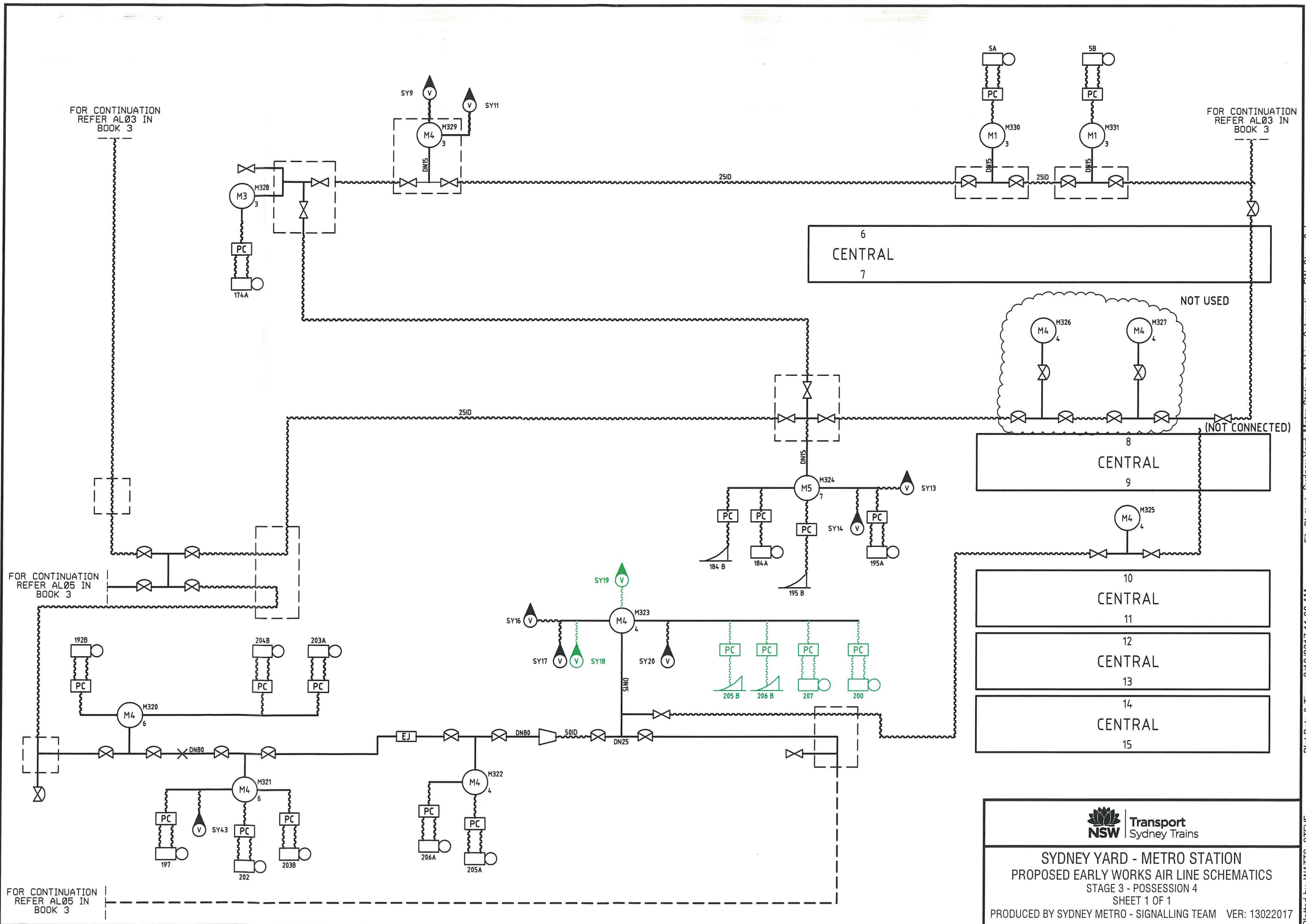
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
64	M	DOWN MAIN	-	-
	64(S)A	BOOKED OUT OF USE	US	STENCIL
	64(S)B	BOOKED OUT OF USE	DM	STENCIL
	64(S)C	BOOKED OUT OF USE	UM	STENCIL

SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 3 - POSSESSION 4 & 5
 SIGNALLING ARRANGEMENT SHEET 3 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 14022017

FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
 Plot Date & Time 2/17/2017 9:15 AM
 File Plotted DD_SYDNEY YARD METRO STATION, PROPOSED EW_STAGE 3.dwg
 Plotted by WATTS, STEVE

Appendix G

Air schematic - Proposed Sydney Yard Early Works Stage 3 –
Possession 4



FOR CONTINUATION
REFER AL03 IN
BOOK 3

FOR CONTINUATION
REFER AL03 IN
BOOK 3

FOR CONTINUATION
REFER AL05 IN
BOOK 3

FOR CONTINUATION
REFER AL05 IN
BOOK 3


SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS AIR LINE SCHEMATICS
 STAGE 3 - POSSESSION 4
 SHEET 1 OF 1
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

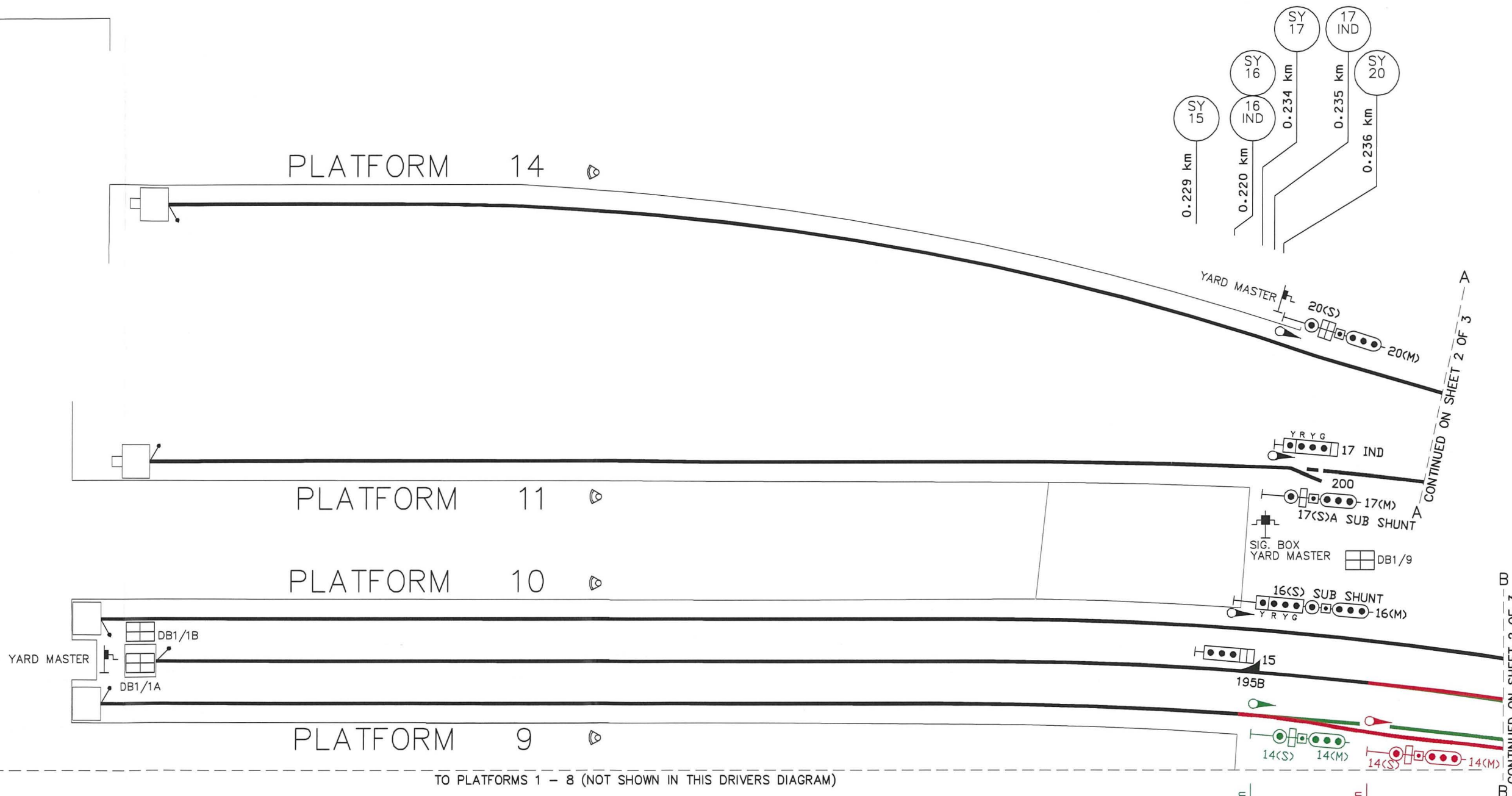
File Plotted - Sydney Yard_Metro Station_Air Line Schematics-EW_Stage 3.dwg
 Plot Date & Time 2/13/2017 11:30 AM
 Plotted by WATTS, STEVE

Appendix H

Drivers Diagram - Proposed Sydney Yard Early Works Stage 4 -
Possession 6

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SYDNEY TERMINAL CONCOURSE



TO PLATFORMS 1 - 8 (NOT SHOWN IN THIS DRIVERS DIAGRAM)

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

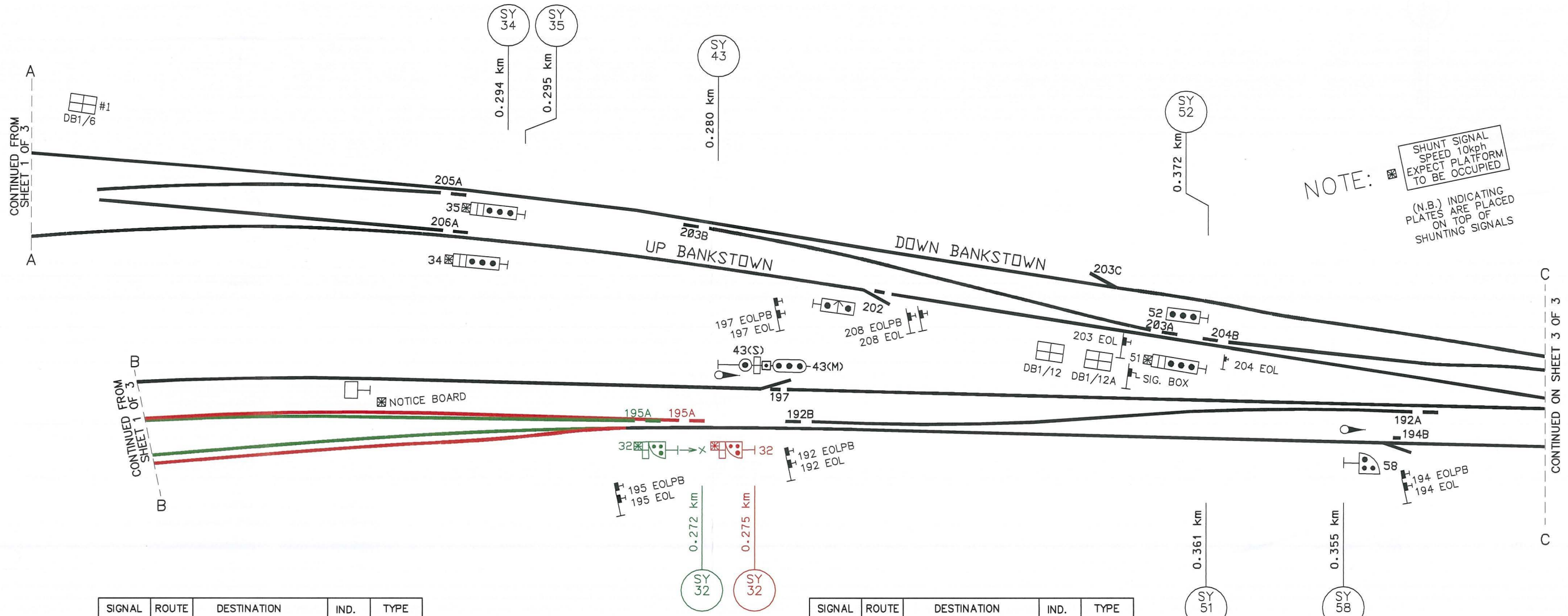
- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

SYDNEY YARD - METRO STATION
PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 4 - POSSESSION 6
 SIGNALLING ARRANGEMENT SHEET 1 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

File Plotted DD_SYDNEY YARD_METRO STATION - PROPOSED EW_STAGE 4.dwg
 Plot Date & Time 2/13/2017 2:50 PM
 Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
34	34A	PLATFORM 11	P11	STENCIL
	34B	PLATFORM 13	P13	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
35	35A	PLATFORM 12	P12	STENCIL
	35B	PLATFORM 14	P14	STENCIL



NOTE: SHUNT SIGNAL SPEED 10kph EXPECT PLATFORM TO BE OCCUPIED
 (N.B.) INDICATING PLATES ARE PLACED ON TOP OF SHUNTING SIGNALS

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
32	32A	PLATFORM 9	P9	STENCIL
	32B	MIDDLE ROAD	MR	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
51	51A	PLATFORM 11	11	MMLRI
	51B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
43	M	DOWN BANKSTOWN	-	-
	43(S)A	DOWN BANKSTOWN	DB	STENCIL
	43(S)B	UP BANKSTOWN	UB	STENCIL

LEGEND:
 EXISTING
 NEW
 RECOVERED
 BOOKED OUT OF USE

NOTE:
 #1 RELOCATED - POSITION TO BE CONFIRMED.

SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 4 - POSSESSION 6
 SIGNALLING ARRANGEMENT SHEET 2 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
59	59A	PLATFORM 11	11	STENCIL
	59B	PLATFORM 14	14	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
73	73A	PLATFORM 6	P6	STENCIL
	73B	PLATFORM 8	P8	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
68	68(M)A	DOWN SUBURBAN	-	-
	68(M)B	DOWN MAIN	M	MLRI
	68(S)A	DOWN SUBURBAN	DS	STENCIL
	68(S)B	UP SUBURBAN	US	STENCIL
	68(S)C	DOWN MAIN	DM	STENCIL
	68(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
74	74(M)A	PLATFORM 9	9	MLRI
	74(M)B	PLATFORM 10	10	MLRI
	74(M)C	PLATFORM 11	11	MLRI
	74(M)D	PLATFORM 12	12	MLRI
	74(M)E	PLATFORM 13	13	MLRI
	74(M)F	PLATFORM 14	14	MLRI
	74(S)A	PLATFORM 9	9	STENCIL
	74(S)B	PLATFORM 10	10	STENCIL
	74(S)C	PLATFORM 11	11	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
75	75X	PLATFORM 9	9	MMLRI
	75A	PLATFORM 10	10	MMLRI
	75B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
79	79A	UP BANKSTOWN	U	MMLRI(UP)
			B	MMLRI(LOW)
	79B	UP SUBURBAN	U	MMLRI(UP)
			S	MMLRI(LOW)
			M	MMLRI(LOW)
	79D	UP MAIN	U	MMLRI(UP)
M			MMLRI(LOW)	

TO PLATFORMS 1 - 8
SYDNEY TERMINAL CONCOURSE

TO POWERHOUSE MUSEUM

- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
63	63(M)A	DOWN MAIN	D	MLRI
	63(M)B	UP MAIN	U	MLRI
	63(S)B	DOWN MAIN	DM	STENCIL
	63(S)C	UP MAIN	UM	STENCIL
	63(S)D	UP SHUNTING NECK	SN	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
69	69(M)B	DOWN MAIN	M	MLRI
	69(S)A	DOWN BANKSTOWN	DB	STENCIL
	69(S)B	DOWN SUBURBAN	DS	STENCIL
	69(S)C	DOWN MAIN	DM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
67	67(S)B	UP SUBURBAN	US	STENCIL
	67(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
64	M	DOWN MAIN	-	-
	64(S)A	BOOKED OUT OF USE	US	STENCIL
	64(S)B	BOOKED OUT OF USE	DM	STENCIL
	64(S)C	BOOKED OUT OF USE	UM	STENCIL

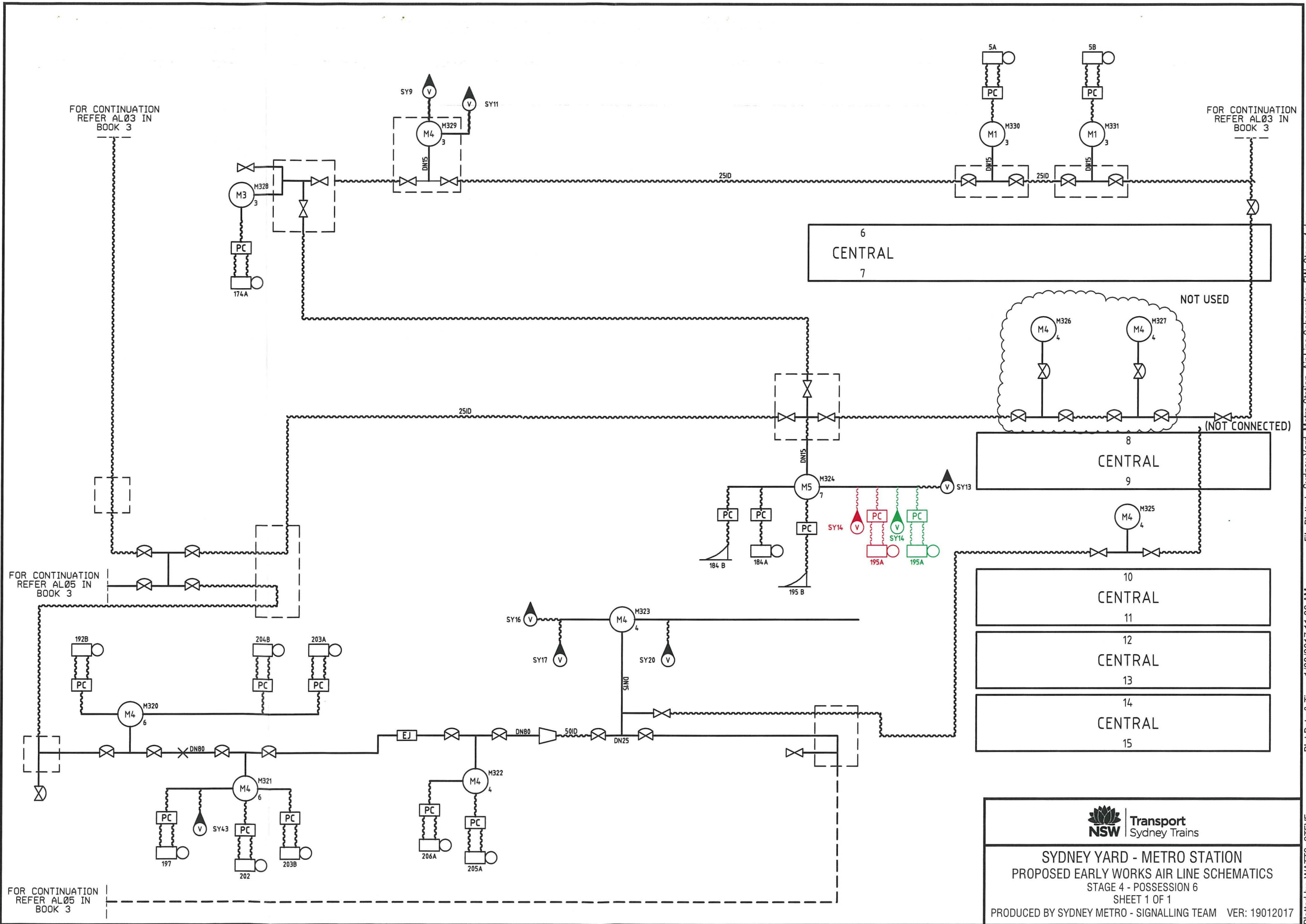


SYDNEY YARD - METRO STATION
PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 4 - POSSESSION 6
 SIGNALLING ARRANGEMENT SHEET 3 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

Appendix I

Air Line Schematic - Proposed Sydney Yard Early Works Stage 4 –

Possession 6



FOR CONTINUATION
REFER AL03 IN
BOOK 3

FOR CONTINUATION
REFER AL03 IN
BOOK 3

6
CENTRAL
7

NOT USED

8
CENTRAL
9

(NOT CONNECTED)

10
CENTRAL
11

12
CENTRAL
13

14
CENTRAL
15

FOR CONTINUATION
REFER AL05 IN
BOOK 3

FOR CONTINUATION
REFER AL05 IN
BOOK 3



SYDNEY YARD - METRO STATION
PROPOSED EARLY WORKS AIR LINE SCHEMATICS
 STAGE 4 - POSSESSION 6
 SHEET 1 OF 1
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 19012017

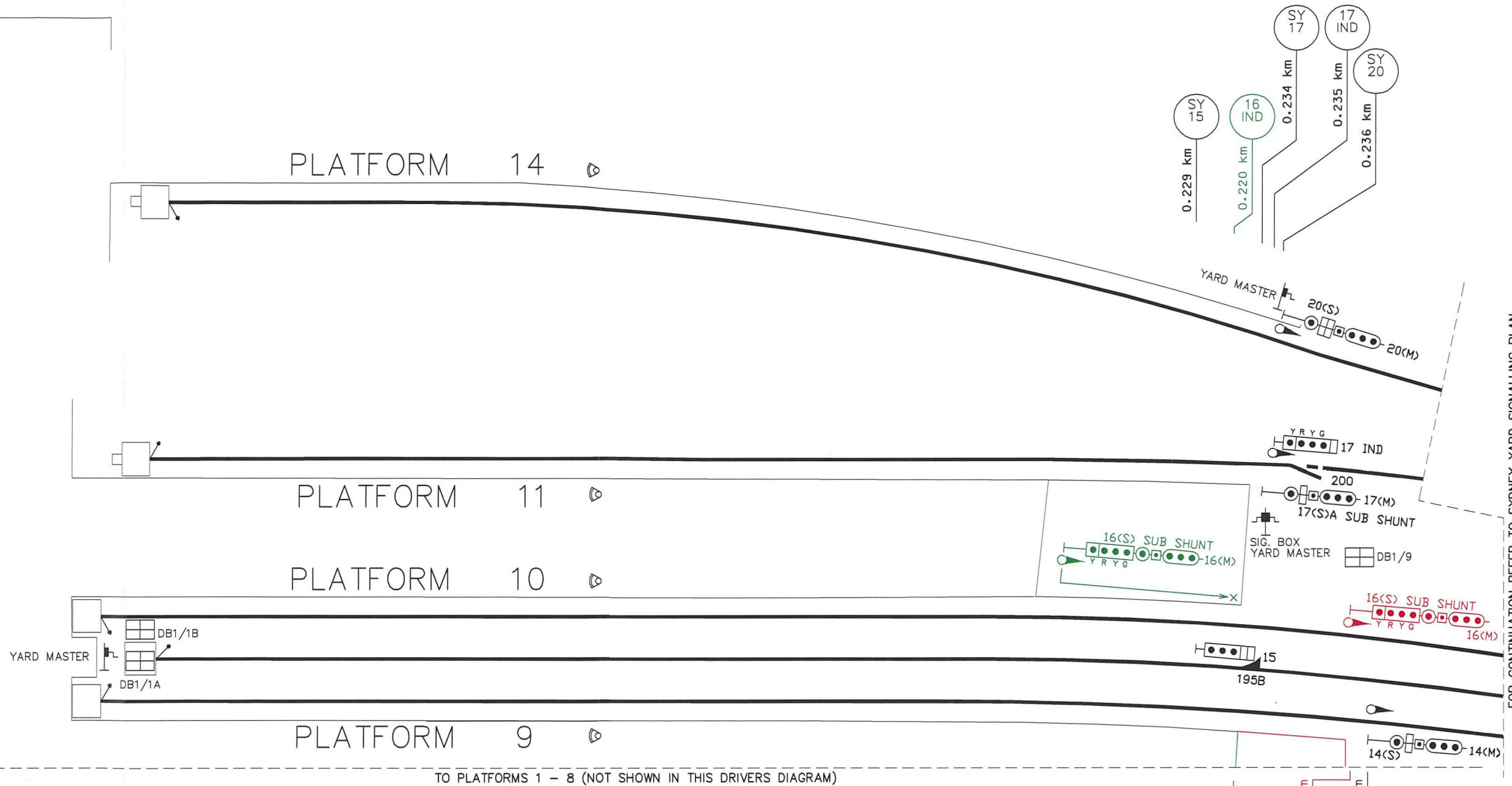
Plot Date & Time 1/23/2017 11:39 AM File Plotted Sydney Yard_Metro Station_Air Line Schematics-EW_Stage 4.dwg

Appendix J

Drivers Diagram - Proposed Sydney Yard Early Works Stage 5 -
Possession 7

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SYDNEY TERMINAL CONCOURSE



SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

LEGEND:

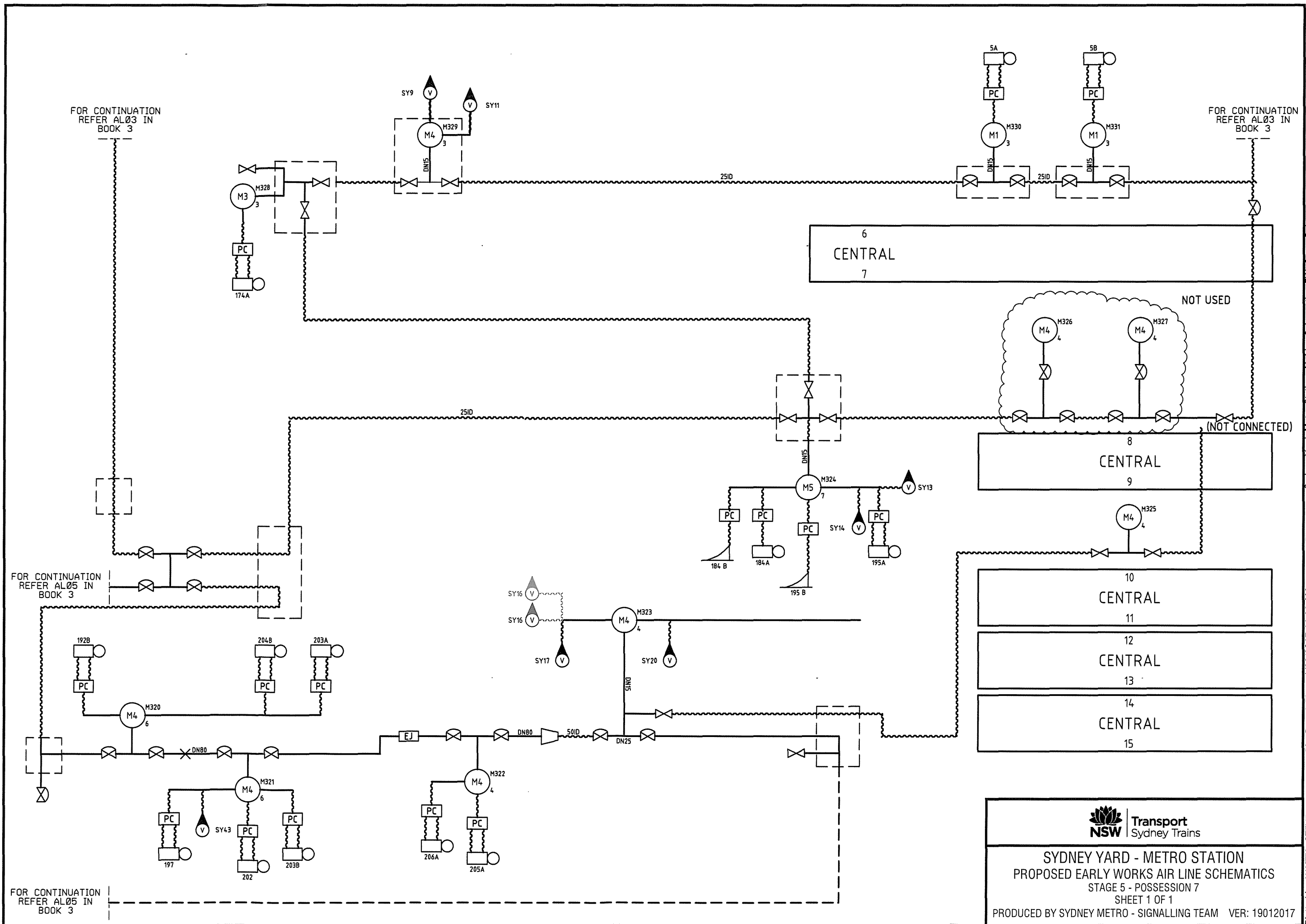
- EXISTING
- NEW
- RECOVERED
- BOOKED OUT OF USE


SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 5 - POSSESSION 7
 SIGNALLING ARRANGEMENT SHEET 1 OF 1
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 20022017

FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
 File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED EW_STAGE 5.dwg
 Plot Date & Time 2/20/2017 8:23 AM
 Plotted by WATTS, STEVE

Appendix K

Air Line Schematic - Proposed Sydney Yard Early Works Stage 5 –
Possession 7





SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS AIR LINE SCHEMATICS
 STAGE 5 - POSSESSION 7
 SHEET 1 OF 1
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 19012017

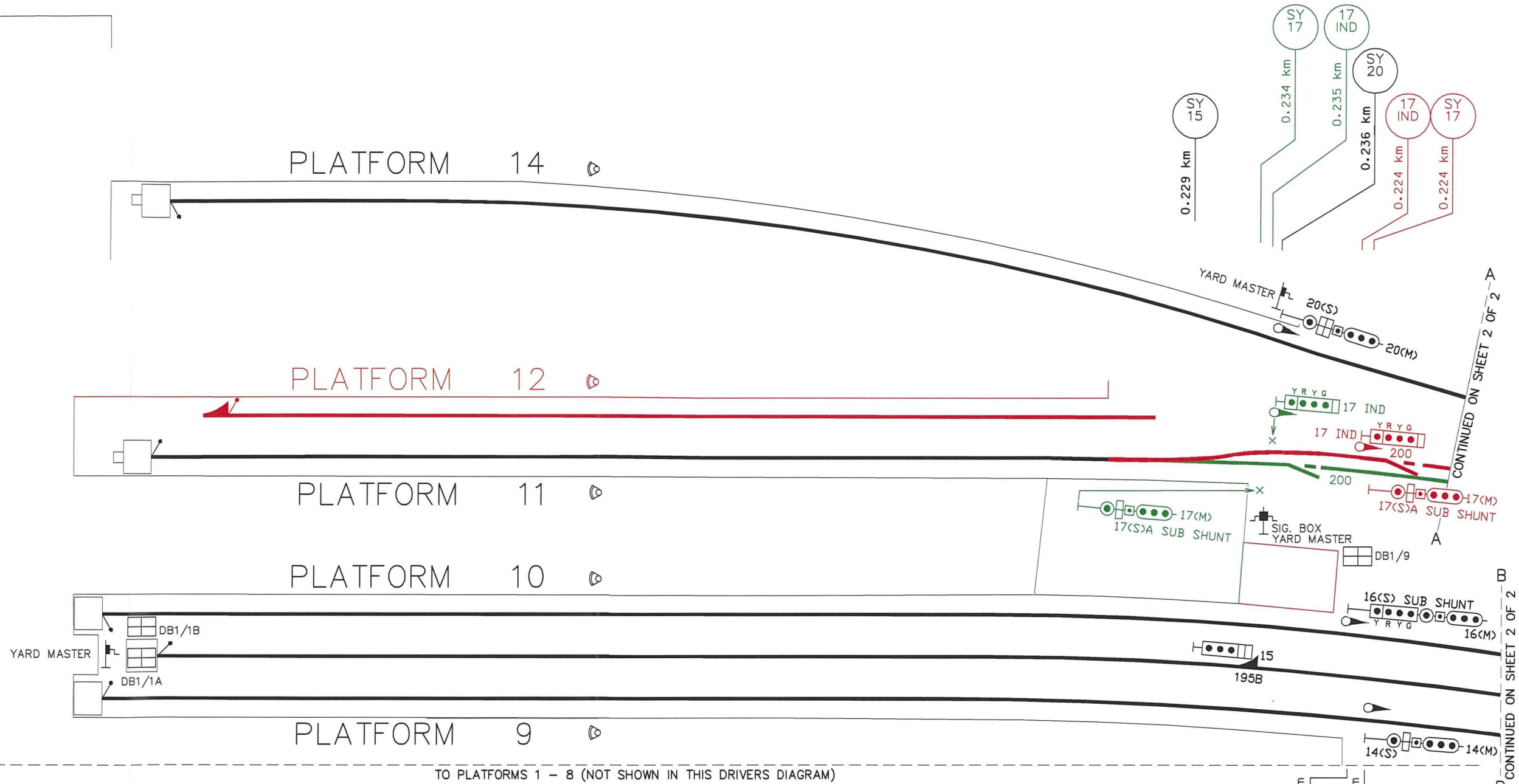
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 Plotted by WATTS, STEVE

Appendix L

Drivers Diagram - Proposed Sydney Yard Early Works Stage 6 -
Possession 8

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SYDNEY TERMINAL CONCOURSE



SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

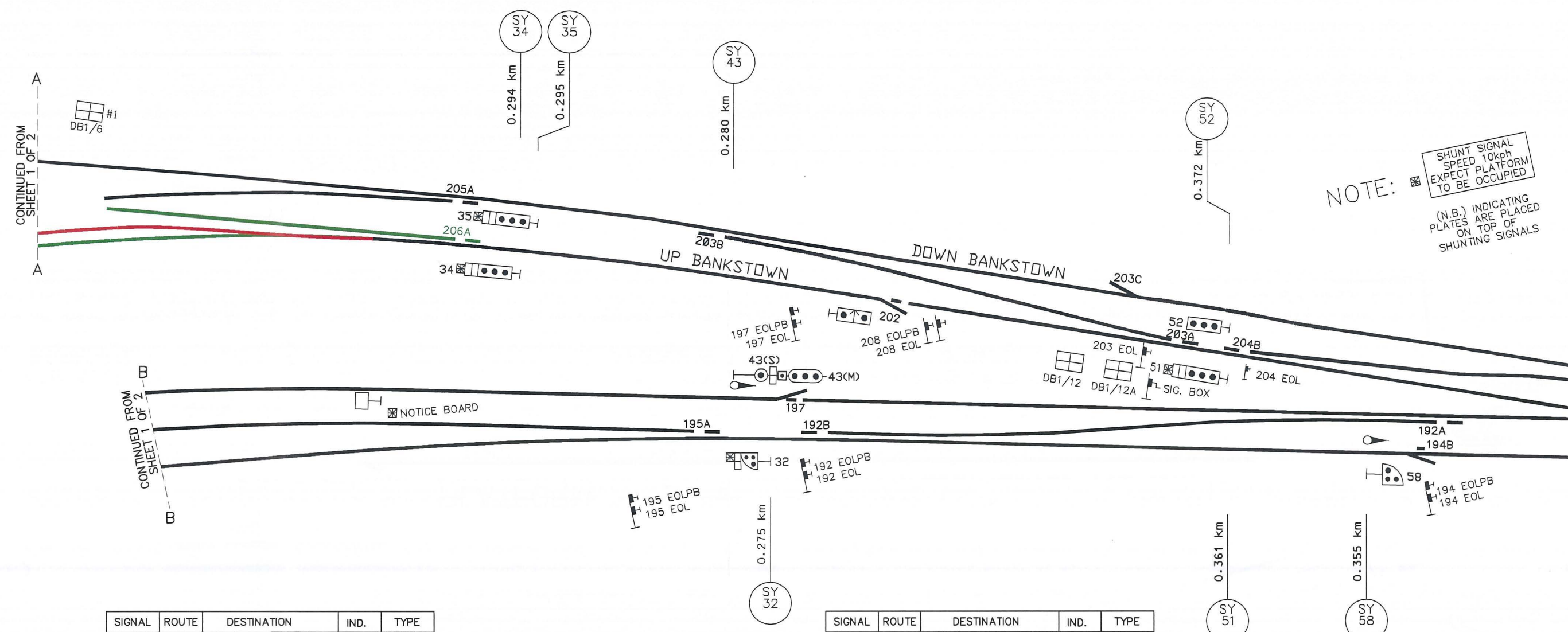
- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

SYDNEY YARD - METRO STATION
PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 6 - POSSESSION 8
 SIGNALLING ARRANGEMENT SHEET 1 OF 2
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 20022017

File Plotted DD_SYDNEY YARD_METRO STATION - PROPOSED EW_STAGE 6.dwg Plot Date & Time 2/20/2017 8:24 AM Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
34	34A	PLATFORM 11	P11	STENCIL
	34B	PLATFORM 13	P13	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
35	35A	PLATFORM 12	P12	STENCIL
	35B	PLATFORM 14	P14	STENCIL



NOTE: SHUNT SIGNAL SPEED 10kph EXPECT PLATFORM TO BE OCCUPIED
 (N.B.) INDICATING PLATES ARE PLACED ON TOP OF SHUNTING SIGNALS

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
32	32A	PLATFORM 9	P9	STENCIL
	32B	MIDDLE ROAD	MR	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
51	51A	PLATFORM 11	11	MMLRI
	51B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
43	M	DOWN BANKSTOWN	-	-
	43(S)A	DOWN BANKSTOWN	DB	STENCIL
	43(S)B	UP BANKSTOWN	UB	STENCIL

LEGEND:
 EXISTING
 NEW
 RECOVERED
 BOOKED OUT OF USE

NOTE:
 #1 RELOCATED - POSITION TO BE CONFIRMED.

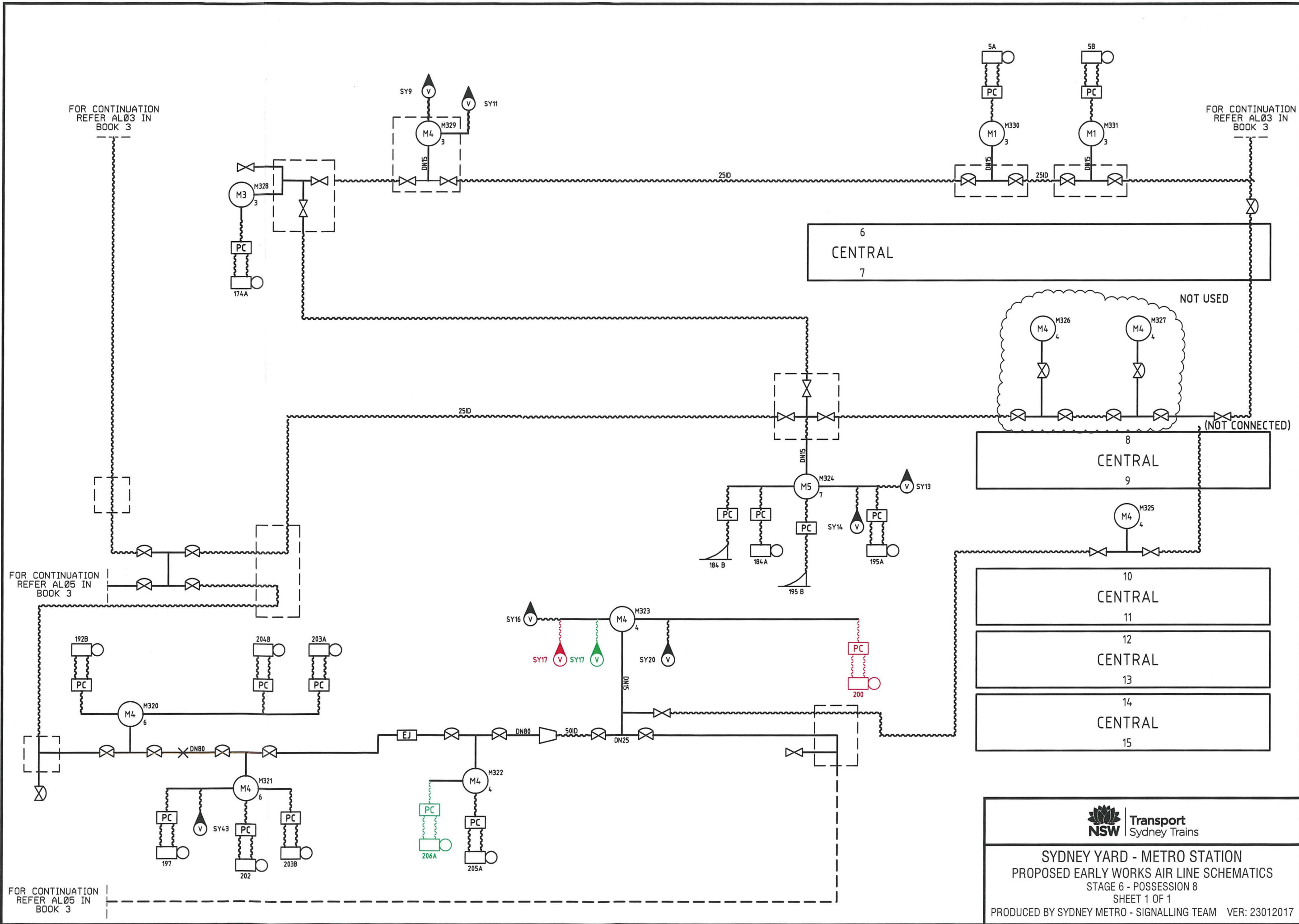
SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 6 - POSSESSION 8
 SIGNALLING ARRANGEMENT SHEET 2 OF 2
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 20022017

FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN

Plot Date & Time 2/20/2017 8:24 AM File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED EW_STAGE 6.dwg Plotted by WATTS, STEVE

Appendix M

Air Line Schematic - Proposed Sydney Yard Early Works Stage 6 –
Possession 8




NSW Transport
 Sydney Trains

SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS AIR LINE SCHEMATICS
 STAGE 6 - POSSESSION 8
 SHEET 1 OF 1
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 23012017

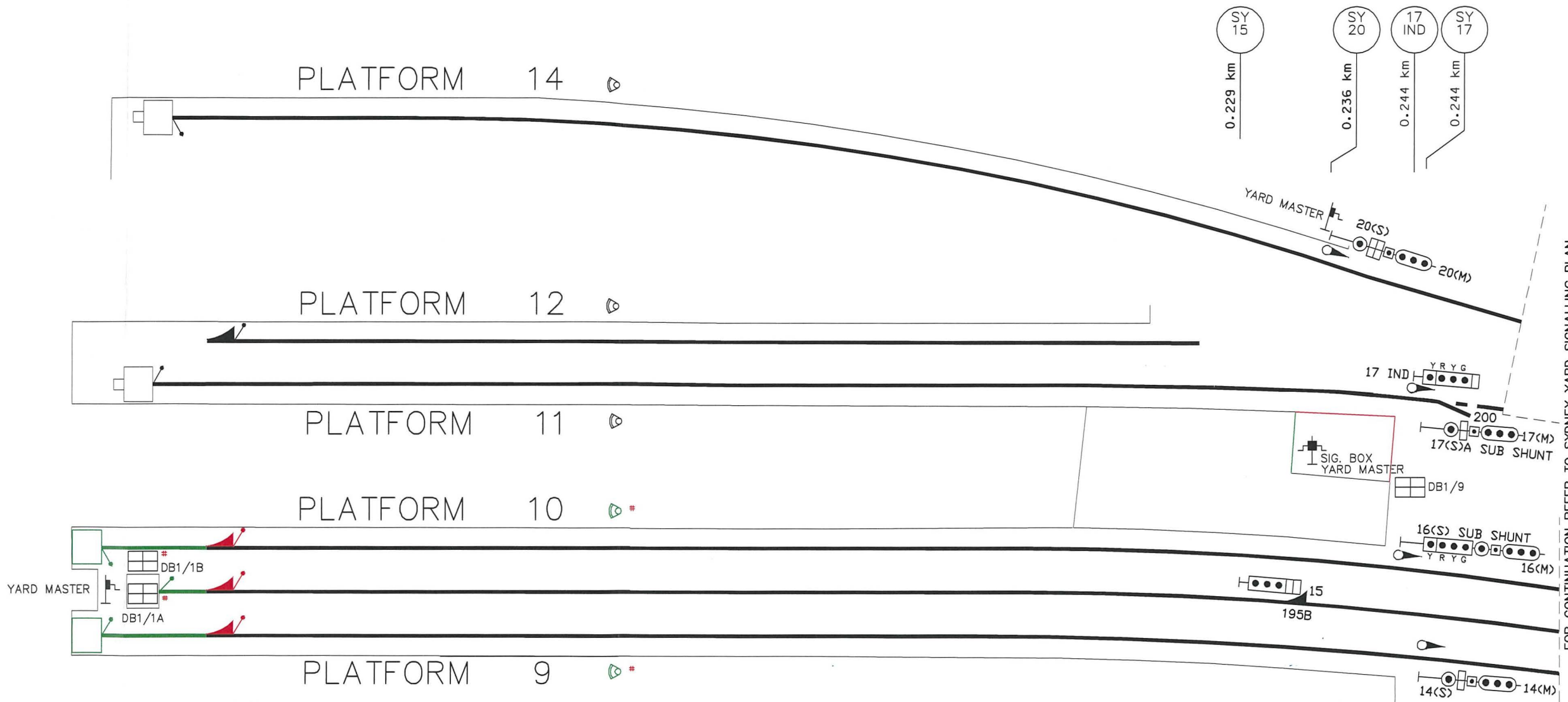
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 Plot Date & Time 1/23/2017 12:06 PM
 Plotted by WATTS, STEVE

Appendix N

Drivers Diagram - Proposed Sydney Yard Early Works Stage 7 -
Possession 9

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SYDNEY TERMINAL CONCOURSE



TO PLATFORMS 1 - 8 (NOT SHOWN IN THIS DRIVERS DIAGRAM)

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

LEGEND:

- EXISTING
- NEW
- RECOVERED
- BOOKED OUT OF USE

NOTE:

* RELOCATED POSITION TO BE CONFIRMED



SYDNEY YARD - METRO STATION
PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 7 - POSSESSION 9
 SIGNALLING ARRANGEMENT SHEET 1 OF 1
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

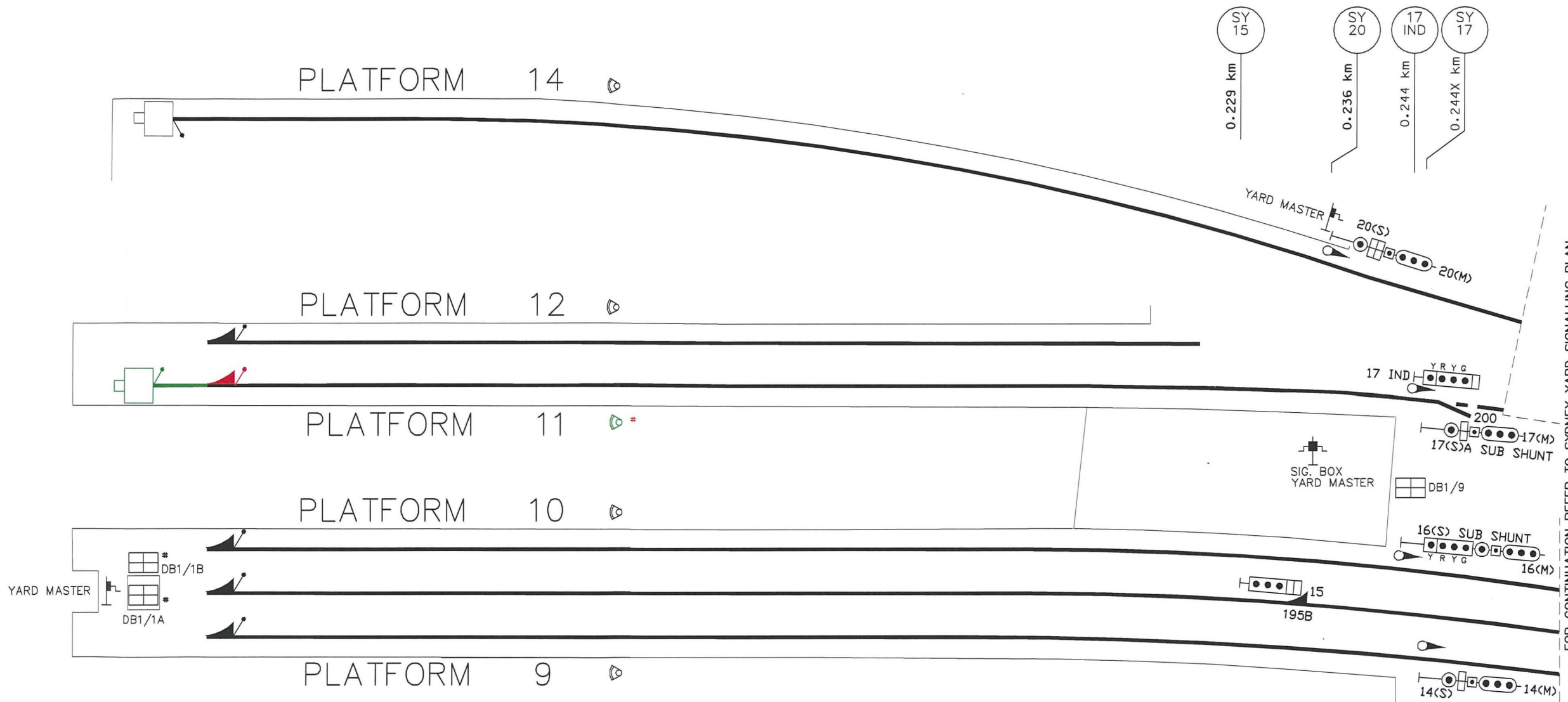
FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
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 Plot Date & Time 2/13/2017 3:16 PM
 Plotted by WATTS, STEVE

Appendix O

Drivers Diagram - Proposed Sydney Yard Early Works Stage 8 -
Possession 10

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SYDNEY TERMINAL CONCOURSE



TO PLATFORMS 1 - 8 (NOT SHOWN IN THIS DRIVERS DIAGRAM)

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

LEGEND:

- EXISTING
- NEW
- RECOVERED
- BOOKED OUT OF USE

NOTE:

- * RELOCATED POSITION TO BE CONFIRMED



SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 8 - POSSESSION 10
 SIGNALLING ARRANGEMENT SHEET 1 OF 1
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

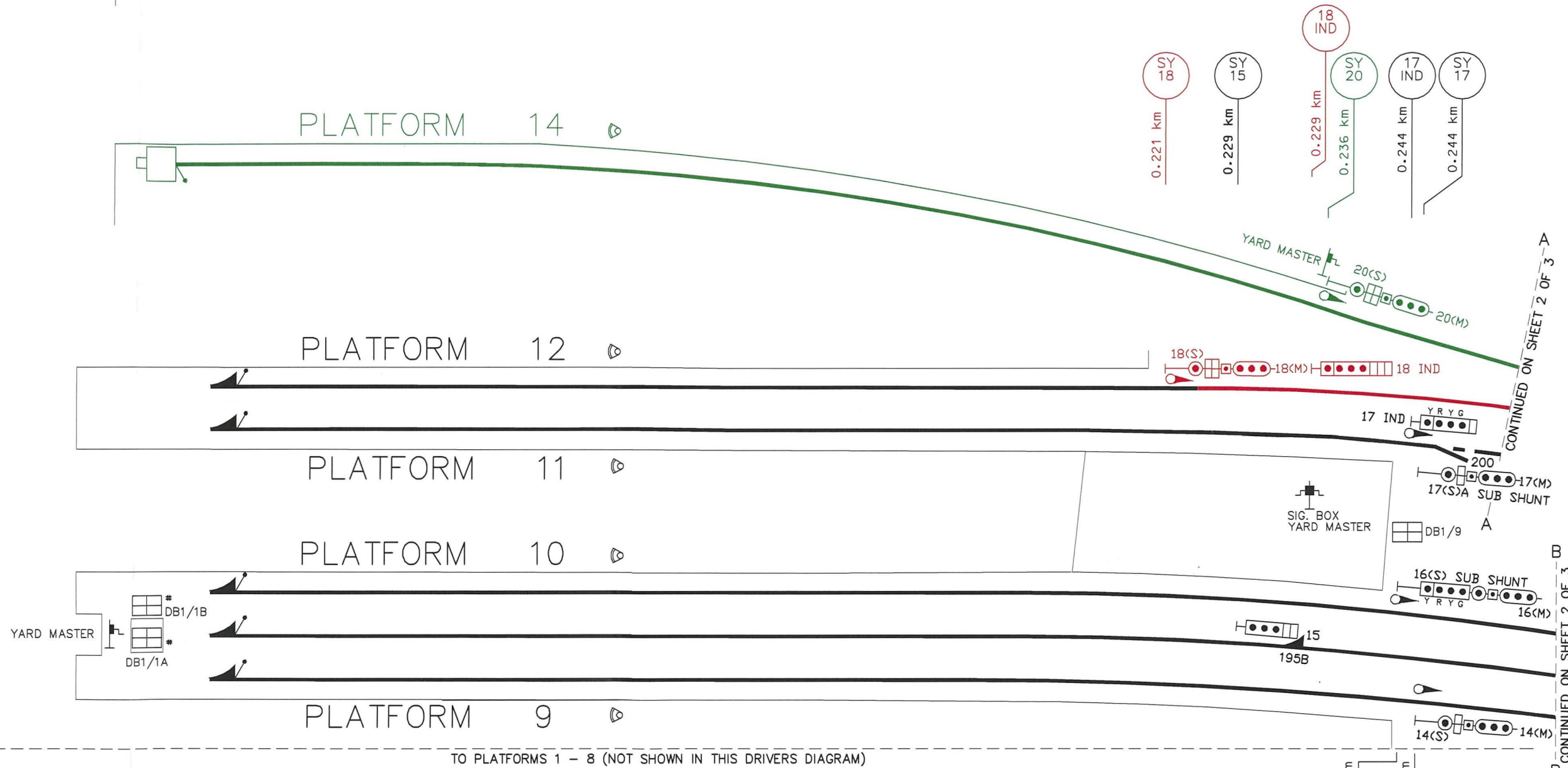
FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
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 Plot Date & Time 2/13/2017 3:13 PM
 Plotted by WATTS, STEVE

Appendix P

Drivers Diagram - Proposed Sydney Yard Early Works Stage 9 -
Possession 11

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SYDNEY TERMINAL CONCOURSE



TO PLATFORMS 1 - 8 (NOT SHOWN IN THIS DRIVERS DIAGRAM)

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18 IND.	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL

- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

NOTE:
* RELOCATED POSITION TO BE CONFIRMED




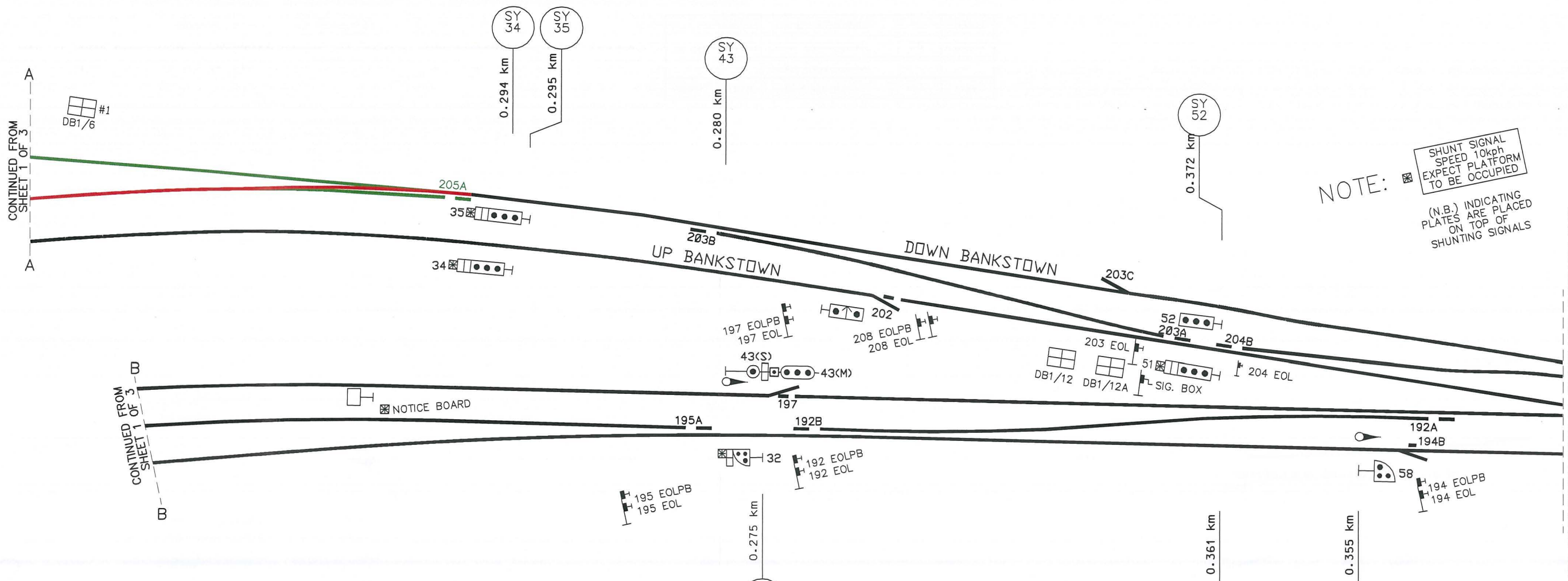
SYDNEY YARD - METRO STATION
PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 9 - POSSESSION 11
 SIGNALLING ARRANGEMENT SHEET 1 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13032017

Plot Date & Time 2/13/2017 3:16 PM File Plotted DD_SYDNEY YARD METRO STATION PROPOSED EW_STAGE 9.dwg Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
34	34A	PLATFORM 11	P11	STENCIL
	34B	PLATFORM 13	P13	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
35	35A	PLATFORM 12	P12	STENCIL
	35B	PLATFORM 14	P14	STENCIL

NOTE:  SHUNT SIGNAL SPEED 10kph EXPECT PLATFORM TO BE OCCUPIED
 (N.B.) INDICATING PLATES ARE PLACED ON TOP OF SHUNTING SIGNALS



SIGNAL	ROUTE	DESTINATION	IND.	TYPE
32	32A	PLATFORM 9	P9	STENCIL
	32B	MIDDLE ROAD	MR	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
51	51A	PLATFORM 11	11	MMLRI
	51B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
43	M	DOWN BANKSTOWN	-	-
	43(S)A	DOWN BANKSTOWN	DB	STENCIL
	43(S)B	UP BANKSTOWN	UB	STENCIL

LEGEND:
 EXISTING
 NEW
 RECOVERED
 BOOKED OUT OF USE

NOTE:
 #1 RELOCATED - POSITION TO BE CONFIRMED.


SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 9 - POSSESSION 11
 SIGNALLING ARRANGEMENT SHEET 2 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN

Plot Date & Time 2/13/2017 3:16 PM File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED EW_STAGE 9.dwg Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
59	59A	PLATFORM 11	11	STENCIL
	59B	PLATFORM 14	14	STENCIL

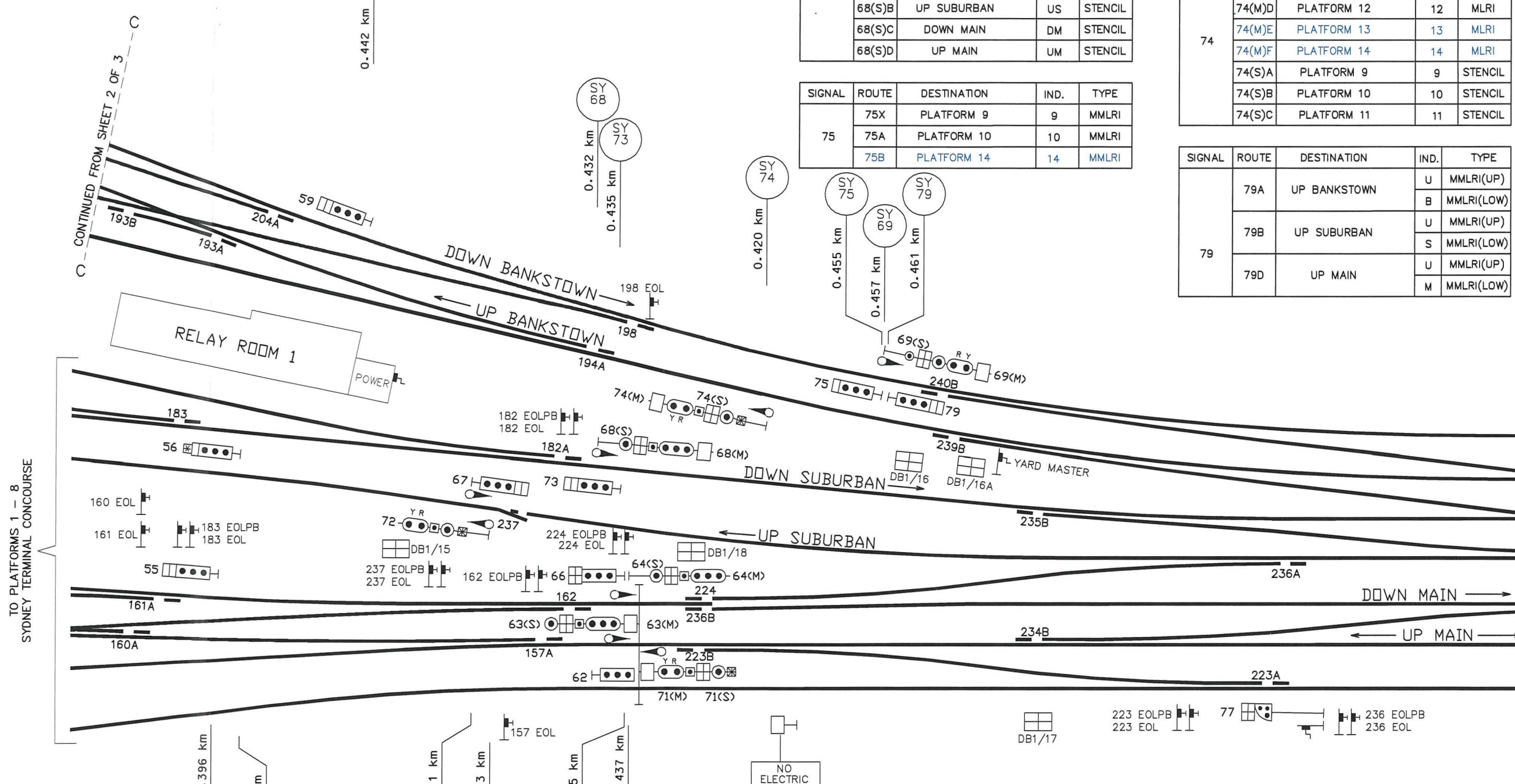
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
73	73A	PLATFORM 6	P6	STENCIL
	73B	PLATFORM 8	P8	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
68	68(M)A	DOWN SUBURBAN	-	-
	68(M)B	DOWN MAIN	M	MLRI
	68(S)A	DOWN SUBURBAN	DS	STENCIL
	68(S)B	UP SUBURBAN	US	STENCIL
	68(S)C	DOWN MAIN	DM	STENCIL
	68(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
74	74(M)A	PLATFORM 9	9	MLRI
	74(M)B	PLATFORM 10	10	MLRI
	74(M)C	PLATFORM 11	11	MLRI
	74(M)D	PLATFORM 12	12	MLRI
	74(M)E	PLATFORM 13	13	MLRI
	74(M)F	PLATFORM 14	14	MLRI
	74(S)A	PLATFORM 9	9	STENCIL
	74(S)B	PLATFORM 10	10	STENCIL
	74(S)C	PLATFORM 11	11	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
75	75X	PLATFORM 9	9	MMLRI
	75A	PLATFORM 10	10	MMLRI
	75B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
79	79A	UP BANKSTOWN	U	MMLRI(UP)
			B	MMLRI(LOW)
	79B	UP SUBURBAN	U	MMLRI(UP)
			S	MMLRI(LOW)
	79D	UP MAIN	U	MMLRI(UP)
			M	MMLRI(LOW)



LEGEND:
 — EXISTING
 — NEW
 — RECOVERED
 — BOOKED OUT OF USE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
63	63(M)A	DOWN MAIN	D	MLRI
	63(M)B	UP MAIN	U	MLRI
	63(S)B	DOWN MAIN	DM	STENCIL
	63(S)C	UP MAIN	UM	STENCIL
	63(S)D	UP SHUNTING NECK	SN	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
69	69(M)B	DOWN MAIN	M	MLRI
	69(S)A	DOWN BANKSTOWN	DB	STENCIL
	69(S)B	DOWN SUBURBAN	DS	STENCIL
	69(S)C	DOWN MAIN	DM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
67	67(S)B	UP SUBURBAN	US	STENCIL
	67(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
64	M	DOWN MAIN	-	-
	64(S)A	BOOKED OUT OF USE	US	STENCIL
	64(S)B	BOOKED OUT OF USE	DM	STENCIL
	64(S)C	BOOKED OUT OF USE	UM	STENCIL



SYDNEY YARD - METRO STATION
 PROPOSED EARLY WORKS DRIVERS DIAGRAM
 STAGE 9 - POSSESSION 11
 SIGNALLING ARRANGEMENT SHEET 3 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

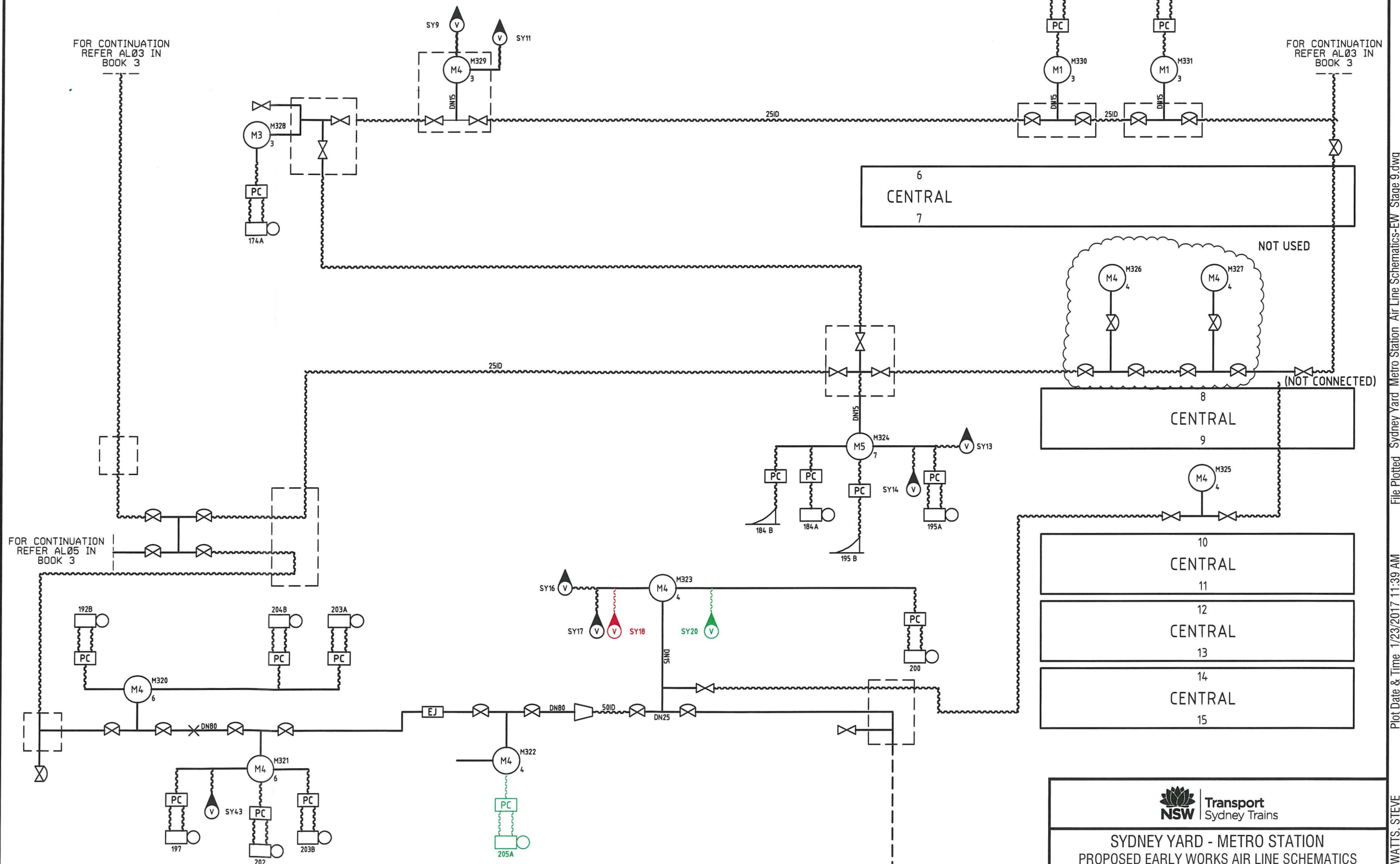
FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
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 File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED EW_STAGE 9.dwg
 Plotted by WATTS, STEVE

Appendix Q

Air Schematics - Proposed Sydney Yard Early Works Stage 9 –
Possession 11

FOR CONTINUATION
REFER AL03 IN
BOOK 3

FOR CONTINUATION
REFER AL03 IN
BOOK 3



FOR CONTINUATION
REFER AL05 IN
BOOK 3

FOR CONTINUATION
REFER AL05 IN
BOOK 3



SYDNEY YARD - METRO STATION
PROPOSED EARLY WORKS AIR LINE SCHEMATICS
STAGE 9 - POSSESSION 11
SHEET 1 OF 1
PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 23012017

Plot Date & Time 1/23/2017 11:39 AM File Plotted Sydney Yard_Metro Station_Air Line Schematics-EW_Stage 9.dwg Plotted by WATTS, STEVE

Appendix R

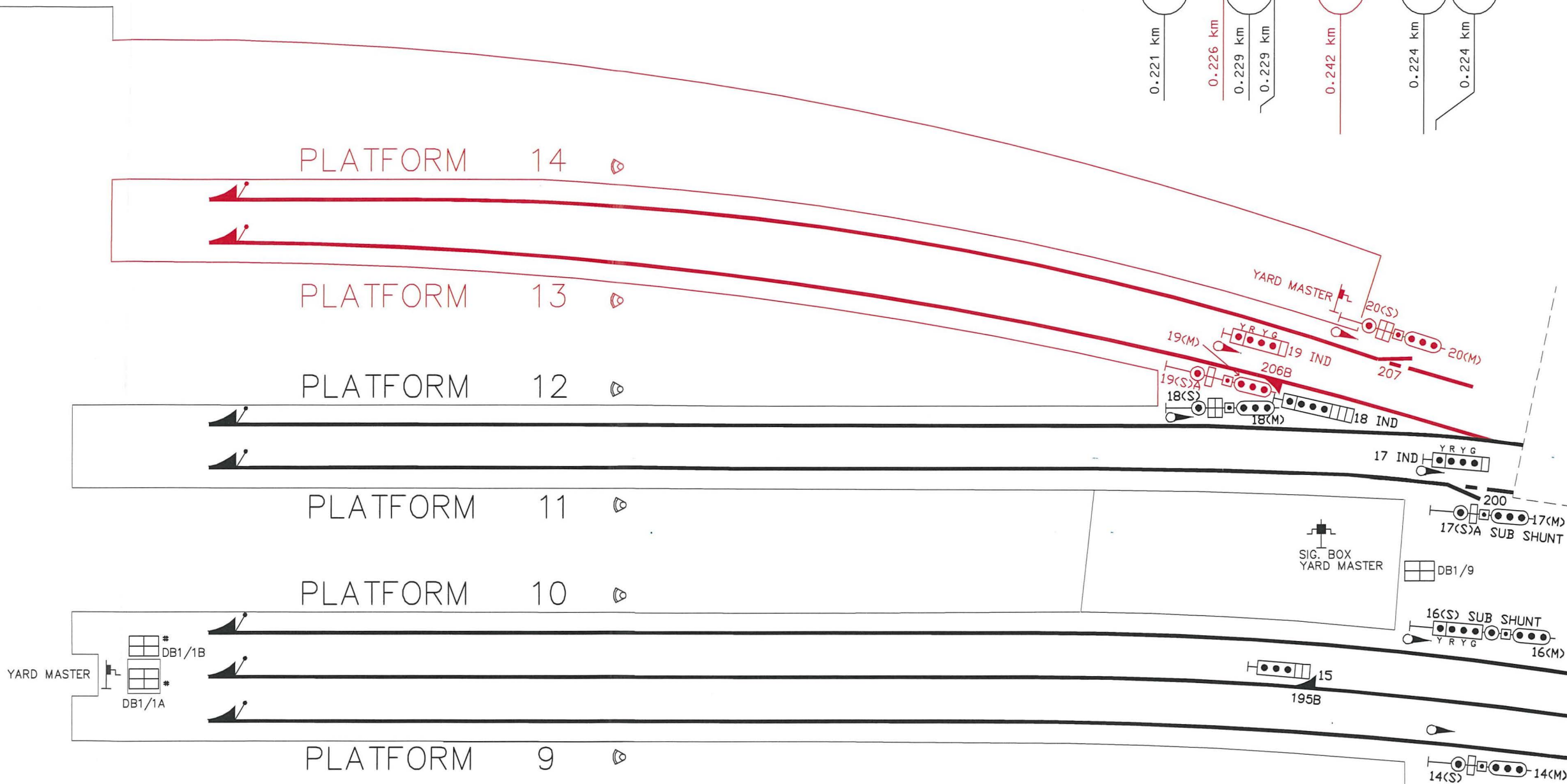
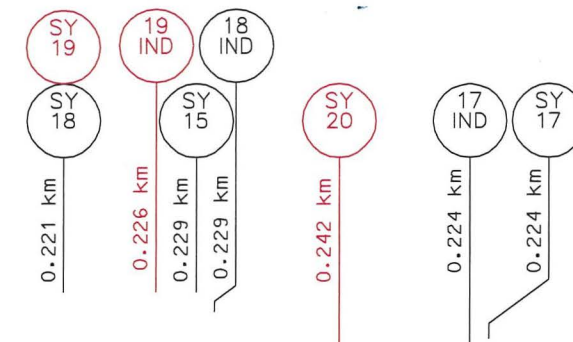
Drivers Diagram – Proposed 'Metro Box Platform 13/14 Return to operations and Western concourse' Works - Stage 1

SYDNEY TERMINAL CONCOURSE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19	M	DOWN BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	DB	STENCIL
	19(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19 IND.	M	UP BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	D	MMLRI
	19(S)B	UP BANKSTOWN	U	MMLRI



TO PLATFORMS 1 - 8 (NOT SHOWN IN THIS DRIVERS DIAGRAM)

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18 IND.	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL

- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

NOTE:
 * RELOCATED POSITION TO BE CONFIRMED



SYDNEY YARD - METRO STATION
 PLATFORM 13/14 RETURN - DRIVERS DIAGRAM
 STAGE 1 - POSSESSION CONFIGURATION STAGE 1
 SIGNALLING ARRANGEMENT SHEET 1 OF 1
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 06042017

Appendix S

Air Line Schematic - Proposed 'Metro Box Platform 13/14 Return to operations and Western concourse Works' Stage 1 – Possession Configuration stage 2

Appendix T

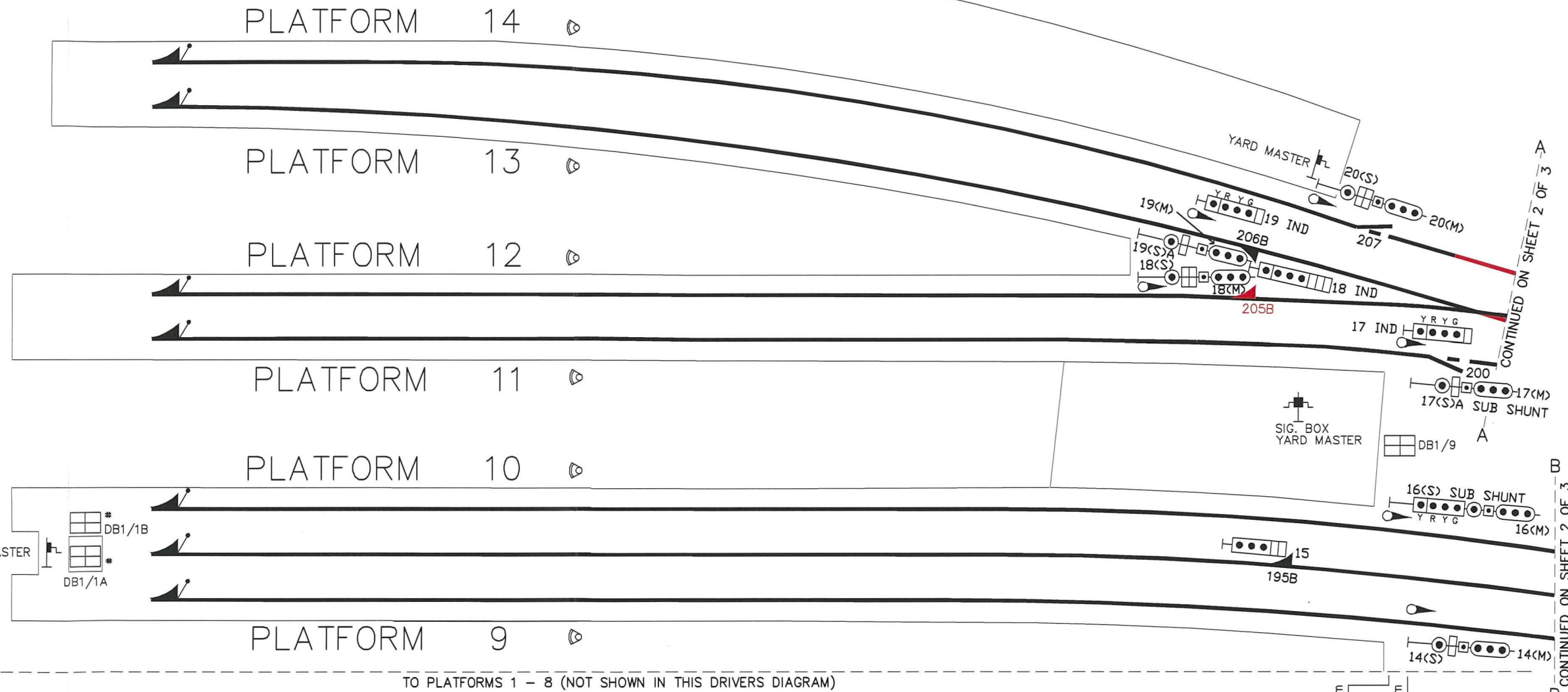
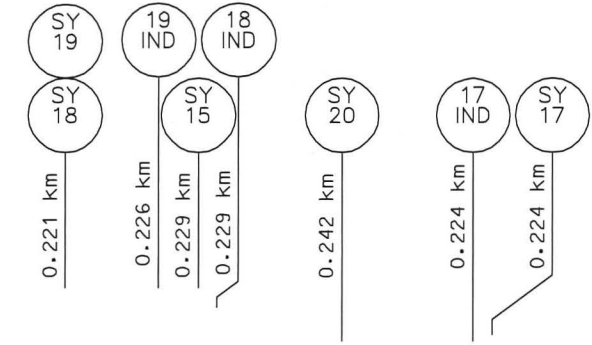
Drivers Diagram – Proposed 'Metro Box Platform 13/14 Return to operations and Western concourse' Works Stage 2- Possession Configuration stage 4

SYDNEY TERMINAL CONCOURSE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19	M	DOWN BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	DB	STENCIL
	19(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19 IND.	M	UP BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	D	MMLRI
	19(S)B	UP BANKSTOWN	U	MMLRI



SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

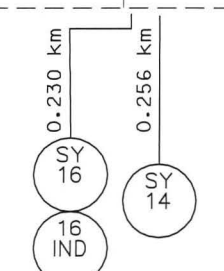
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18 IND.	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL



- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

NOTE:
* RELOCATED POSITION TO BE CONFIRMED

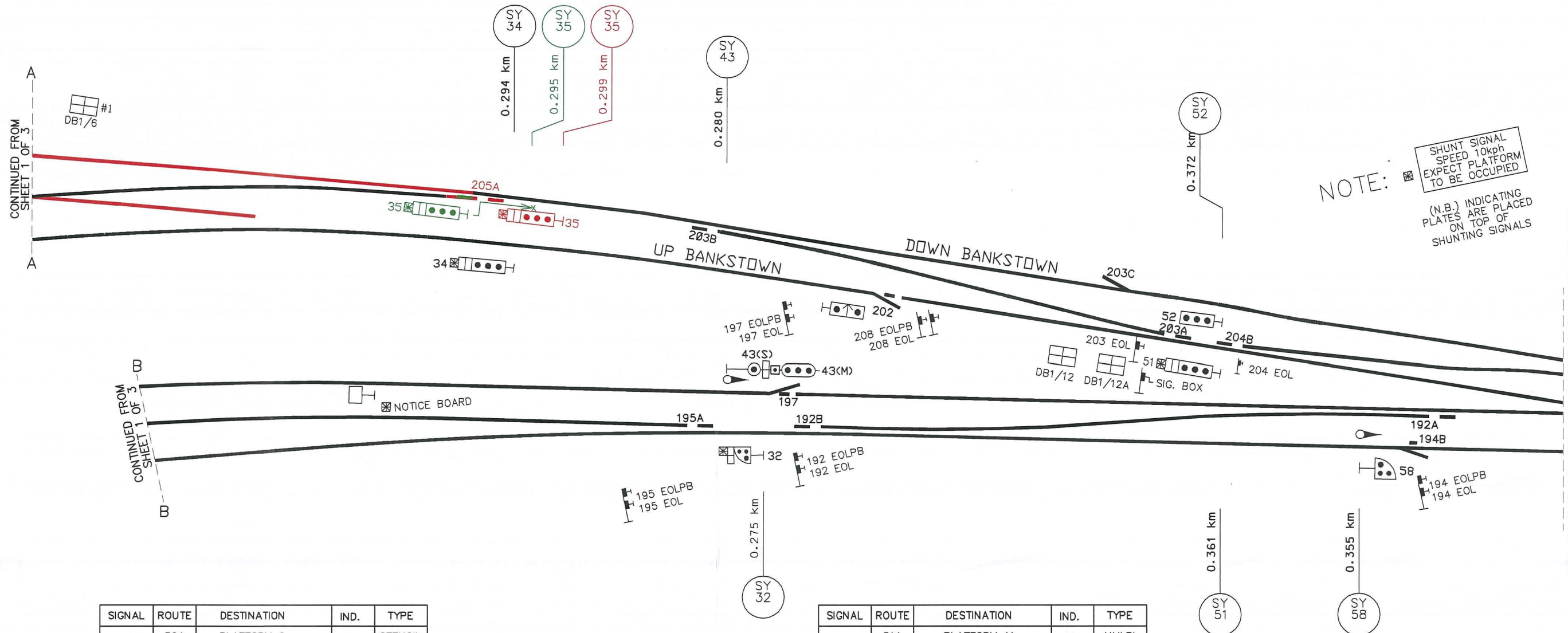
NSW Transport Sydney Trains

SYDNEY YARD - METRO STATION
PLATFORM 13/14 RETURN - DRIVERS DIAGRAM
 STAGE 2 - POSSESSION CONFIGURATION STAGE 4
 SIGNALLING ARRANGEMENT SHEET 1 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 06042017

Plot Date & Time 4/6/2017 9:59 AM File Plotted DD_SYDNEY YARD_Metro STATION - PROPOSED MW_STAGE 2.dwg Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
34	34A	PLATFORM 11	P11	STENCIL
	34B	PLATFORM 13	P13	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
35	35A	PLATFORM 12	P12	STENCIL
	35B	PLATFORM 14	P14	STENCIL



NOTE: SHUNT SIGNAL SPEED 10kph EXPECT PLATFORM TO BE OCCUPIED
 (N.B.) INDICATING PLATES ARE PLACED ON TOP OF SHUNTING SIGNALS

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
32	32A	PLATFORM 9	P9	STENCIL
	32B	MIDDLE ROAD	MR	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
51	51A	PLATFORM 11	11	MMLRI
	51B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
43	M	DOWN BANKSTOWN	-	-
	43(S)A	DOWN BANKSTOWN	DB	STENCIL
	43(S)B	UP BANKSTOWN	UB	STENCIL

- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

NOTE:
 #1 RELOCATED - POSITION TO BE CONFIRMED.

SYDNEY YARD - METRO STATION
 PLATFORM 13/14 RETURN - DRIVERS DIAGRAM
 STAGE 2 - POSSESSION CONFIGURATION STAGE 4
 SIGNALLING ARRANGEMENT SHEET 2 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 06042017

FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
 File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED MW_STAGE 2.dwg
 Plot Date & Time 4/6/2017 9:59 AM
 Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
59	59A	PLATFORM 11	11	STENCIL
	59B	PLATFORM 14	14	STENCIL

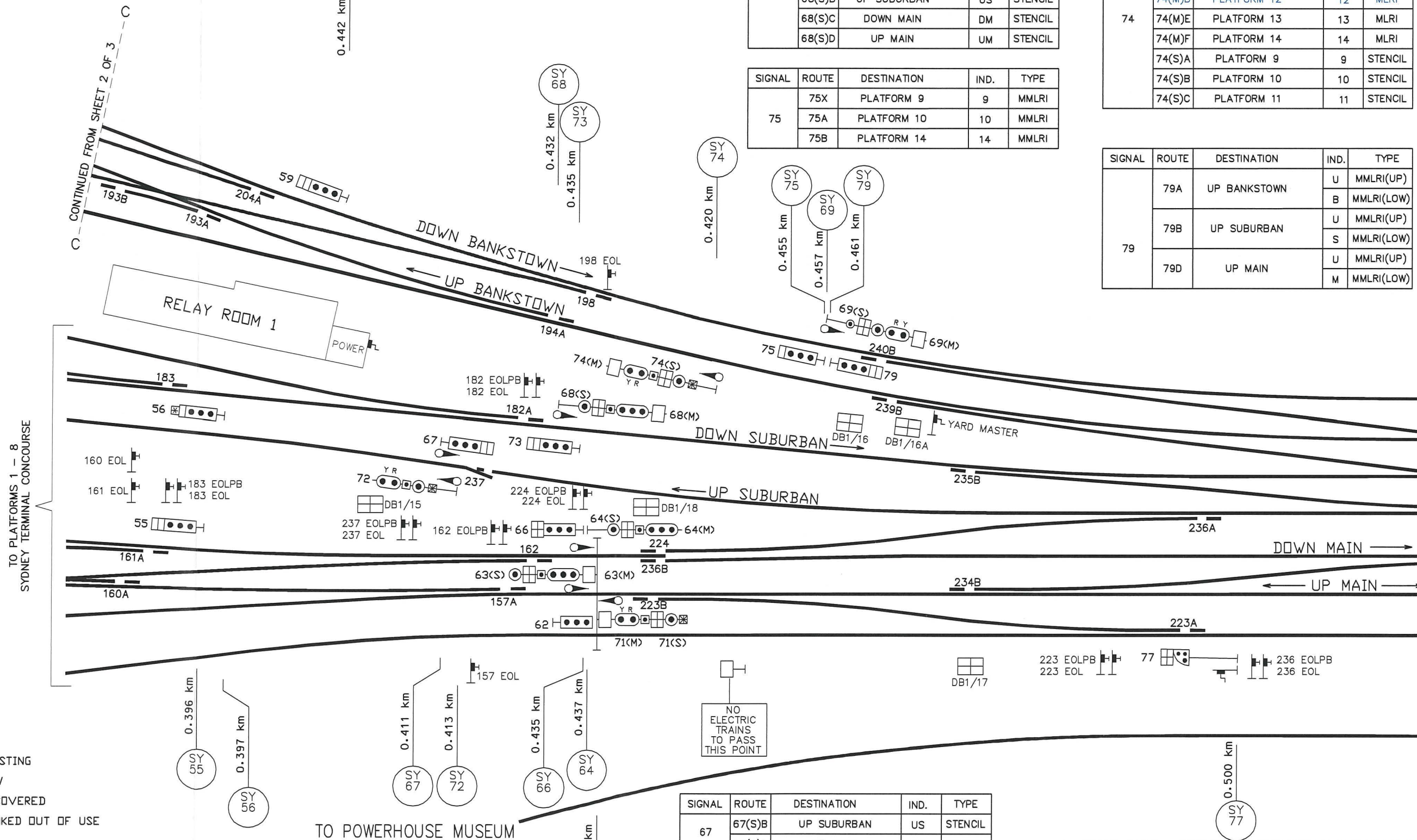
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
73	73A	PLATFORM 6	P6	STENCIL
	73B	PLATFORM 8	P8	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
68	68(M)A	DOWN SUBURBAN	-	-
	68(M)B	DOWN MAIN	M	MLRI
	68(S)A	DOWN SUBURBAN	DS	STENCIL
	68(S)B	UP SUBURBAN	US	STENCIL
	68(S)C	DOWN MAIN	DM	STENCIL
	68(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
74	74(M)A	PLATFORM 9	9	MLRI
	74(M)B	PLATFORM 10	10	MLRI
	74(M)C	PLATFORM 11	11	MLRI
	74(M)D	PLATFORM 12	12	MLRI
	74(M)E	PLATFORM 13	13	MLRI
	74(M)F	PLATFORM 14	14	MLRI
	74(S)A	PLATFORM 9	9	STENCIL
	74(S)B	PLATFORM 10	10	STENCIL
	74(S)C	PLATFORM 11	11	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
75	75X	PLATFORM 9	9	MMLRI
	75A	PLATFORM 10	10	MMLRI
	75B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
79	79A	UP BANKSTOWN	U	MMLRI(UP)
			B	MMLRI(LOW)
	79B	UP SUBURBAN	U	MMLRI(UP)
			S	MMLRI(LOW)
			M	MMLRI(LOW)
	79D	UP MAIN	U	MMLRI(UP)
			M	MMLRI(LOW)



LEGEND:
 — EXISTING
 — NEW
 — RECOVERED
 — BOOKED OUT OF USE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
63	63(M)A	DOWN MAIN	D	MLRI
	63(M)B	UP MAIN	U	MLRI
	63(S)B	DOWN MAIN	DM	STENCIL
	63(S)C	UP MAIN	UM	STENCIL
	63(S)D	UP SHUNTING NECK	SN	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
69	69(M)B	DOWN MAIN	M	MLRI
	69(S)A	DOWN BANKSTOWN	DB	STENCIL
	69(S)B	DOWN SUBURBAN	DS	STENCIL
	69(S)C	DOWN MAIN	DM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
67	67(S)B	UP SUBURBAN	US	STENCIL
	67(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
64	M	DOWN MAIN	-	-
	64(S)A	BOOKED OUT OF USE	US	STENCIL
	64(S)B	BOOKED OUT OF USE	DM	STENCIL
	64(S)C	BOOKED OUT OF USE	UM	STENCIL

NO ELECTRIC TRAINS TO PASS THIS POINT

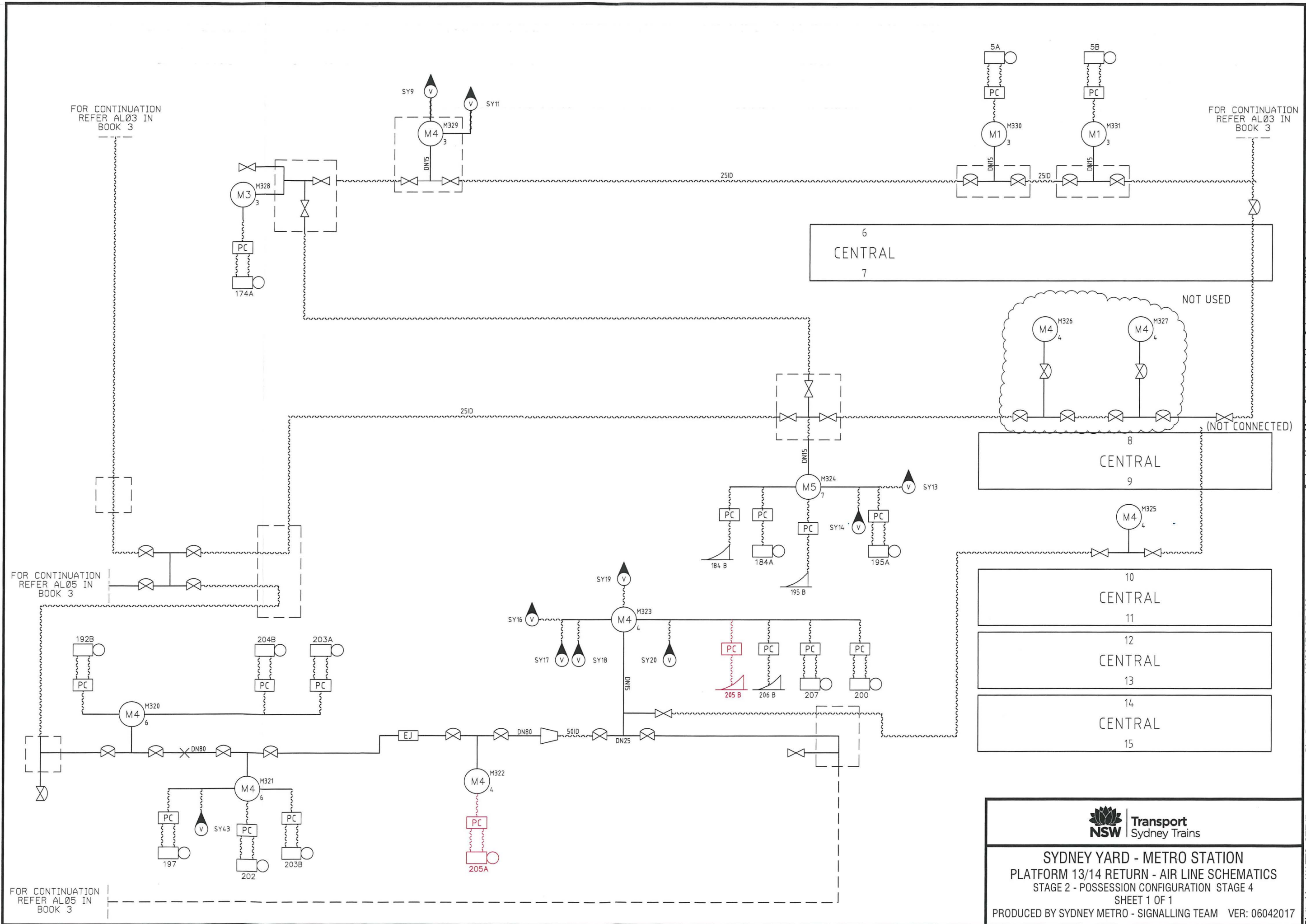


SYDNEY YARD - METRO STATION
 PLATFORM 13/14 RETURN - DRIVERS DIAGRAM
 STAGE 2 - POSSESSION CONFIGURATION STAGE 4
 SIGNALLING ARRANGEMENT SHEET 3 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 06042017

FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
 Plot Date & Time: 4/6/2017 9:59 AM
 File Plotted: DD_SYDNEY YARD_METRO STATION_PROPOSED MW_STAGE 2.dwg
 Plotted by: WATTS, STEVE

Appendix U

Air Line Schematic - Proposed 'Metro Box Platform 13/14 Return to operations and Western concourse' Works Stage 2 - Possession Configuration stage 4



SYDNEY YARD - METRO STATION
PLATFORM 13/14 RETURN - AIR LINE SCHEMATICS
 STAGE 2 - POSSESSION CONFIGURATION STAGE 4
 SHEET 1 OF 1
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 06042017

File Plotted Sydney Yard_Metro Station_Air Line Schematics-MW_Stage 2.dwg Plot Date & Time 4/6/2017 9:37 AM Plotted by WATTS, STEVE

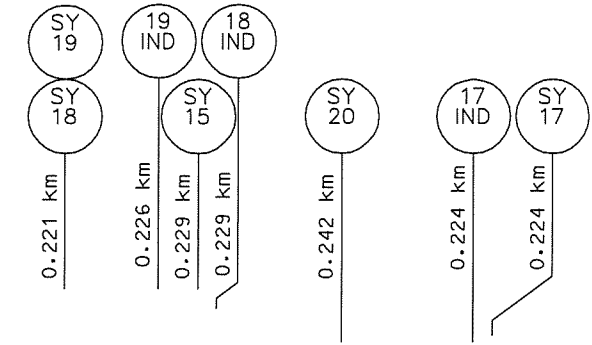
Appendix V

Drivers Diagram – Proposed 'Metro Box Platform 13/14 Return to operations and Western concourse' Works Stage 3- Possession Configuration stage 6

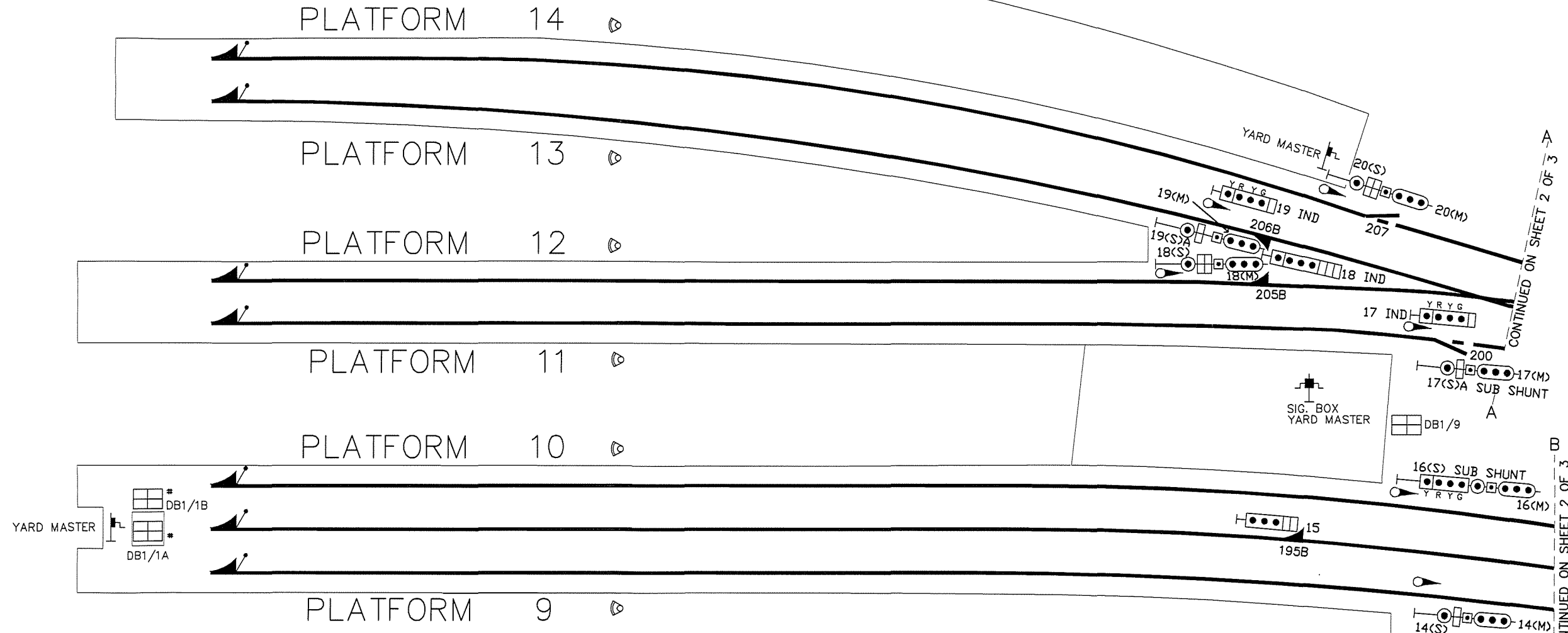
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19	M	DOWN BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	DB	STENCIL
	19(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19 IND.	M	UP BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	D	MMLRI
	19(S)B	UP BANKSTOWN	U	MMLRI



SYDNEY TERMINAL CONCOURSE



TO PLATFORMS 1 - 8 (NOT SHOWN IN THIS DRIVERS DIAGRAM)

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

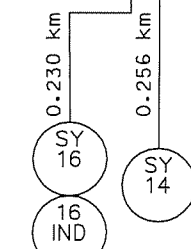
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18 IND.	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL



- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

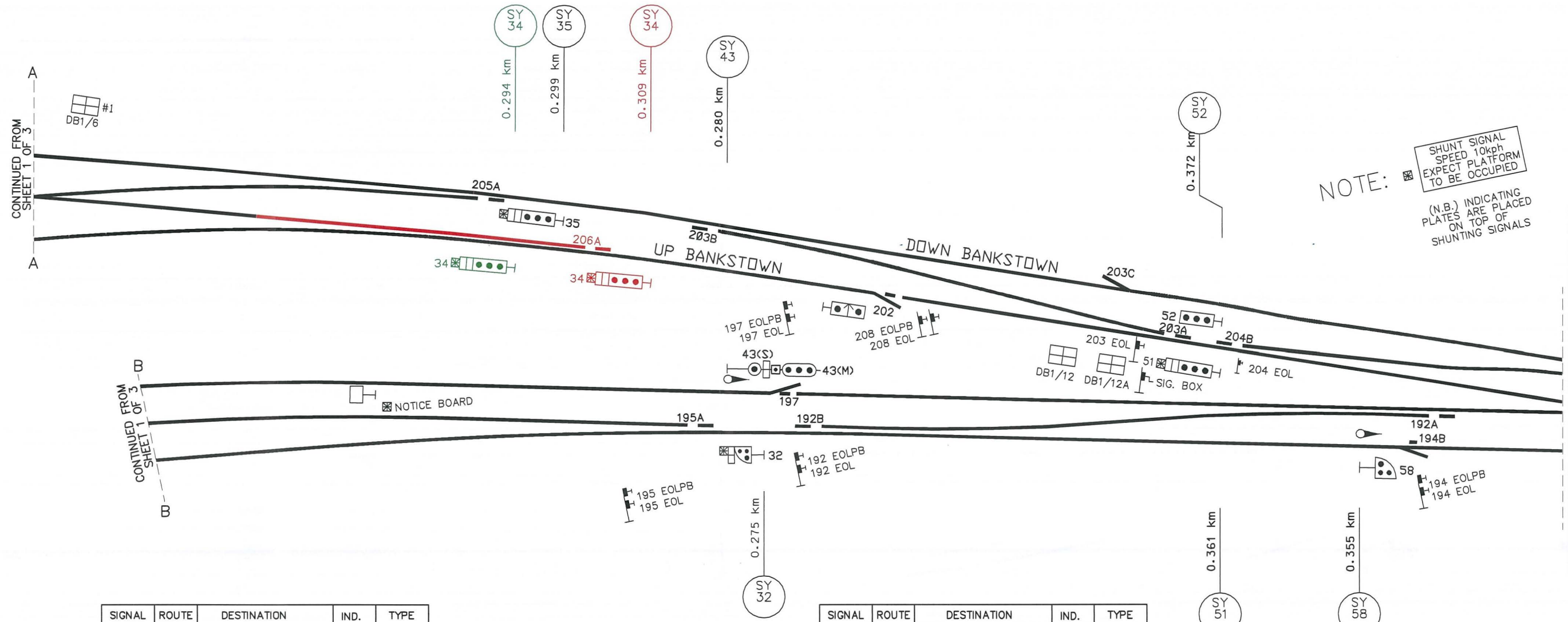
NOTE:
 * RELOCATED POSITION TO BE CONFIRMED

SYDNEY YARD - METRO STATION
 PLATFORM 13/14 RETURN - DRIVERS DIAGRAM
 STAGE 3 - POSSESSION CONFIGURATION STAGE 6
 SIGNALLING ARRANGEMENT SHEET 1 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 06042017

File Plotted DD_SYDNEY YARD_METRO STATION - PROPOSED MW_STAGE 3.dwg
 Plot Date & Time 4/6/2017 9:56 AM
 Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
34	34A	PLATFORM 11	P11	STENCIL
	34B	PLATFORM 13	P13	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
35	35A	PLATFORM 12	P12	STENCIL
	35B	PLATFORM 14	P14	STENCIL



NOTE: SHUNT SIGNAL SPEED 10kph EXPECT PLATFORM TO BE OCCUPIED
 (N.B.) INDICATING PLATES ARE PLACED ON TOP OF SHUNTING SIGNALS

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
32	32A	PLATFORM 9	P9	STENCIL
	32B	MIDDLE ROAD	MR	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
51	51A	PLATFORM 11	11	MMLRI
	51B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
43	M	DOWN BANKSTOWN	-	-
	43(S)A	DOWN BANKSTOWN	DB	STENCIL
	43(S)B	UP BANKSTOWN	UB	STENCIL

- LEGEND:
- EXISTING
 - NEW
 - RECOVERED
 - BOOKED OUT OF USE

NOTE: #1 RELOCATED - POSITION TO BE CONFIRMED.

SYDNEY YARD - METRO STATION
 PLATFORM 13/14 RETURN - DRIVERS DIAGRAM
 STAGE 3 - POSSESSION CONFIGURATION STAGE 6
 SIGNALLING ARRANGEMENT SHEET 2 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 06042017

FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
 File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED MW_STAGE 3.dwg
 Plot Date & Time 4/6/2017 9:56 AM
 Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
59	59A	PLATFORM 11	11	STENCIL
	59B	PLATFORM 14	14	STENCIL

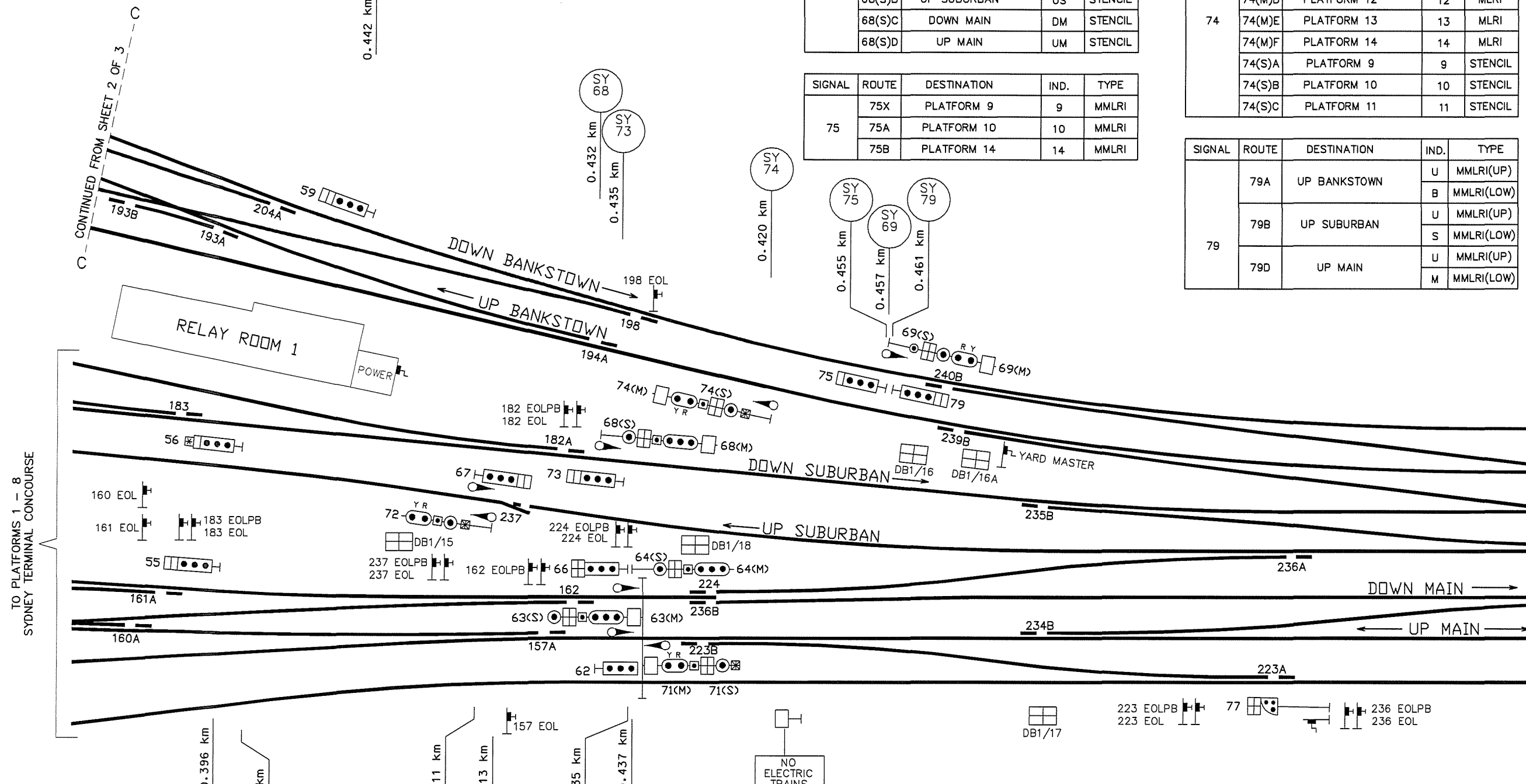
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
73	73A	PLATFORM 6	P6	STENCIL
	73B	PLATFORM 8	P8	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
68	68(M)A	DOWN SUBURBAN	-	-
	68(M)B	DOWN MAIN	M	MLRI
	68(S)A	DOWN SUBURBAN	DS	STENCIL
	68(S)B	UP SUBURBAN	US	STENCIL
	68(S)C	DOWN MAIN	DM	STENCIL
	68(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
74	74(M)A	PLATFORM 9	9	MLRI
	74(M)B	PLATFORM 10	10	MLRI
	74(M)C	PLATFORM 11	11	MLRI
	74(M)D	PLATFORM 12	12	MLRI
	74(M)E	PLATFORM 13	13	MLRI
	74(M)F	PLATFORM 14	14	MLRI
74(S)	74(S)A	PLATFORM 9	9	STENCIL
	74(S)B	PLATFORM 10	10	STENCIL
	74(S)C	PLATFORM 11	11	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
75	75X	PLATFORM 9	9	MMLRI
	75A	PLATFORM 10	10	MMLRI
	75B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
79A	UP BANKSTOWN	U	MMLRI(UP)	
		B	MMLRI(LOW)	
		S	MMLRI(LOW)	
79B	UP SUBURBAN	U	MMLRI(UP)	
		S	MMLRI(LOW)	
		M	MMLRI(LOW)	
79D	UP MAIN	U	MMLRI(UP)	
		M	MMLRI(LOW)	



LEGEND:

- EXISTING
- NEW
- RECOVERED
- BOOKED OUT OF USE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
63	63(M)A	DOWN MAIN	D	MLRI
	63(M)B	UP MAIN	U	MLRI
	63(S)B	DOWN MAIN	DM	STENCIL
	63(S)C	UP MAIN	UM	STENCIL
	63(S)D	UP SHUNTING NECK	SN	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
69	69(M)B	DOWN MAIN	M	MLRI
	69(S)A	DOWN BANKSTOWN	DB	STENCIL
	69(S)B	DOWN SUBURBAN	DS	STENCIL
	69(S)C	DOWN MAIN	DM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
67	67(S)B	UP SUBURBAN	US	STENCIL
	67(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
64	M	DOWN MAIN	-	-
	64(S)A	BOOKED OUT OF USE	US	STENCIL
	64(S)B	BOOKED OUT OF USE	DM	STENCIL
	64(S)C	BOOKED OUT OF USE	UM	STENCIL

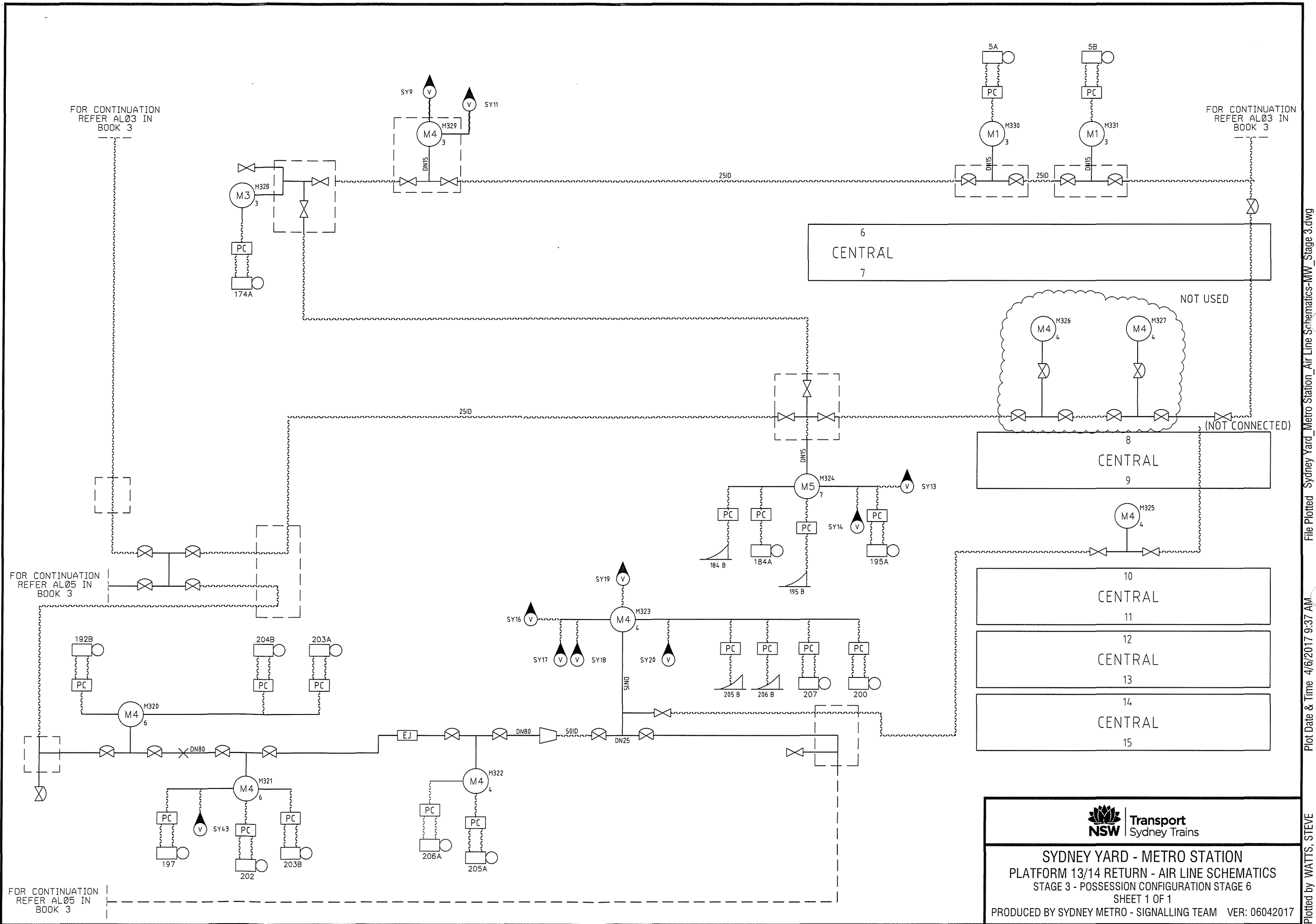


SYDNEY YARD - METRO STATION
 PLATFORM 13/14 RETURN - DRIVERS DIAGRAM
 STAGE 3 - POSSESSION CONFIGURATION STAGE 6
 SIGNALLING ARRANGEMENT SHEET 3 OF 3
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 06042017

File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED MW_STAGE 3.dwg
 Plot Date & Time 4/6/2017 9:56 AM
 FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
 Plotted by WATTS, STEVE

Appendix W

Air Line Schematic - Proposed 'Metro Box Platform 13/14 Return to operations and Western concourse' Works Stage 3 - Possession Configuration stage 6





SYDNEY YARD - METRO STATION
 PLATFORM 13/14 RETURN - AIR LINE SCHEMATICS
 STAGE 3 - POSSESSION CONFIGURATION STAGE 6
 SHEET 1 OF 1
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 06042017

File Plotted Sydney Yard_Metro Station_Air Line Schematics-MW_Stage 3.dwg Plot Date & Time 4/6/2017 9:37 AM Plotted by WATTS, STEVE

Appendix X

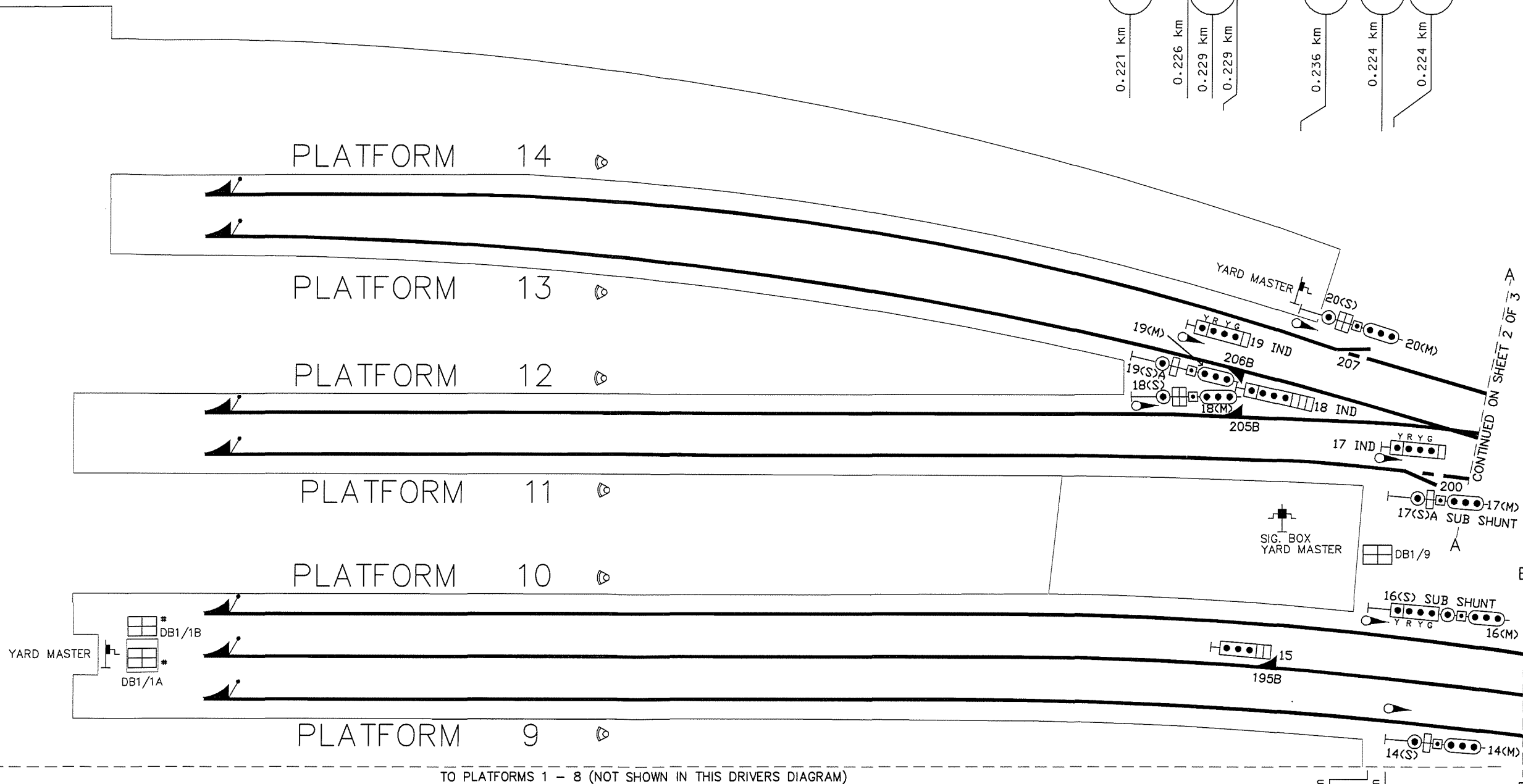
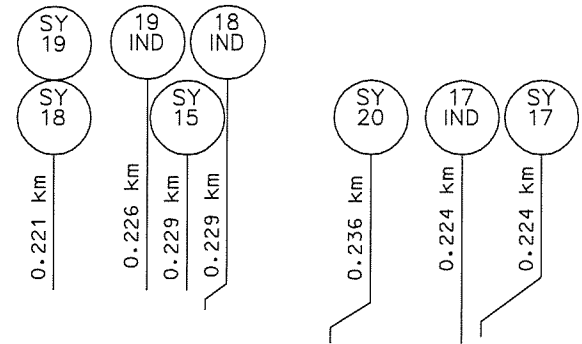
Drivers Diagram – Final Signalling Arrangement

SYDNEY TERMINAL CONCOURSE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17 IND.	17(S)A	DOWN BANKSTOWN	D	MMLRI
	17(S)B	UP BANKSTOWN	U	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19	M	DOWN BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	DB	STENCIL
	19(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
19 IND.	M	UP BANKSTOWN	-	-
	19(S)A	DOWN BANKSTOWN	D	MMLRI
	19(S)B	UP BANKSTOWN	U	MMLRI



SIGNAL	ROUTE	DESTINATION	IND.	TYPE
14	14(M)A	DOWN BANKSTOWN	-	-
	14(S)A	DOWN BANKSTOWN	DB	STENCIL
	14(S)B	UP BANKSTOWN	UB	STENCIL

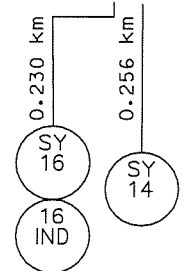
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
17	17(M)	DOWN BANKSTOWN	-	-
	17(S)A	DOWN BANKSTOWN	DB	STENCIL
	17(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18 IND.	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
15	15(S)A	DOWN BANKSTOWN	DB	STENCIL
	15(S)B	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
18	M	DOWN BANKSTOWN	-	-
	18(S)B	DOWN BANKSTOWN	DB	STENCIL
	18(S)C	UP BANKSTOWN	UB	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
20	M	DOWN BANKSTOWN	-	-
	20(S)B	DOWN BANKSTOWN	DB	STENCIL
	20(S)C	UP BANKSTOWN	UB	STENCIL



NOTE:
* RELOCATED POSITION TO BE CONFIRMED

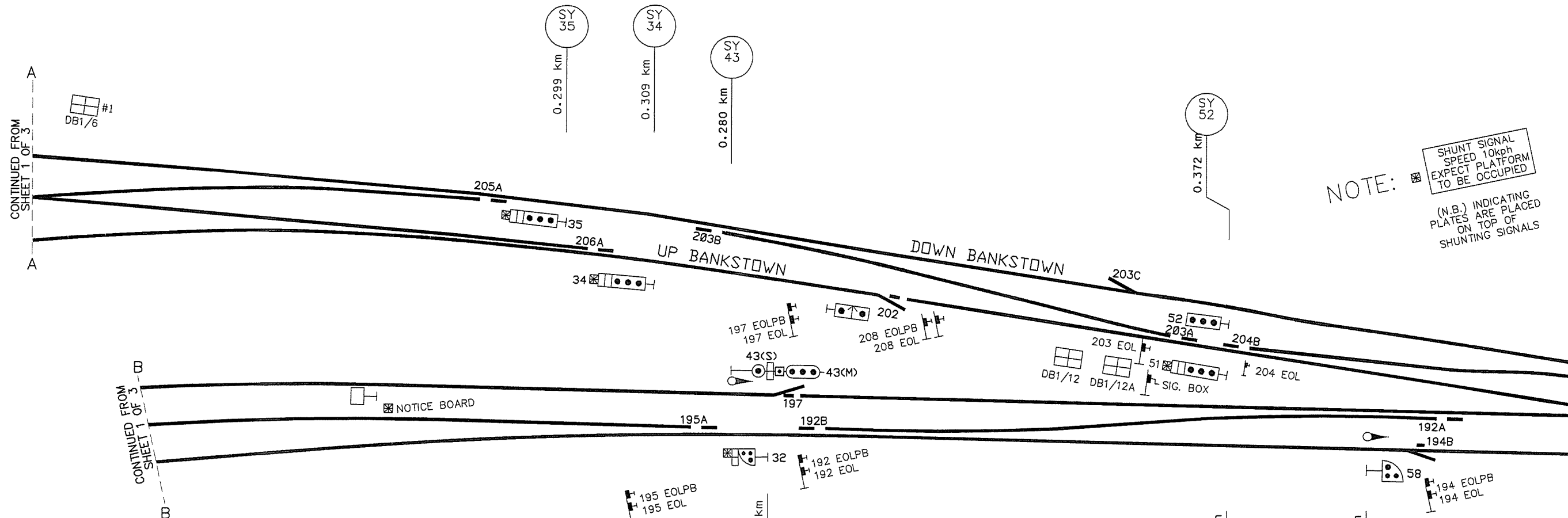
SYDNEY YARD - METRO STATION
 PROPOSED FINAL DRIVERS DIAGRAM
 SIGNALLING ARRANGEMENT SHEET 1 OF 3

PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED_FINAL.dwg
 Plot Date & Time 2/13/2017 3:18 PM
 Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
34	34A	PLATFORM 11	P11	STENCIL
	34B	PLATFORM 13	P13	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
35	35A	PLATFORM 12	P12	STENCIL
	35B	PLATFORM 14	P14	STENCIL



NOTE: SHUNT SIGNAL
SPEED 10kph
EXPECT PLATFORM
TO BE OCCUPIED

(N.B.) INDICATING
PLATES ARE PLACED
ON TOP OF
SHUNTING SIGNALS

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
32	32A	PLATFORM 9	P9	STENCIL
	32B	MIDDLE ROAD	MR	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
51	51A	PLATFORM 11	11	MMLRI
	51B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
43	M	DOWN BANKSTOWN	-	-
	43(S)A	DOWN BANKSTOWN	DB	STENCIL
	43(S)B	UP BANKSTOWN	UB	STENCIL

NOTE:
#1 RELOCATED - POSITION TO BE CONFIRMED.

SYDNEY YARD - METRO STATION
 PROPOSED FINAL DRIVERS DIAGRAM
 SIGNALLING ARRANGEMENT SHEET 2 OF 3

PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
 File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED_FINAL.dwg
 Plot Date & Time 2/13/2017 3:18 PM
 Plotted by WATTS, STEVE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
59	59A	PLATFORM 11	11	STENCIL
	59B	PLATFORM 14	14	STENCIL

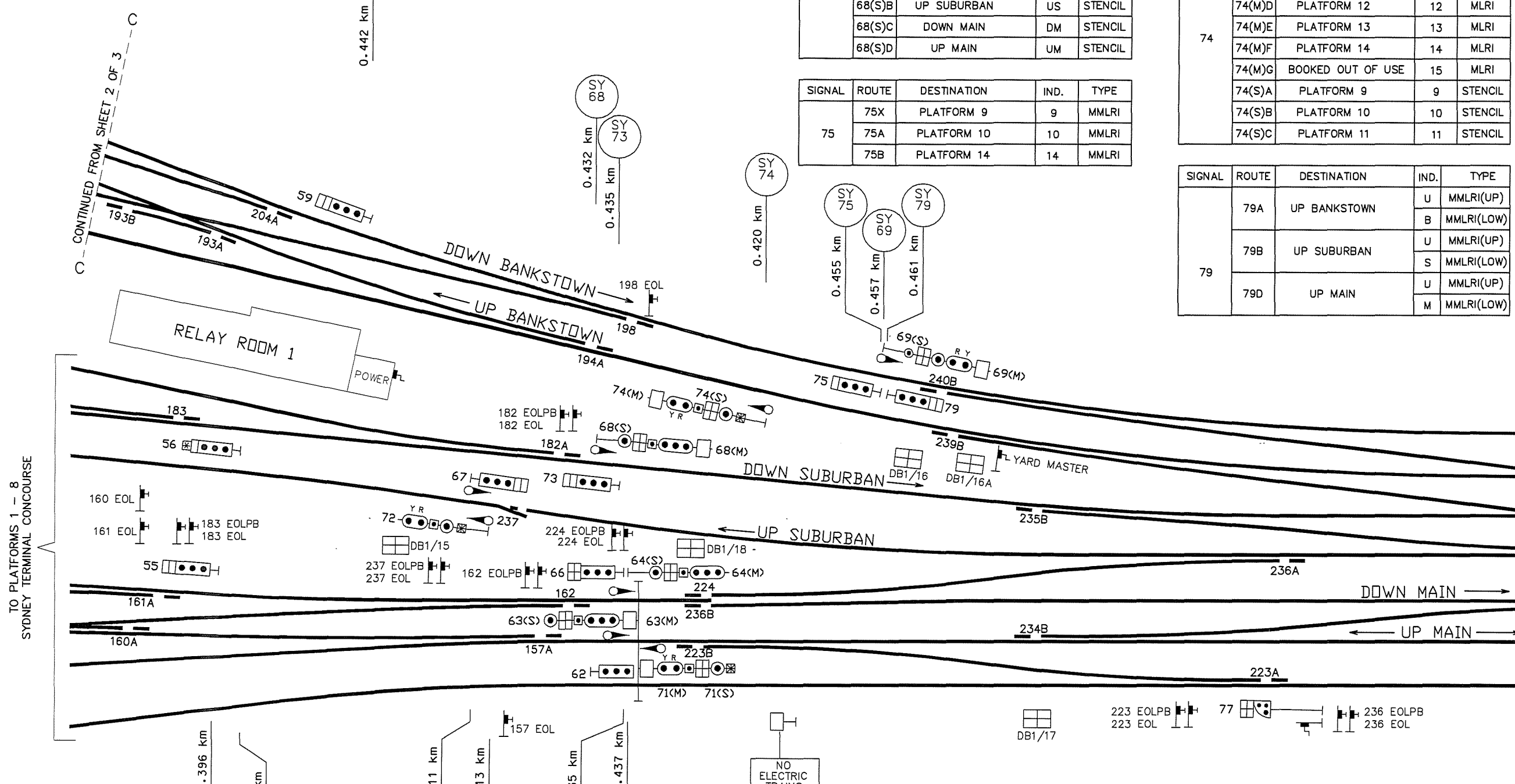
SIGNAL	ROUTE	DESTINATION	IND.	TYPE
73	73A	PLATFORM 6	P6	STENCIL
	73B	PLATFORM 8	P8	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
68	68(M)A	DOWN SUBURBAN	-	-
	68(M)B	DOWN MAIN	M	MLRI
	68(S)A	DOWN SUBURBAN	DS	STENCIL
	68(S)B	UP SUBURBAN	US	STENCIL
	68(S)C	DOWN MAIN	DM	STENCIL
	68(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
74	74(M)A	PLATFORM 9	9	MLRI
	74(M)B	PLATFORM 10	10	MLRI
	74(M)C	PLATFORM 11	11	MLRI
	74(M)D	PLATFORM 12	12	MLRI
	74(M)E	PLATFORM 13	13	MLRI
	74(M)F	PLATFORM 14	14	MLRI
	74(M)G	BOOKED OUT OF USE	15	MLRI
	74(S)A	PLATFORM 9	9	STENCIL
	74(S)B	PLATFORM 10	10	STENCIL
	74(S)C	PLATFORM 11	11	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
75	75X	PLATFORM 9	9	MMLRI
	75A	PLATFORM 10	10	MMLRI
	75B	PLATFORM 14	14	MMLRI

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
79	79A	UP BANKSTOWN	U	MMLRI(UP)
			B	MMLRI(LOW)
	79B	UP SUBURBAN	U	MMLRI(UP)
			S	MMLRI(LOW)
	79D	UP MAIN	U	MMLRI(UP)
			M	MMLRI(LOW)



LEGEND:
 — EXISTING
 — NEW
 — RECOVERED
 — BOOKED OUT OF USE

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
63	63(M)A	DOWN MAIN	D	MLRI
	63(M)B	UP MAIN	U	MLRI
	63(S)B	DOWN MAIN	DM	STENCIL
	63(S)C	UP MAIN	UM	STENCIL
	63(S)D	UP SHUNTING NECK	SN	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
69	69(M)B	DOWN MAIN	M	MLRI
	69(S)A	DOWN BANKSTOWN	DB	STENCIL
	69(S)B	DOWN SUBURBAN	DS	STENCIL
	69(S)C	DOWN MAIN	DM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
67	67(S)B	UP SUBURBAN	US	STENCIL
	67(S)D	UP MAIN	UM	STENCIL

SIGNAL	ROUTE	DESTINATION	IND.	TYPE
64	M	DOWN MAIN	-	-
	64(S)A	BOOKED OUT OF USE	US	STENCIL
	64(S)B	BOOKED OUT OF USE	DM	STENCIL
	64(S)C	BOOKED OUT OF USE	UM	STENCIL

NO ELECTRIC TRAINS TO PASS THIS POINT



SYDNEY YARD - METRO STATION
 PROPOSED FINAL DRIVERS DIAGRAM
 SIGNALLING ARRANGEMENT SHEET 3 OF 3

PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 13022017

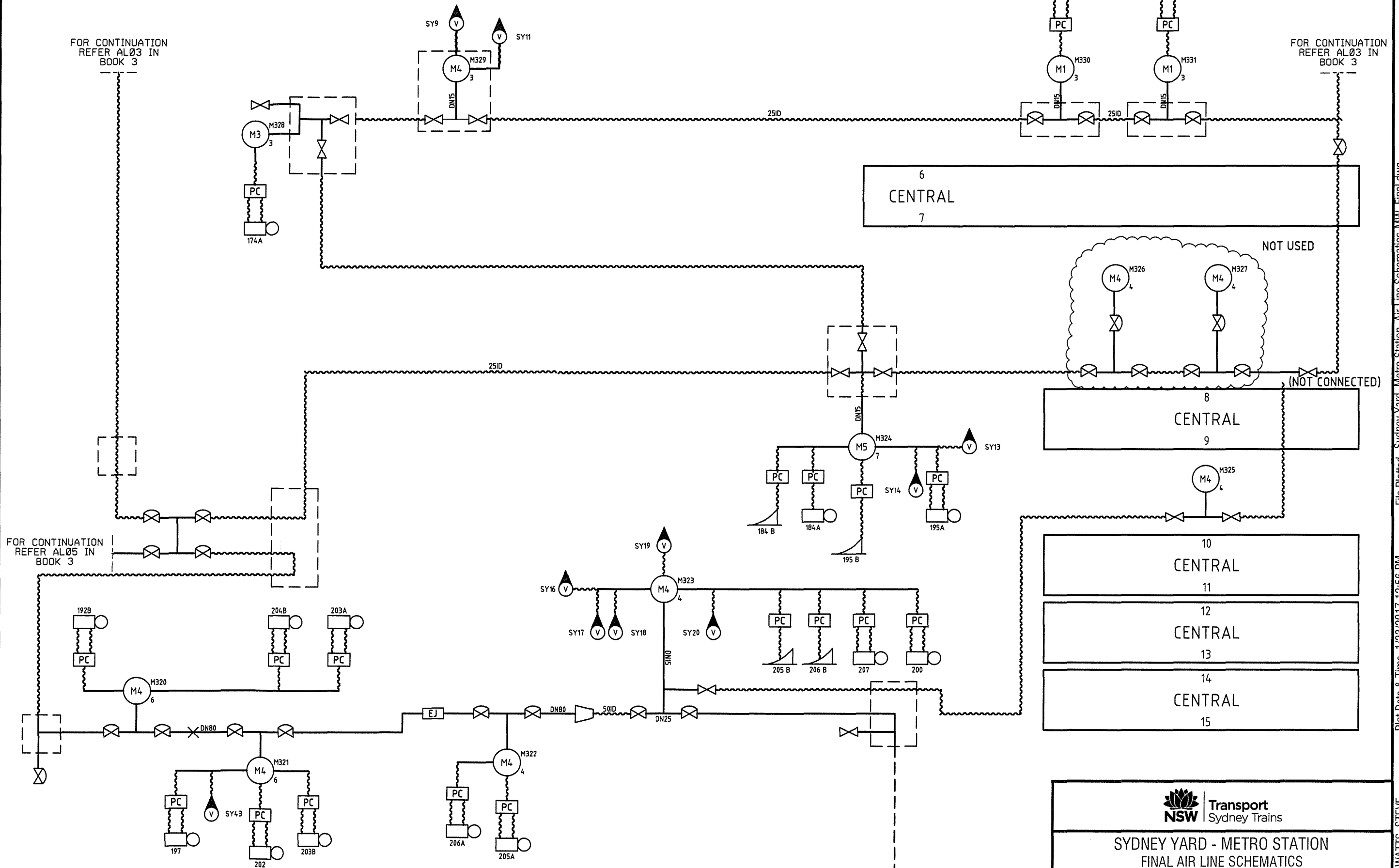
FOR CONTINUATION REFER TO SYDNEY YARD SIGNALLING PLAN
 Plot Date & Time 2/13/2017 3:18 PM
 File Plotted DD_SYDNEY YARD_METRO STATION_PROPOSED_FINAL.dwg
 Plotted by WATTS, STEVE

Appendix Y

Air Line Schematic – Final Arrangement


FOR CONTINUATION
REFER AL03 IN
BOOK 3

FOR CONTINUATION
REFER AL03 IN
BOOK 3



FOR CONTINUATION
REFER AL05 IN
BOOK 3

FOR CONTINUATION
REFER AL05 IN
BOOK 3



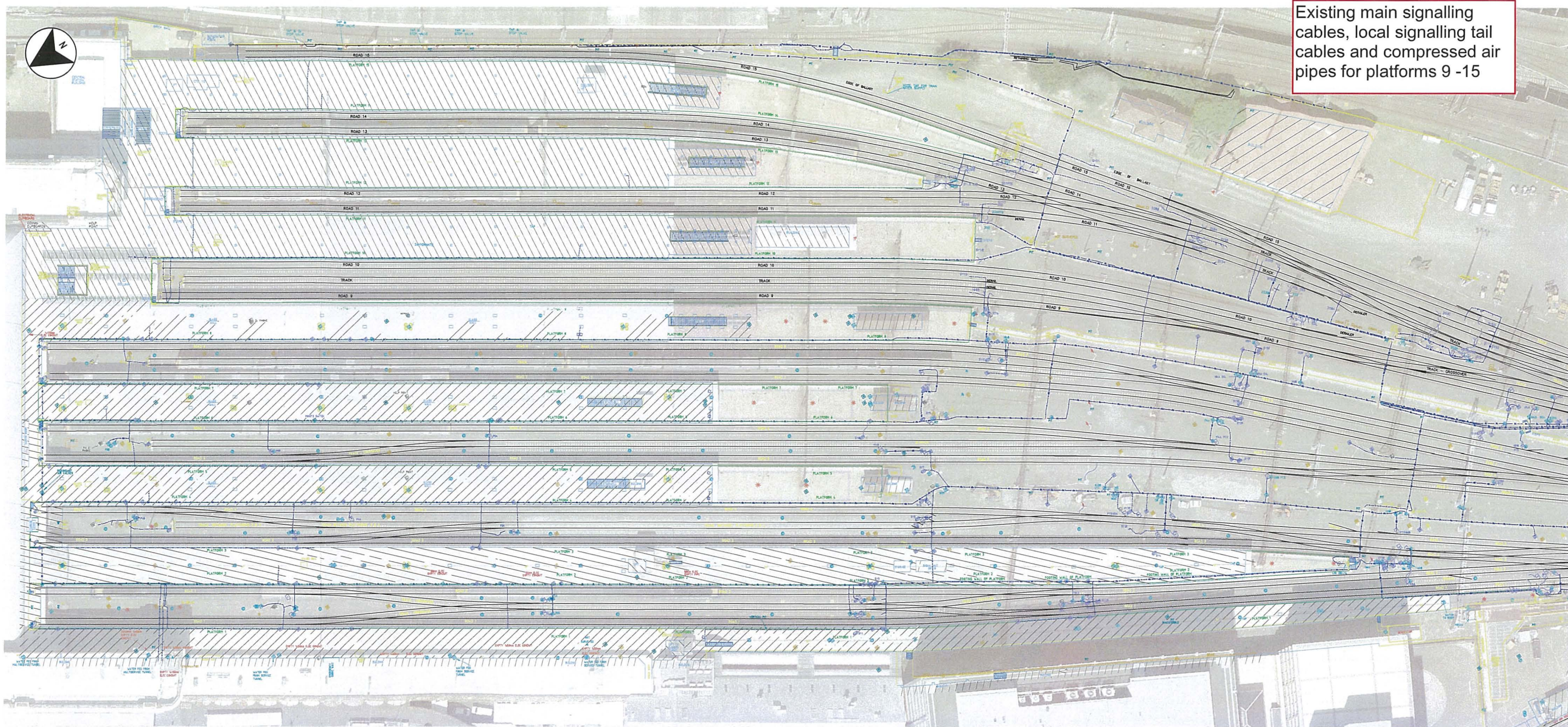
SYDNEY YARD - METRO STATION
 FINAL AIR LINE SCHEMATICS
 SHEET 1 OF 1
 PRODUCED BY SYDNEY METRO - SIGNALLING TEAM VER: 23012017

Plot Date & Time 1/23/2017 12:56 PM File Plotted Sydney Yard_Metro Station_Air Line Schematics-IW_Final.dwg Plotted by WATTS, STEVE

Appendix Z

DSS

100mm AT FULL SIZE Plot Date: 19/10/16 - 11:09 Cad File: X:\09_CADD\Drawings_Sketches\38_Central\NWRLSRT-PBA-SCS-ED-DWG-389450.dwg



Existing main signalling cables, local signalling tail cables and compressed air pipes for platforms 9 - 15

PLAN
N.T.S.

ADJOINS NWRLSRT-PBA-SCS-ED-DWG-389451

CHECK PRINT
SYDNEY METRO CITY & SOUTHWEST

CENTRAL STATION
 SYDNEY YARD
 EXISTING SIGNALLING SERVICES
 SHEET 1
 STATUS: SKETCH - FOR INFORMATION ONLY SHEET 1 OF 2
 NWRL Dwg No. NWRLSRT-PBA-SCS-ED-DWG-389450 NWRL REV. A

REVISION IN PROGRESS				
REV.	BY	DATE	DESCRIPTION	APPD.

SCALES

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BACKRAFTING REQUIRED
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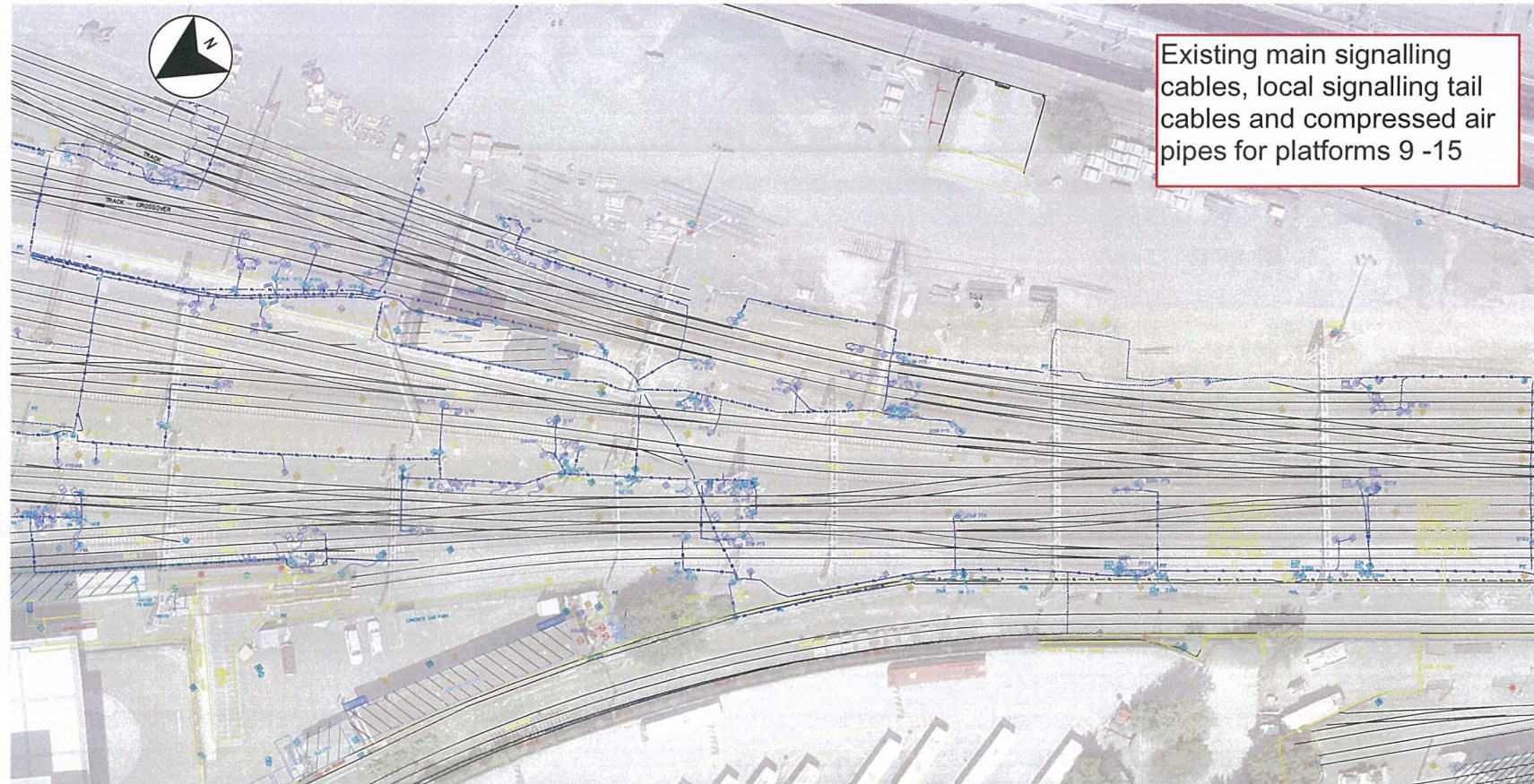
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100mm AT FULL SIZE Plot Date: 19/10/16 - 11:09

AD JOINS NWRLSRT-PBA-SCS-ED-DWG-389450



Existing main signalling cables, local signalling tail cables and compressed air pipes for platforms 9 -15

PLAN
N.T.S.

CHECK PRINT

<p style="font-size: 2em; opacity: 0.5; transform: rotate(-45deg);">REVISION IN PROGRESS</p>		<p>SCALES</p>		<p><input type="checkbox"/> BACKDRAFTING REQUIRED CHECK PRINT</p> <p><input type="checkbox"/> READY TO ISSUE</p>		<p>CLIENT</p>		<p><small>The information shown on this drawing is for the purposes of the North West Rail Link (NWRL) Project only. No warranty is given or implied as to its suitability for any other purpose. The Service Providers accept no liability arising from the use of this drawing and the information shown thereon for any purpose other than the North West Rail Link (NWRL) Project.</small></p>							
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Appendix AA

Operational Modelling

Rail Services Delivery Office Request For Information (RFI)

Attention: *Mark Keogh*

RSDO RFI No.

RSP-114

Status

1. RFI Raised

Project	Date Raised	Response Required By
Choose an item. Sydney Metro City & Southwest	19/09/2016	15/10/2016

Subject

Sydney Metro City & Southwest, Central Station – Central Station Platform Utilisation

RFI Type	From	Organisation
Clarification	Jane Richardson	Sydney Metro

Details

Please confirm if RSDO can manage its Timetables using the passenger platforms at Central Terminus as set out in the various options in Table 1 below. Options are listed in order of benefit provided to the Sydney metro program.

Sydney Metro are also seeking insight on the implications of managing timetables due to these changes, e.g. additional operational costs for alternative stabling location use and/or empty running of trains, relative to the base assumption that all 14 platforms are available throughout this period.

Sydney Metro requires an initial response (including Sydney Trains and NSW Trains considerations) by 15-Oct-2016 (4 weeks).

Note:

- Platform 15 utilisation is the subject of a separate CCG paper
- This RFI supersedes Sydney Metro RFI-003 sent 10-Aug-2016.

Table 1: Central Terminus Shutdown Options

Option	14 Platforms Available Platforms 1-14	12 Platforms Available	11 Platforms Available Platforms 1-11
1	Today – 29 June 2017	1 Apr 2018 – Jan 2024 Initially: Platforms 1-12 Once Platforms 13 & 14 returned, 2 platforms at a time will be taken out between 1 and 12	30 June 2017 – 31 Mar 2018
2	Today – 29 June 2017	30 June 2017 – 21 Jan 2018 Platforms 1-11 and 14 1 Sep 2018 – Jan 2024 Initially: Platforms 1-12. Once Platforms 13 & 14 returned, 2 platforms at a time will be taken out between 1 and 12	22 Jan 2018 – 31 Aug 2018
3	Today – 21 Jan 2018	1 Sep 2018 – Jan 2024 Initially: Platforms 1-12 Once Platforms 13 & 14 returned, 2 platforms at a time will be taken out between 1 and 12	22 Jan 2018 – 31 Aug 2018

Response

Response is provided in the attached brief.

Response By

Nikolai Prince

Response Date

31/10/2016

Attachments

Brief: Response to Sydney Metro RFI-006 (James Archer)

Response to Sydney Metro RFI-006

Topic: Sydney Terminal Platform Investigation for response to Sydney Metro RFI-006

Analysis: RSDO endorse that the 2017 standard working timetable would be able to be operated with platforms 1-11 available to timetable. There are further issues to be resolved regarding the closure of other platforms once platforms 13 and 14 are returned to operation. No assessment has been performed on the 2018 standard working timetable, expected to be implemented in October 2018. This timetable contains more services into Sydney Terminal and would require a separate assessment if a closedown of particular platforms was required post October 2018.

Key issues

Request for Information by Sydney Metro

Sydney Metro requested information (RFI-006) on whether the 2017 “more services, more trains” standard working timetable could accommodate only 11 platforms being available in Sydney Terminal. An investigation was undertaken to investigate the platform requirement at Sydney Terminal (Central(i)) to handle the intercity, NSW TrainLink and suburban services and associated operation requirements.

The production standard working timetable for 2017 was not available for the use as a base. As a result 0.5 version of the production 2017 timetable was modified to create platform working and rostering based on the current timetable rosters, acknowledging that existing timetables incorporate maintenance requirements, decant needs and set rotations.

A Wednesday timetable was used as the base, primarily to make sure the busiest periods were incorporated with NSW TrainLink services, and that the Indian Pacific and associated restrictions were included in the analysis.

It was assumed that the platforms that were available were platforms 1-11, and platforms 12-15 were withdrawn. If in practice, available platforms were different to these, an assessment would need to be made on suitability of the particular platform combination due to platforms having different approaches and departures as well as interactions and limitations.

No assessment has been performed on the 2018 standard working timetable, expected to be implemented in October 2018. This timetable contains more services into Sydney Terminal and would require a separate assessment if a closedown of particular platforms was required post October 2018.

Assessment was not performed on continuous closures of platforms 2 at a time once platforms 13 and 14 were returned to operation. However this would be a much larger piece of work to resolve issues around the Indian Pacific service if platforms 1, 2 or 3 were unavailable.

The work was performed in the RailSys Timetable Simulation software.

Results

The working was able to be achieved with the use of 10 platforms throughout the day. An 11th platform was able to be kept spare at all times in the day. Service Planning realise the

need of Train Operations to have some flexibility in a central location such as Sydney Terminal. As a result, the 11th platform should be considered a requirement of the timetable for contingency reasons. No conflicts existed in the region Redfern to Sydney Terminal in the planned working.

All necessary rosters and connections were able to be maintained. Sufficient clearance and margins were maintained throughout the day.

Platforms 1-3 are protected for the times that the Indian Pacific is in the terminal, with shunting clearances allocated in the timetable for 30 minute after arrival, and 30 minutes before departure.

Special Events Requirements

There was also some investigation of the plausibility of running extra trains out of Sydney Yard for special events. Most weekday events are in the post PM peak. As well as the 11th platform being available all day, platforms gradually become released throughout the PM peak, as intercity services return to their outer network locations. From 5pm (17:00) platform 3 becomes available for other uses, and from 5:30pm (17:30) platform 5 is also available. These platforms could be used for special event train services.

Feedback from Sydney Trains – Daily Working Timetable Review

Sydney Trains (Daily Working Timetable) are in agreement with the response and reaffirm the following based upon analysis done in current timetable (2013):

Current Timetable impact is as follows:

1. Major events like State of Origin will be impacted but can be managed subject to reduced turnaround times as well as less time between departure and arrival on the same platform.
2. 4x8 car sets will need an alternative day stabling location out of Sydney terminal.
3. Standby set at Sydney terminal will need to Standby elsewhere.
4. 3x8 car sets stabling overnight at Sydney will need to be stabled elsewhere (due to Hornsby junction Possession).
5. Relocation costs in terms of overnight stabling, crewing costs etc.
6. Additional empty movements (Crewing impact) between Sydney and Flemington CS.
7. Platform availability in degraded situations will be an issue.
8. Indian Pacific **will not** be able to operate to Sydney terminal if any one platform (1 to 3) is under possession.
9. Without full visibility of Track Possession / electric isolation / Safe working limits and Loss of Middle roads etc, assessment can't be made in relation to closures of 2 platforms at a time once platforms 13 and 14 are returned to operation.

Recommendation

As a result, RSDO endorse that the 2017 timetable would be able to be operated with platforms 1-11 available to timetable. There are however further issues to be resolved regarding the closure of other platforms once platforms 13 and 14 are returned to operation.

Supporting analysis

Consultation

Consultation has been carried out within RSDO including Simulation and Evaluation, Short Term Service Planning and Timetable Production. Feedback was also sought from Sydney Trains as to the impact on possessions and special event timetables.

Specific Platform Analysis

The planned platform occupations can be seen below in figures 1-6 in 4 hour blocks. The colouring of trains is based on the below classifications.

Red = Newcastle and Central Coast Services

Blue = South Coast Services

Orange = Blue Mountains Services

Pink = NSW TrainLink Services

Aqua = Other Services (e.g. Suburban and Private Passenger)

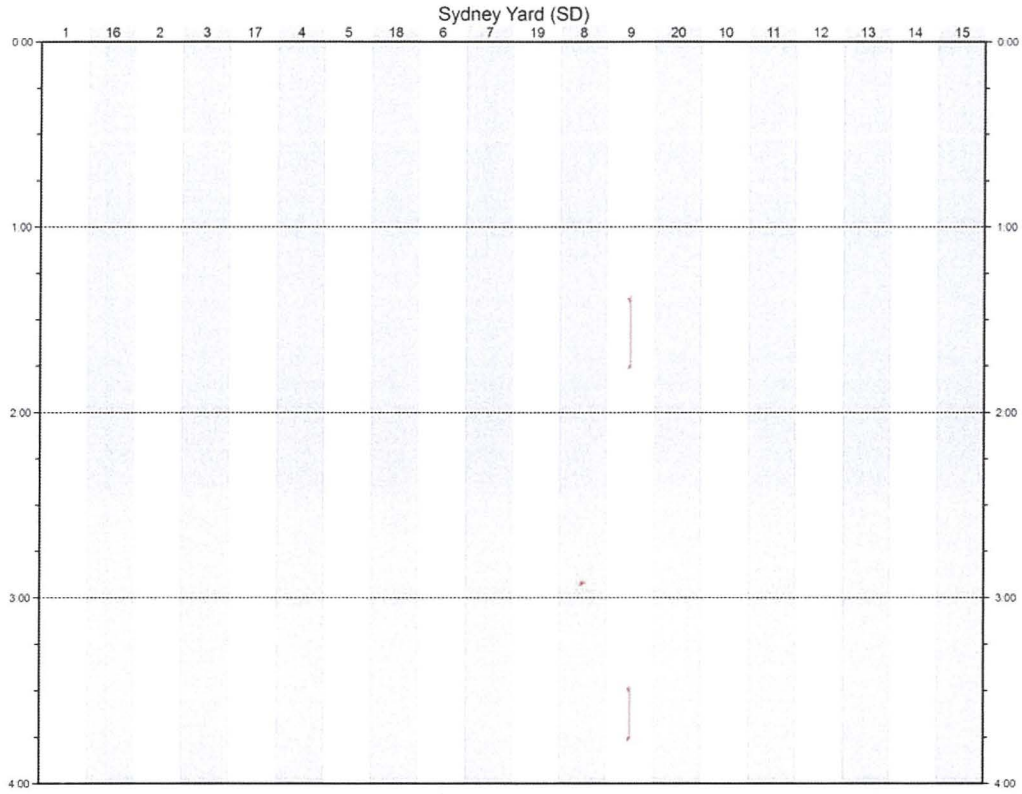


Figure 1: Sydney Terminal Platform Occ 0-4 hrs

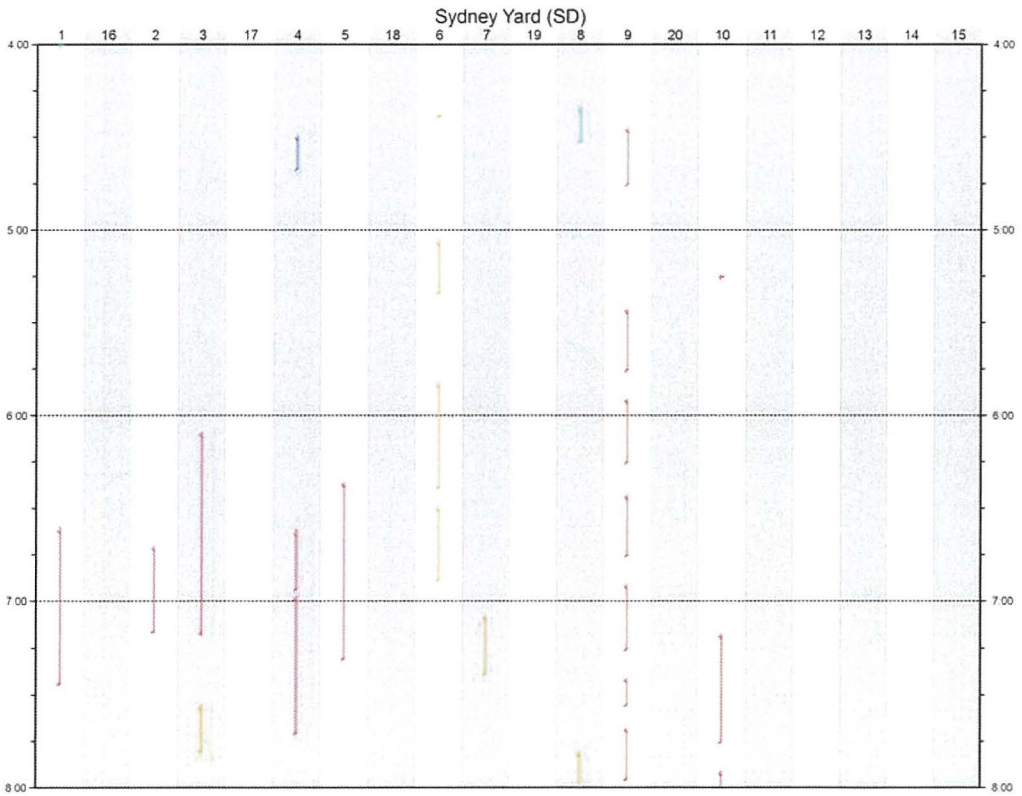


Figure 2: Sydney Terminal Platform Occ 4-8 hrs

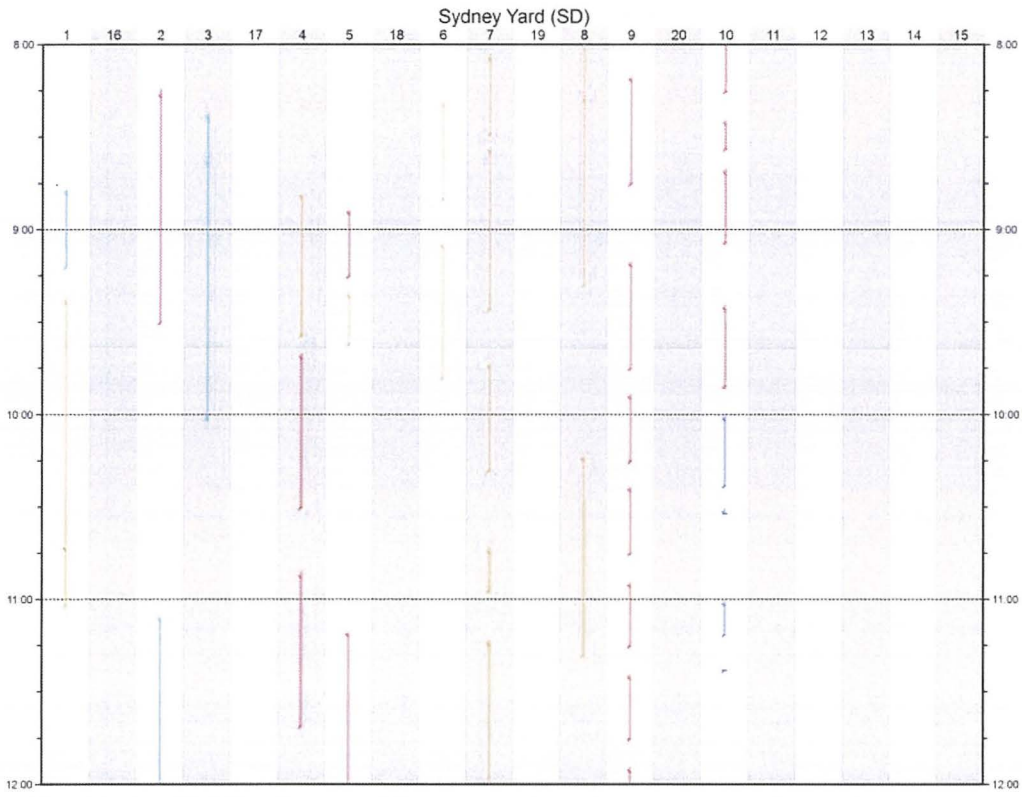


Figure 3: Sydney Terminal Platform Occ 8-12 hrs

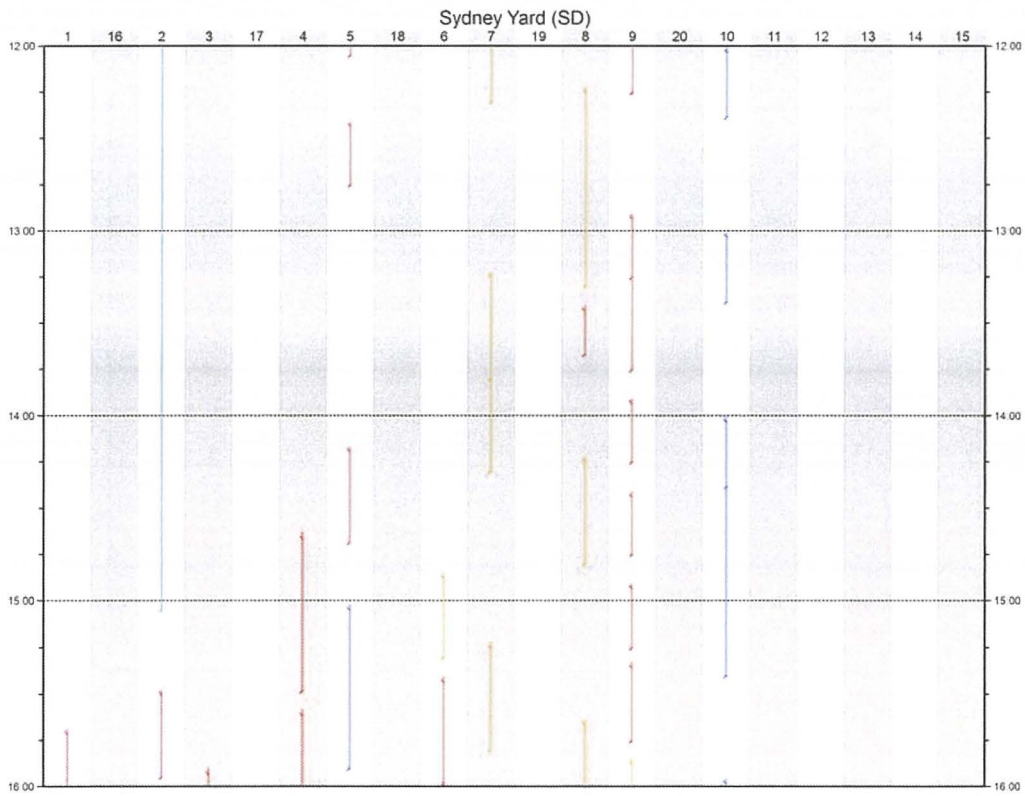


Figure 4: Sydney Terminal Platform Occ 12-16 hrs

Objective Reference:

Contact: James Archer, A/Mgr Sim and Eval,
0466955641

5 of 6

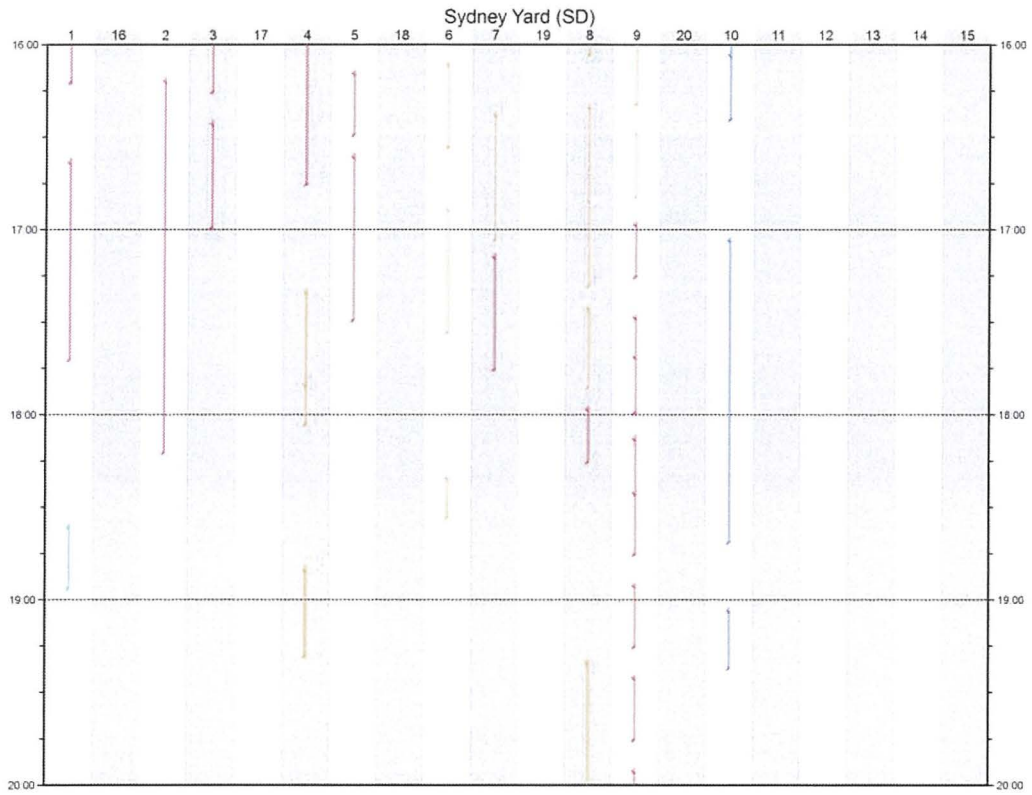


Figure 5: Sydney Terminal Platform Occ 16-20 hrs

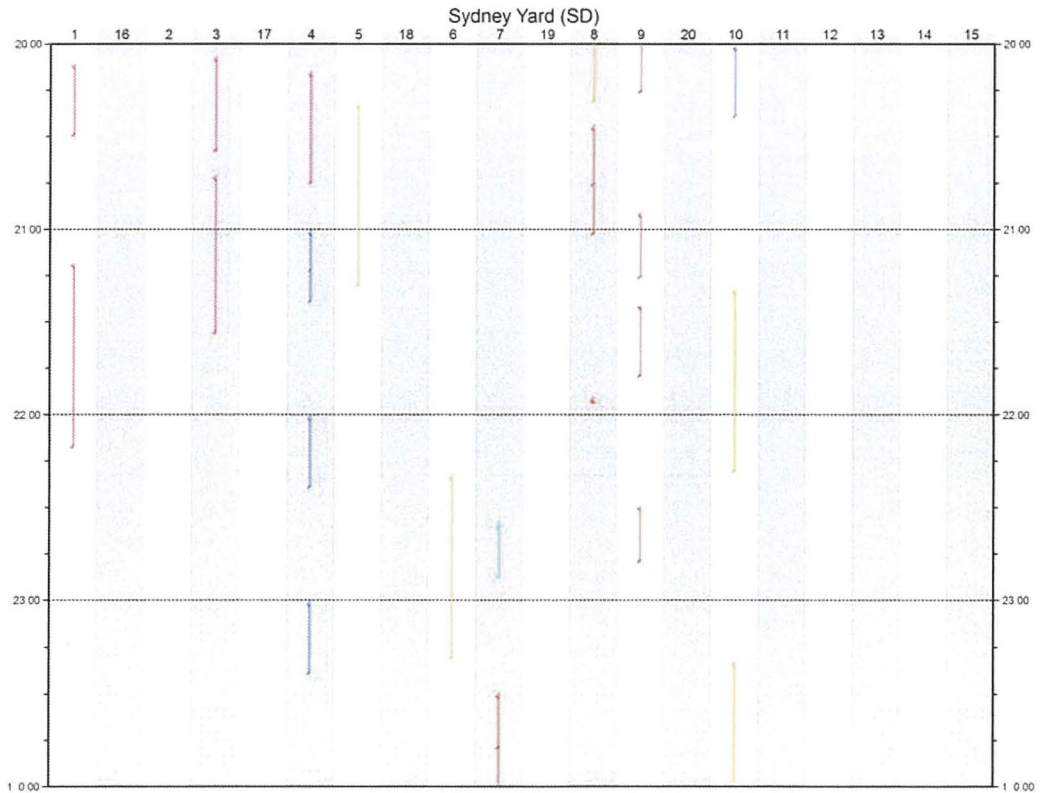


Figure 6: Sydney Terminal Platform Occ 20-24 hr

Sydney Metro City & Southwest

Central Station Main Works

Schedule C1

Scope of Works and Technical Criteria
(SWTC)

Appendix B03 – Architectural Requirements -
Spatial, Functional and Finishes

PROJECT	Sydney Metro City & Southwest	DATE	27 February 2018
GROUP	Sydney Metro City & Southwest	STATUS	Final
AUTHOR	Transport for NSW	REVISION	3.1
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00000292
FILE NAME	Central Station Main Works (CSM) SWTC App B03		

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1 Overview

- (a) The building works to Central Station and Metro Station include the permanent new infrastructure and modifications to existing infrastructure associated with the Project Works and Temporary Works. This Appendix B03 addresses the following in relation to that infrastructure:
 - (i) design objectives;
 - (ii) spatial and functional requirements for the Station Precinct and Public Domain;
 - (iii) finishes, fittings, fixtures and materials for Central Station and Metro Station buildings, Station Precinct and Public Domain;
 - (iv) fire life safety requirements for egress and compartmentation;
 - (v) urban design infrastructure;
 - (vi) landscape works; and
 - (vii) prototypes, samples and quality benchmarks.

2 Design Objectives

2.1 Architectural Design Objectives

- (a) The architectural design objectives for the Project Works are to provide:
- (i) **a world-class** multi-modal transport interchange that:
 - A. incorporates an architectural response that is distinctive to Central Station;
 - B. integrates Sydney Metro City & Southwest design characteristics;
 - C. integrates transport modes and services;
 - D. builds on nominated world-class precedents;
 - E. exemplifies design excellence; and
 - F. integrates and allows for Sydney Metro City & Southwest line-wide components.
 - (ii) an **enduring** and **sustainable legacy** where heritage is integral to the identity of the place that:
 - A. builds on the legacy of the original Central Station origins by integrating the next stage of Central Station and the NSW transport network's evolution with the introduction of Sydney Metro City & Southwest; and
 - B. achieves a sustainable outcome that respects Central Station's architectural, transport and social heritage and supports environmentally, economically and socially sustainable development.
 - (iii) **an Interchange that provides effortless** accessibility and connectivity by:
 - A. improving the accessibility and connectivity within and across the Station Precinct;
 - B. improving accessibility and connectivity between Sydney Metro City & Southwest train services and Sydney Trains train services;
 - C. improving accessibility and connectivity to connecting transport services within the Interchange precinct including buses and light rail;
 - D. providing equitable and universal accessibility;
 - E. providing sufficient capacity to meet demand well into the future; and
 - F. including self-navigation within spaces with integrated active signage where necessary.
 - (iv) **a premium** customer experience as part of an **iconic place that**:

- A. is unique and memorable;
 - B. creates a welcoming and intuitive customer experience with simple, uncluttered spaces, ensuring a comfortable, enjoyable and safe experience for a diverse range of customers;
 - C. provides an easy customer journey; and
 - D. includes high quality public art that is integrated with architecture and engineering.
- (v) a revitalised place with an enhanced **civic role** as a key part of the city by:
- A. reinforcing and supporting Central Station as a gateway to the city and NSW transport network;
 - B. reinforcing and supporting Central Station as the key access and interchange station for Sydney Metro City & Southwest;
 - C. creating spaces that contribute to city life;
 - D. designing the Interchange to be a social and cultural asset;
 - E. delivering a curated retail experience, and
 - F. delivering seamless integration throughout the Interchange and the Station Precinct.

2.2 Architectural Design Requirements

- (a) The CSM Contractor must, as a minimum, demonstrate through the Customer Centred Design process, (through Design Stage 1, Design Stage 2 and Design Stage 3) a design response that meets the architectural design objectives and following the design requirements as described in the Sydney Metro City & Southwest Design Guidelines.
- (b) The CSM Contractor must respond to the local context with an architectural design that:
- (i) identifies with, protect and enhance the heritage, environment and urban environment of Central Station;
 - (ii) respects and reinforces local character and its community;
 - (iii) is planned and developed to integrate into the existing urban environment through sensitive integration of new buildings within both existing and future context with consideration of scale, height, character, massing and material;
 - (iv) ensures that important existing views are not obscured, whilst recognising and enhancing important vistas and visual connections;
 - (v) responds to and interprets the existing exceptional heritage value the Central Station buildings;
 - (vi) responds to the local climatic conditions;

- (vii) reflects the broader aspirations of Sydney Metro City & Southwest in its role as a stimulus for efficient intermodal public transport, community benefits, and as a key element of place making;
 - (viii) reflects a consistent line-wide identity for Sydney Metro City & Southwest while responding sensitively to the local context around Central Station;
 - (ix) is a simple and unified solution to provide a strong identity;
 - (x) uses a consistent and coherent architectural language demonstrating how the new elements of the design respond to the Central Station;
 - (xi) is an inspiring and uplifting civic presence that provides a positive and lasting legacy for future generations;
 - (xii) maximises opportunities for improved and efficient connectivity to adjoining uses and areas; and
 - (xiii) acknowledges and integrates representation of Aboriginal heritage and culture by:
 - A. establishing relationships, and seeking counsel with Aboriginal Elders and senior community representatives in the local area; and
 - B. incorporating and celebrating Aboriginal heritage and culture within the final design of the Project Works.
- (c) The CSM Contractor must deliver an easy door to door customer experience which:
- (i) is equitable and universally accessible;
 - (ii) is designed in direct response to the outcomes of the Customer Centred Design (CCD) process with consideration of customer types, journey types and user requirements;
 - (iii) applies Sydney Metro City & Southwest Customer Service Principles;
 - (iv) responds to the Customer Satisfaction Drivers
 - (v) delivers a consistent high quality integrated customer experience, in terms of products and systems;
 - (vi) maximises personal safety and security through the provision of appropriate active and passive surveillance in accordance with crime prevention through environmental design (CPTED) principles;
 - (vii) creates safe, inviting and attractive places for different trip purposes and people of all ages and abilities to visit;
 - (viii) maximises comfortable environments that provide shade, shelter, resting points, minimise wind and glare disturbance, and minimise nuisance through noise;
 - (ix) delivers a well-considered integration and complementary relationship between the Sydney Metro City & Southwest brand, public art, signage and

- wayfinding, and station identity to provide a well-integrated customer experience;
- (x) provides an effortless, intuitive and easy customer journey and pedestrian connectivity;
 - (xi) promotes activation through the identification of retail opportunities, public art, advertising and the like.
 - (xii) promotes and provides provisions for active uses (e.g. services for permanent and temporary retail, services for community activities both permanent and temporary) that enhance the customer experience; and
 - (xiii) provides seamless and intuitive customer experience with simple access that is consistent with Sydney Metro Wayfinding Guideline for Metro Station and a complementary approach to the affected areas of Central Station.
- (d) The CSM Contractor must respond to the Interchange requirements by:
- (i) directly responding to the Central Station Interchange Access Plan (IAP) which identifies design principles and requirements for transport integration elements;
 - (ii) incorporating safe, well defined, clear, direct, accessible and adequately sized pedestrian access and circulation routes;
 - (iii) supporting easy station access and transfer between transport modes and services;
 - (iv) providing direct pedestrian connectivity and interchange with other transport modes, with street level entrances and exits that minimise level and direction change for pedestrians;
 - (v) adopting integrated transport solutions that include application of a hierarchy of movement access modes that places relative importance to each transport mode as follows:
 - A. Priority 1: pedestrian movement and access (including transfer between Sydney Trains train services and Sydney Metro City & Southwest train services);
 - B. Priority 2: bicycle movement and access;
 - C. Priority 3: bus movement and access;
 - D. Priority 4: taxi movement and access;
 - E. Priority 5: Kiss-and-Ride movement and access; and
 - F. Priority 6: park and ride movement and access.
- (e) The CSM Contractor must provide a high-quality solution that:
- (i) applies design excellence in the whole and in each component part;
 - (ii) creates spaces that are cohesive, welcoming, safe and attractive;
 - (iii) is simple, elegant and aesthetically pleasant;

- (iv) utilises high quality and consistent materials, finishes and detailing;
 - (v) is architecturally innovative and creative;
 - (vi) provides high quality spaces that balance performance and function, while remaining adaptable and able to meet any changing functional needs; and
 - (vii) is designed integrally, fusing architecture with engineering as one cohesive and compelling product.
- (f) The CSM Contractor must provide coordinated materials and finishes that:
- (i) are high quality, attractive, robust, durable and long-life materials that are graffiti resistant and easy to clean and maintain;
 - (ii) expresses the architectural concept and promotes the civic character for Metro Station, Central Station, Station Precinct and the Public Domain;
 - (iii) do not impede legibility, decision making or wayfinding, and where appropriate enrich Central Station, accentuating movement around the circulation and Vertical Transport areas;
 - (iv) comply with the requirements of the CSM Contractor's FLS strategy; and
 - (v) maximises economies of scale and ensures safe installation, maintenance and replacement.
- (g) The CSM Contractor must coordinate components:
- (i) to offer a consistent customer experience, reinforce Sydney Metro City & Southwest line-wide identity and maximise economies of scale; and
 - (ii) to be integrated as part of a system.
- (h) The CSM Contractor must coordinate and integrate lighting with the architectural design.
- (i) The CSM Contractor must coordinate customer-facing elements into the architecture or building elements so as to enhance and not conflict with the overall customer environment; and must:
- (i) contain coordinated detailing, and palette of materials and finishes;
 - (ii) assist in the legibility, wayfinding, and orientation of customers; and
 - (iii) respond to the principles of the Sydney Metro Wayfinding Guideline.
- (j) The CSM Contractor must provide facilities that are easily maintained and provide ease of access for maintenance, repair and replacement of materials, fittings, fixtures and equipment.
- (k) The CSM Contractor must integrate Human Factors into the Project Works and encompass all aspects of the safety management system to be adopted during operations and maintenance, and related issues.
- (l) The CSM Contractor must integrate fire and life safety including the requirements for emergency egress, Emergency Services access, fire and smoke separation and compartmentation, and the Fire Hazard Properties of materials, furniture and fixings to comply with the CSM Contractor's FLS strategy and the Contract

- (m) The CSM Contractor must meet the security requirements set out in the SWTC and this Appendix B03.

2.3 CSM Design Quality

- (a) The CSM Contractor must deliver a design outcome that:
 - (i) provides an architectural response that demonstrates the importance of Central Station and the integration of the Sydney Metro City & Southwest system;
 - (ii) presents a contemporary design solution that recognises the unique interface Metro Station elements have with the existing Central Station facilities;
 - (iii) utilises high quality finishes and materials that provides a unique theme to Central Station;
 - (iv) demonstrates meticulous attention to detailing that delivers a fully coordinated design outcome with seamless transitions between materials and spaces;
 - (v) integrates Sydney Metro City & Southwest line-wide elements such as Platform Screen Doors and customer information elements that provide a sense of uniformity and consistency with other Sydney Metro City & Southwest stations; and
 - (vi) demonstrates a high standard of design across the Central Station and Metro Station and public spaces that sets a benchmark for other stations in the future, ensuring the longevity of the Sydney Metro City & Southwest system.

2.4 Design Excellence

- (a) The CSM Contractor must clearly demonstrate how design excellence has been achieved. As a minimum this must include:
 - (i) regular presentations and workshops with the Design Review Panel, the Operators, the Heritage Working Group, the Principal's Representative and other key stakeholders including those concerned with signage and wayfinding, product, customer service and public art;
 - (ii) a detailed design process including fortnightly design coordination meetings with the Principal's Representative;
 - (iii) meeting Customer Centred Design requirements;
 - (iv) preparation of regular submissions, reports and option analysis for recommendation and comment;
 - (v) undertaking extensive prototyping and mock up production and testing;
 - (vi) preparation of physical models, visualisations, perspective views and the like;
 - (vii) providing evidence that the following have been addressed and incorporated into the design:

- A. the design objectives identified in section 2;
 - B. the recommendations and comments of the Design Review Panel;
 - C. the recommendations and comments of the Heritage Working Group;
 - D. the recommendations and comments from the Operators;
 - E. the recommendations and comments from the Principal's Representative; and
 - F. the comments and recommendations from key stakeholders.
- (b) The demonstration of how design excellence has been achieved must be included in the Design Documentation for each of Design Stages 1, Design Stage 2 and Design Stage 3.

2.5 Delivery Excellence

- (a) This Appendix B03 defines the minimum workmanship and quality requirements for materials and trades to be used by the CSM Contractor.
- (b) The CSM Contractor must ensure all work is undertaken by fully qualified, skilled and experienced personnel.
- (c) CSM Contractor must comply with all relevant Codes and Standards and compliance must be demonstrated in each case where mandatory requirements apply.
- (d) The CSM Contractor must ensure all work is designed and constructed to:
 - (i) remain intact, weatherproof and waterproof (exterior systems only) under the ambient in-service and climatic conditions;
 - (ii) withstand the anticipated loads without damage or impairment of performance;
 - (iii) provide adequate means of dealing with thermal and differential movement;
 - (iv) resist ambient climatic conditions; and
 - (v) satisfy thermal, acoustic, and other specified performance criteria.
- (e) The CSM Contractor must design and construct to meet the air temperature range (shade) as per 100 year return period of Bureau of Meteorology records for maximum and minimum temperature at the Site taking into account projected change in climate.
- (f) The CSM Contractor must install and assemble all materials in accordance with manufacturer's published instructions.

3 Station and Buildings Spatial and Functional Requirements

3.1 General

- (a) The CSM Contractor must design and construct all new spaces and adjustments to existing spaces included in the Project Works (including platforms, concourses, entrances, tunnels and walkways) to, as a minimum:
- i) meet all functional requirements in this Appendix B03 for Normal Operation, Degraded Operation, Abnormal Operation and Emergency Operation, unless otherwise specified;
 - ii) comply with the height and width requirements in section 3.2 of this Appendix B03;
 - iii) satisfy the customer spatial planning requirements in section 3.3 of this Appendix B03;
 - iv) comply with the accessibility requirements in section 3.4 of this Appendix B03;
 - v) cater for the capacity requirements in section 3.5 of this Appendix B03
 - vi) provide the spatial capacity and deliver the LOS specified in section 3.6 of this Appendix B03;
 - vii) comply with the run-off and queue zone distance requirements in section 3.7 of this Appendix B03;
 - viii) include the rooms, spaces and facilities, i.e. toilets, bicycle parking, drinking fountains, mobile device charging facilities, specified in section 3.8 of this Appendix B03;
 - ix) include operational and customer service facilities for Central Station specified in section 3.9 of this Appendix B03;
 - x) include operational and customer service facilities for the Metro Station specified in section 3.10 of this Appendix B03;
 - xi) in relation to entrances, comply with the requirements in section 3.11 of this Appendix B03;
 - xii) in relation to concourses, comply with the requirements in section 3.12 of this Appendix B03;
 - xiii) in relation to existing tunnels, comply with the requirements in section 3.13 of this Appendix B03;
 - xiv) include the VT specified in sections 3.14 and 3.15 of this Appendix B03;
 - xv) in relation to platforms, comply with the requirements in sections 3.16 and 3.17 of this Appendix B03;

- xvi) include the public seating specified in section 3.18 of this Appendix B03
- xvii) comply with the Help Points requirements in section 3.19 of this Appendix B03;
- xviii) comply with the infotainment requirements in section 3.20 of this Appendix B03;
- xix) comply with the light line requirements in section 3.21 of this Appendix B03
- xx) comply with the fire compartmentation requirements in section 3.22 of this Appendix B03
- xxi) comply with the bollard requirements in section 3.23 of this Appendix B03
- xxii) comply with the cleaning requirements in section 3.24 of this Appendix B03
- xxiii) comply with the acoustic criteria requirements in section 3.25 of this Appendix B03; and
- xxiv) comply with the pest, bird and vermin protection requirements in section 3.26 of this Appendix B03.

(b) The CSM Contractor must, as part of the design process, undertake pedestrian modelling in accordance with Appendix B16 to determine dimensions and arrangement of facilities and demonstrate required LoS levels are achieved.

3.2 Heights and Widths

3.2.1 Minimum Clear Height (MCH)

(a) The public areas must provide the MCH indicated in Table 1.

Table 1 - Minimum Clear Height

Central Station Element	Minimum Clear Height (MCH) from FFL
Station awning	3.5m
Eastern Entrance at Randle Lane	4.0m
Eastern Entrance at Chalmers Street	6.5m
Eastern Entrance at mezzanine level	3.8m
Eastern Entrance at East Concourse level	6.0m
North South Concourse	4.0m (lowest point)
East Concourse	4.0m
ESR Concourse between northern end and the ESR stairs.	3.8m
ESR Concourse between ESR stairs and the southern end Gateline	3.5m
North Concourse	3.0m

Central Station Element	Minimum Clear Height (MCH) from FFL
South Concourse	3.0m
Surface platform canopies lowest point	3.3m (lowest point)
North Concourse canopy	4.0m (lowest point)
Public stairs and escalators	4.0m generally (2.4m acceptable at pinch points)
BOH circulation space / corridors	2.4m
Fire stairs and passageways	2.4m
Underside of signage / PIDS	2.5m
Southern Suburban Baggage Tunnel	To match existing
Southern Suburban Interchange Tunnel	Existing where retained
Devonshire Street Tunnel	To match existing
Olympic Tunnel (Western and Eastern)	To match existing
Metro Station platform	4m to any intruding structure or cladding;

- (b) Spaces under stairs and escalators with an MCH of 2.1m or less must be enclosed.

3.2.2 Maximum structure height (MSH)

- (a) The public areas must provide the maximum structure heights indicated in Table 2.

Table 2 - Maximum structure height

Element	Maximum Structure Height (MSH)
Platform canopies: highest point	Similar to existing Intercity Platform canopies
Intercity Concourse canopy: highest point	To oversail the Central Electric Station Building.

3.2.3 Minimum Clear Width (MCW)

- (a) The Project Works must provide the minimum clear widths in accordance with Table 3 below:

Table 3 – Minimum Clear Width

Central Station Element	Minimum Clear Width (MCW)
North South Concourse	20.4m

Central Station Element	Minimum Clear Width (MCW)
East Concourse	19m
All existing concourses, entrances and tunnels	To match existing
Metro Station platform	1. 12m between inner face of PSDs on either side of island platform 2. 3.1m clear of obstructions at any publicly accessible location on island platform

- (b) Columns are permitted in the North South Concourse to accommodate structural loadings from above, provided they:
 - (i) do not impede clear movement pathways and are aligned with other fixed elements; and
 - (ii) comprise a maximum of 2 rows from east to west side.

3.3 Customer Spatial Planning

- (a) Spatial planning for Normal Operations must:
 - (i) minimise congestion;
 - (ii) minimise pedestrian cross flows;
 - (iii) be resilient to train service disruption;
 - (iv) achieve the LoS described in Appendix B16, including:
 - A. provide sufficient space to enable efficient customer movement and operations function;
 - B. allow sufficient additional space for customer decision making; and
 - C. provide adequate space in areas expected to become congested or where multiple circulation routes interact.
- (b) The spatial planning must provide sufficient space for customers on platforms and concourse to wait in weather protected areas for Normal Operations.
- (c) The spatial planning must ensure that obvious routes and minimal travel distances are achieved:
 - (i) which are free from obstructions;
 - (ii) have good sightlines;
 - (iii) avoid dead ends and hiding places; and

- (iv) establish splayed or deeply chamfered corners at all major changes in direction to ease flow. Chamfers must be a minimum of 15 degrees from the perpendicular on plan with a long side of not less than 4.8m length.
- (d) The design of the Project Works must consider the microclimate and prevailing winds, minimising the likelihood of wind tunnel effects.
- (e) The Metro Station and Central Station must be accessible including the platform-train interface, platform, concourse, public facilities and Interchange.
- (f) The CSM Contractor must maximise unobstructed views to the Central Station clock tower.
- (g) Customer transfer connections within the Project Works must be easy, intuitive, efficient and direct.
- (h) Resting seats must be provided along pathways within Central Station in accordance with the Central Station Interchange Access Plan.
- (i) Station furniture must align with relevant guidelines for comfort in transit environments, CPTED principles, and incorporate graffiti prevention treatments.
- (j) Escalator landings on concourses and platform levels must be fitted with:
 - (i) adjustable barriers which retract fully to the inside of the escalators and allow each individual escalator to be closed when not in use;
 - (ii) barriers must be designed as part of the station furniture and must be continuous and not be discrete free-standing elements; and
 - (iii) where possible, barriers must be recessed and concealed in adjacent wall cladding.

3.4 Accessibility

3.4.1 General

- (a) The CSM Contractor must develop an accessibility strategy that provides a level of accessibility within the Project Works, both during construction and for the operational lifetime of the facility, that as a minimum:
 - (i) meets the requirements of the Australian Disability Discrimination Act 1992 and the associated Disability Standards for Accessible Public Transport 2002;
 - (ii) meets the accessibility related requirements of the NSW Environmental Planning & Assessment Act 1979 and the associated Building Code of Australia (BCA), where the BCA is applicable;
 - (iii) meets the accessibility related requirements of the NSW Work Health and Safety Act 2011;
 - (iv) demonstrates that the safety risk associated with accessibility, including the risk of slips, trips and falls, has been reduced So Far As Is Reasonably Practicable (SFAIRP) as required by the NSW Rail Safety (Adoption of National Law) Act 2012; and

- (v) is consistent with and supports the Transport for NSW Disability Action Plan 2012 – 2017.
- (b) The CSM Contractor must engage an access consultant who must:
 - (i) be accredited with the Association of Consultants in Access Australia (ACAA);
 - (ii) have a minimum of five years' experience as an access consultant in a rail environment;
 - (iii) have undertaken an accessibility role on at least two projects of a similar nature including underground stations;
- (c) The access consultant must:
 - (i) lead the accessibility elements of the design;
 - (ii) plan, prepare, and update a design access report (DAR);
 - (iii) communicate all necessary information regarding required accessibility measures to other design disciplines so that accessibility is correctly incorporated into the detailed design;
 - (iv) coordinate and lead all stakeholder consultation as it relates to accessibility;
 - (v) witness the construction, installation, testing and commissioning process of the accessibility components of the Project Works;
 - (vi) certify the compliance of accessibility measures with legislative requirements.
- (d) The CSM Contractor must review the accessibility strategy for Sydney Metro Northwest and must then ensure that the accessibility strategy prepared by the CSM Contractor for the Metro Station elements of the Project Works is consistent and compatible with the Sydney Metro Northwest accessibility strategy, unless agreed in writing by both the Principal's Representative and the Operator.
- (e) The accessibility strategy for the Project Works must address the Metro Station Works, Central Station Works, and Central Walk Works.
- (f) The accessibility strategy must be compatible with the CSM Contractor's FLS strategy.
- (g) During construction, the CSM Contractor must determine and implement interim accessibility strategies, prior to each phase of construction, that maintain an acceptable level of accessibility in all parts of Central Station that remain operational.
- (h) The CSM Contractor must consult, as a minimum, the following stakeholders in developing the accessibility strategy:
 - (i) TfNSW;
 - (ii) Sydney Trains,
 - (iii) the Operator

- (iv) the Crown Certifier;
- (v) ATAC (Accessible Transport Advisory Committee);
- (vi) Vision Australia; and
- (vii) Guide Dogs NSW/ACT.

3.4.2 Construction

- (a) During construction the CSM Contractor must as a minimum:
 - (i) undertake site inspections and witness commissioning and testing as required to ensure that all accessibility related building works are constructed, installed and are operational in accordance with legislative requirements and the Design Stage 3 DAR requirements; and
 - (ii) provide Sydney Trains with all necessary information, for Sydney Trains to update their site wide access plans and accessibility related operational procedures to incorporate the Project Works and all interim stages during construction.
- (b) The CSM Contractor must provide certification by the access consultant, at the completion of each phase of construction, that the installed and commissioned accessibility measures meet the requirements of the accessibility strategy as documented in the interim DAR.
- (c) The CSM Contractor must provide certification by the access consultant at Construction Completion, that the installed and commissioned accessibility measures are compliant with the legislative requirements.
- (d) Certification of the installed and commissioned Project Works by the access consultant cannot be conditional on the satisfactory completion of any outstanding works, unless agreed in writing with the Principal.
- (e) Certification of the installed and commissioned accessibility measures by the access consultant, must include sufficient detail and evidence that a thorough inspection has been conducted including:
 - (i) dates of inspections and names of those conducting the inspections;
 - (ii) a breakdown of the elements of the accessibility strategy inspected. These may have been verified by various means including:
 - A. visual inspection;
 - B. witnessing commissioning of active systems;
 - C. review of test reports, letters of opinion, and installation certificates prepared by others; and
 - D. active testing of systems including interlocks between systems.

3.4.3 Building Regulation Compliance

- (a) The CSM Contractor must demonstrate compliance of the design and construction of the Project Works with:
 - (i) all relevant conditions and requirements from the Planning Approval; and

- (ii) the state Environmental Planning & Assessment Act 1979 (EP&A Act) and the associated Building Code of Australia (BCA), where the BCA is applicable.
- (b) The CSM Contractor must engage a BCA consultant who must:
 - (i) be an A1 certifier currently accredited with the NSW Building Professionals Board, and without any conditions on their accreditation that will prevent them from fulfilling all requirements of this SWTC;
 - (ii) have a minimum of ten years' experience as a BCA consultant in a rail environment;
 - (iii) have undertaken a Crown certification role on at least three Crown projects in NSW in the last five years; and
 - (iv) have undertaken a BCA consultant role on at least two rail projects where the Rail Safety National Law applied, as administered by the Office of the National Rail Safety Regulator (ONRSR).
- (c) The BCA consultant must:
 - (i) provide advice and interpretations to the project team on building related planning approval conditions and building regulation requirements necessary to ensure certification;
 - (ii) identify non-complying items against building related planning approval conditions and building regulation requirements, in the design drawings and all other documents produced in relation to the Project Works, and providing advice on means to achieve compliance;
 - (iii) review and confirm compliance of the sustainability design with section J of the BCA where applicable;
 - (iv) undertake regulatory review and assessment of the CSM Contractor's FLS strategy in the capacity of Crown Certifier;
 - (v) identify non-complying items against the CSM Contractor's FLS strategy, in the Design Documents;
 - (vi) prepare, and update a BCA compliance report;
 - (vii) conduct necessary inspections of the construction, installation, testing and commissioning of the Project Works necessary to achieve certification;
 - (viii) provide certification in accordance the requirements of Section 109R of the EP&A Act including:
 - A. Design Verification Certification
 - B. BCA Occupation Verification Certification
- (d) The BCA consults scope must include the Metro Station Works, Central Station Works, and Central Walk Works:
- (e) During construction, the CSM Contractor must demonstrate compliance with Planning Approval and the EP&A Act, prior to each phase of construction, addressing all parts of Central Station that remain operational.

3.4.4 Testing and Commissioning

- (a) The CSM Contractor must undertake site inspections and witness commissioning and testing as required to ensure that building works are constructed, installed and are operational in accordance with building regulation requirements, the CSM Contractor’s FLS strategy.
- (b) The CSM Contractor must provide an updated fire safety schedule defining all statutory fire safety measures in accordance with the EP&A Regulation, for the whole of Central Station, to be provided to Sydney Trains.
- (c) The CSM Contractor must compile a complete portfolio of design, supply and installation certificates, stakeholder approvals and letters of opinion, as necessary to enable:
 - (i) Crown certification.
 - (ii) certification of statutory fire safety measures in accordance with the approved fire safety schedule
- (d) The BCA consultant, in the capacity as Crown Certifier must review any formal review comments received from the Fire Commissioner under S152 of the EP&A Regulation and coordinate any response required.
- (e) The CSM Contractor must provide certification by the BCA consultant in their capacity as Crown Certifier, in accordance with the requirements of Section 109R of the EP&A Act, including:
 - (i) Interim BCA Occupation Verification Certificate at the commencement of each phase of construction; and
 - (ii) Final BCA Occupation Verification Certificate at the completion of the Project Works and prior to full occupancy.

3.5 Capacity Requirements

- (a) Capacity requirements are set out in Appendix B16.

3.6 Level of Service and Space Capacity

LOS and space capacity requirements are set out in Appendix B16.

3.7 Run-off and Queue Zone Requirements

- (a) The Metro Station and Central Station design must incorporate the minimum run-off requirements as set in Table 4 below, noting that run-off and queue zones must not overlap:

Table 4 - Minimum run-off requirements

Run-offs and Queuing		Minimum Distance
(a)	Stair to Gateline	6m
(b)	Stair to passageway	4m

Run-offs and Queuing		Minimum Distance
(c)	Stair at street (to boundary or footpath)	4m
(d)	Gateline to Public Domain cross flow or circulation	6m
(e)	Opal Machines (including CLD (cash) and CLD (EFT)) and equipment queuing zones	4m
(f)	Vending machines and ATMs	2m
(g)	Customer information (including poster cases and information points)	2m
(h)	Lift queue waiting zone	1.5m times the lift car depth
Escalator Run-offs (measured from the comb)		
(i)	1-2 escalators to Gateline	8m
(j)	Bank of more than 2 escalators to Gateline	12m
(k)	Escalator to passageway	6m
(l)	1-2 escalator to escalator	8m
(m)	Bank of more than 2 escalators	12m
(n)	Escalator at street (to boundary or footpath)	6m
Escalator switchbacks run-offs		
(o)	1 escalator	6m
(p)	2 escalators	7.3m
(q)	3 escalators	8.7m
(r)	4 escalators	10m

3.8 Facilities

3.8.1 Customer Toilets

- (a) The CSM Contractor must provide one set of toilet facilities located:
 - (i) in the paid area of the ESR Concourse in the vicinity of the Eastern Entrance Gateline; and
 - (ii) in the paid area of the North South Concourse.
- (b) At each location, the following facilities are required, as a minimum:
 - (i) two unisex accessible toilets;
 - (ii) one male ambulant toilet;
 - (iii) one female ambulant toilet;

- (iv) one male toilet;
 - (v) one female toilet; and
 - (vi) one parent room containing a toilet, baby change facilities and clean facilities for breastfeeding / private space.
- (c) Toilets must be located where they are easy to find and where passive surveillance opportunities exist, with sightlines to the doors from public spaces
- (d) Toilet doors must open directly onto public spaces and sightlines must be provided to the doors from public spaces;
- (e) Ambulant toilets must meet DDA and DSAPT requirements.
- (f) Toilets must be fitted out in accordance with the Room Data Sheets and the finishes requirements included in Section 4 below.
- (g) Toilet design for customers must comply with TfNSW CSD's Toilet Design for Customers Guidelines.

3.8.2 Bicycle Parking

- (a) The CSM Contractor must provide secure bicycle parking:
- (i) within Eddy Ave Forecourt and Chalmers Street Entrance;
 - (ii) according to Class 2 – bicycle parking lock-ups as defined in AS/NZS 2890.3;
 - (iii) to house a minimum of 80 individual vertical-format bike racks in a caged space; and
 - (iv) with access control infrastructure to allow Opal Card based access to the facility.
- (b) Bicycle parking lock-up areas must:
- (i) be integrated with station or service building built form where possible;
 - (ii) have a galvanised steel framing structure with a black paint finish that meets the extent steelwork (exposed) requirements of section 5.17;
 - (iii) have woven stainless steel mesh wall panelling with a maximum aperture of 25mm x 50mm;
 - (iv) have adequate stiffness support for the woven mesh type to minimise deformation;
 - (v) have a full weather protection roofing system detailed and coloured to integrate with the station architecture;
 - (vi) include a smart card lock system for each bicycle;
 - (vii) have minimal signage attached to the lock-up structure; and
 - (viii) have bike pump and quick tools available.
- (c) At the Chalmers Street Entrance, outdoor bicycle parking to Class 3 – bicycle parking rails as defined in AS/NZS 2890.3, must be provided comprising:

- (i) a minimum of 34 horizontal format bike racks placed perpendicular to the entry stairs, placed equally on north and south faces of the Chalmers Street Entrance; and
 - (ii) overall not less than 176 bicycles spaces, including those in internal secure spaces.
- (d) Bicycle parking must be located in areas with good passive surveillance, with bicycle parking rails to be located in a highly visible and easily accessible location close to the station entrances.
- (e) Class 3 bicycle parking rails must:
- (i) be stainless steel or equal quality;
 - (ii) be a simple half circle or similar shape;
 - (iii) have concealed footings and fixings;
 - (iv) accommodate storage of two bicycles, and
 - (v) have protection from weather.

3.8.3 Drinking Fountains

- (a) Drinking fountains design must:
- (i) enable filling of water bottles;
 - (ii) be wheelchair accessible;
 - (iii) include a free draining system, with no basins;
 - (iv) read as an integral part to the suite of station furniture and fittings; and
 - (v) be customised design, based on leading available industry products and capability, to achieve a high quality unique solution for Central Station.
- (b) Drinking fountains must be located as follows:
- (i) one at the Eastern Entrance on Chalmers Street Level;
 - (ii) two in the East Concourse collocated with resting seats areas in the centre of the concourse;
 - (iii) one North South Concourse collocated with resting seats areas in the centre of the concourse; and
 - (iv) one to be located at the edge of pedestrian and cyclist movement routes adjacent to the Chalmers Street exit at street level.

3.8.4 Mobile Device Charging Facilities

- (a) The CSM Contractor must provide mobile device charging facilities at seating areas on platforms and concourses.
- (b) Device charging facilities must:
- (i) comprise a combination of standard wired device connections and induction surfaces;

- (ii) read as an integral part to the suite of station furniture and fittings;
- (iii) be freely available to customers; and
- (iv) be customised design, based on leading available industry products and capability, to achieve a high quality unique solution for Central Station

3.9 Central Station Operational Spatial Planning

3.9.1 General

- (a) The CSM Contractor must provide operational and customer service facilities in accordance with the Room Schedules and Room Data Sheets:
 - (i) as developed through consultation with Sydney Trains; and
 - (ii) as approved by the Principal's Representative.
- (b) The existing Central Station fire control room must be upgraded to meet Fire & Rescue NSW requirements to support the Project Works.
- (c) The CSM Contractor must make adequate spatial allowance for maintenance access and equipment replacement as identified in the RAMS assessments to be included in the Design Documentation.
- (d) The CSM Contractor must provide all fixtures, finishes and fitout in accordance with Codes and Standards and the Central Station Room Data Sheets.

3.9.2 Station Operation

- (a) A multipurpose room that can be used for multiple functions must be provided in the vicinity of the Eastern Entrance.
- (b) The CSM Contractor must provide bin room, cleaning rooms and chemical store that:
 - (i) allow for storage of general waste, co-mingled recyclables, chemicals and cleaning equipment;
 - (ii) are located for efficient station operations;
 - (iii) are discreet from the public areas;
 - (iv) are easily accessible via a BOH pathway where practicable;
 - (v) allow for safe transport and storage of dangerous and noxious materials; and
 - (vi) are provided with appropriate ventilation.

3.9.3 Staff Facilities

- (a) Staff facilities must be provided on the ESR Concourse level for customer-facing staff in accordance with the Room Schedules.
- (b) Staff facilities must be consolidated where possible, with a common BOH corridor.
- (c) Two separate access-controlled entrances to the staff facilities must be provided.

3.9.4 Train Crew Facilities

- (a) The CSM Contractor must remove existing train crew facilities from platforms 16-23.
- (b) Before removal of the existing train crew facilities, the CSM Contractor must provide new train crew facilities to platforms 16-23 located at either the northern or southern end of the platforms:
 - (i) as developed through consultation with Sydney Trains.

3.9.5 Plant and Equipment Rooms and BOH Corridors

- (a) Plant and equipment rooms must provide:
 - (i) safe access to all equipment; and
 - (ii) clear access for maintenance and replacement of all equipment that is achievable without the removal of other equipment or permanent infrastructure.
- (b) BOH corridors must:
 - (i) provide clear access for maintenance and replacement of plant and equipment where appropriate.
- (c) Doors and access hatches must:
 - (i) provide clear access for maintenance and replacement of plant and equipment;
 - (ii) provide removable panel.
 - (iii) be integrated with adjacent finishes;
 - (iv) provide safe access to all equipment; and
 - (v) provide clear access for maintenance and replacement of all equipment that is achievable without the removal of other equipment or permanent infrastructure, where possible.

3.9.6 Building Services Integration

- (a) The CSM Contractor must ensure:
 - (i) all building services and systems including plant, equipment, cabling, pipe work and conduits, located in the public areas, are concealed from pedestrian view by locating these elements behind walls, in ceilings or in floors, with provision for appropriate and easy servicing and maintenance access and future augmentation;
 - (ii) the design and finishes of any exposed building services elements and fixtures in public area are coordinated with the surrounding architectural design and finishes; and
 - (iii) the building and general works are coordinated with all other works where the Project Works has interfaces as required by the Interface Schedules.

3.10 Metro Station Operational Spatial Planning

3.10.1 General

- (a) The CSM Contractor must provide staff facilities and customer service facilities in accordance with the Room Schedules to facilitate operational requirements.
- (b) The CSM Contractor must make adequate spatial allowance for maintenance access and equipment replacement as identified in the RAMS assessments included in the Design Documentation.
- (c) Escalator landings on concourses and platform levels must be fitted with:
 - (i) adjustable barriers which retract fully to the inside of the escalators and allow each individual escalator to be closed when not in use;
 - (ii) barriers must be designed as part of the station furniture and must be continuous and not be discrete free-standing elements; and
 - (iii) where possible, barriers must be recessed and concealed in adjacent wall cladding.

3.10.2 Station Operation

- (a) A multipurpose room that can be used for multiple functions must be provided in the vicinity of the North South Concourse.
- (b) The CSM Contractor must provide a bin room, cleaning rooms and chemical store that:
 - (i) allow for storage of general waste, co-mingled recyclables, chemicals and cleaning equipment;
 - (ii) are located for efficient Station operations;
 - (iii) are discreet from the public areas;
 - (iv) are easily accessible via a BOH pathway where practicable;
 - (v) allow for safe transport and storage of dangerous and noxious materials; and
 - (vi) are provided with appropriate ventilation.

3.10.3 Staff Facilities

- (a) Staff facilities must be provided on the North South Concourse for customer-facing staff in accordance with the Room Schedules
- (b) Staff facilities must be consolidated where possible, with a common BOH corridor.
- (c) Two separate access-controlled entrances to the staff facilities must be provided.

3.10.4 Service Buildings and Facilities

- (a) All new service buildings and facilities must:

- (i) minimise the impact on the built form of Central Station, the Station Precinct and Public Domain by integrating the facilities with the landscape and topography;
 - (ii) minimise the extent of plant levels above ground;
 - (iii) meet all functional requirements;
 - (iv) minimise extent of blank walls;
 - (v) ensure access for maintenance and replacement of plant including access for regular maintenance;
 - (vi) ensure service access points are consolidated to reduce the scale of impact on the existing and are located away from customer interface points; and
 - (vii) incorporate integration of landscaping and landscaped roofs where practicable.
- (b) Service building roofs must be designed architecturally with consideration to vistas from surrounding tall buildings and must have a parapet on all exposed sides to conceal roof attachments.
- (c) Surface level services and utility structures servicing the Metro Station and North South Concourse must be located at the south end of the reinstated platform 14. An option for utility structures located on platform 14 at the northern end of the Metro Station box is to be developed and assessed as part of stage1 design.
- (i) Permissible exceptions include:
 - A. small exhaust risers;
 - B. vent or outside air intakes; and
 - C. fire stairs.
- (d) All independent vent structures must:
- (i) be located in a neat and orderly manner to complement the context;
 - (ii) be aggregated in common risers where practicable;
 - (iii) provide inlets and vent relief shafts that are integrated into Central Station;
 - (iv) not be located in the Eddy Avenue forecourt; and
 - (v) be of a scale and massing appropriate to the architectural context and concept.

3.10.5 Plant and Equipment Rooms and BOH Corridors

- (a) Plant and equipment rooms must provide:
 - (i) safe access to all equipment; and
 - (ii) clear access for maintenance and replacement of all equipment that is achievable without the removal of other equipment or permanent infrastructure.
- (b) BOH corridors must:

- (i) provide clear access for maintenance and replacement of plant and equipment where appropriate.
- (c) Doors and access hatches must:
 - (i) provide clear access for maintenance and replacement of plant and equipment;
 - (ii) be integrated with adjacent finishes;
 - (iii) provide safe access to all equipment; and
 - (iv) provide clear access for maintenance and replacement of all equipment that is achievable without the removal of other equipment or permanent infrastructure, where possible.

3.10.6 Building Services Integration

- (a) The CSM Contractor must ensure:
 - (i) all building services and systems including plant, equipment, cabling, pipe work and conduits located in the public areas, are concealed from pedestrian view by locating these elements behind walls, in ceilings or in floors, with provision for appropriate and easy servicing and maintenance access;
 - (ii) the design and finishes of any exposed building services elements and fixtures in public area are coordinated with the surrounding architectural design and finishes; and
 - (iii) the building and general works are coordinated with all other works where the Project Works has interfaces as required by the Interface Schedules.

3.11 Station Entrances

3.11.1 General

- (a) The station entrances must be recognisable, easily identifiable, logical and support the inherent functionality of the space.
- (b) The design of station entrances must assist wayfinding for customers.
- (c) Each station entrance must include the following elements:
 - (i) a Gateline, in accordance with the requirements set out in section 3.11.8;
 - (ii) a means of securing Central Station to a minimum height of 2400mm above ground level, that:
 - A. is operable at all times;
 - B. is consistent in design with adjacent wall systems;
 - C. is concealed when stored (in the open position), clear of all circulation and queuing zones and integrated with architectural cladding;
 - D. when closed, provide security to station entrances that is equivalent to adjacent wall systems;

- E. provides for emergency egress which must be a minimum of 820mm wide, adjacent to the security barrier and be permanently available (wicket doors/gates or other access doors integrated into roller shutters are not permitted); and
 - F. is alarmed and connected back to the Central Station OCC.
- (d) The provisions must be made for group meeting points (up to 20 people) that are a 'safe place' for customers to wait and orient themselves between the Gateline and station exit and are easily identifiable and comfortable, in accordance with CPTED principles. This must be demonstrated within the Design Documentation.
- (e) The CSM Contractor must make spatial, power and communications infrastructure provision for a minimum of one slimline wall-mounted public telephone in close proximity to the Eastern Entrance Gateline, in the unpaid area.
- (f) The CSM Contractor must make spatial, power and communications infrastructure provision for public telephone relocation within the unpaid Northern Concourse and Chalmers Street Entrance.
- (g) The location of public telephones must be:
 - (i) adjacent to areas space proofed for ATMs, where ATMs are also required;
 - (ii) clearly visible, in positions that will avoid encroaching upon the free flow of customers;
 - (iii) in a safe area;
 - (iv) integrated with other fixed elements, in order to avoid clutter; and
 - (v) coordinated and integrated with adjacent architectural finishes.
- (h) The CSM Contractor must provide space and supporting infrastructure for a minimum of one automatic teller machine (ATM) in the Eastern Entrance. This must be:
 - (i) co-located within the area identified for public telephones in the unpaid area;
 - (ii) in a safe location;
 - (iii) recessed within adjacent wall surfaces; and
 - (iv) in an area where the queuing zone does not overlap with customer circulation paths, or other queuing zones.

3.11.2 Ticketing Equipment

- (a) The CSM Contractor must provide space and supporting infrastructure for the ETS equipment, as described in the Interface Schedules.
- (b) Self-Service ETS machines must be incorporated within a modular cladding system in a consistent manner across Central Station.
- (c) Self-Service ETS machines must be clearly identifiable.

- (d) All ETS equipment in public areas must be monitored by CCTV in accordance with Appendix B02.
- (e) ETS equipment must be located in convenient, visible and safe locations and be recessed flush with adjacent wall surfaces.
- (f) ETS display screens must be provided with shading from direct and indirect sunlight.
- (g) Placement of ticket vending machines must be in accordance with the TfNSW Ticketing Self Service Machines Placement Principles and accessible for those with disabilities (i.e. DDA compliant installation).
- (h) Provision for ETS equipment must be made in the unpaid portion of the North Concourse to meet the following parameters as nominated by the Opal system supplier in compliance with applicable current TfNSW guidelines:
 - (i) physical footprint;
 - (ii) space for maintenance of equipment;
 - (iii) preferred location;
 - (iv) power supply; and
 - (v) communications.

3.11.3 Eastern Entrance

- (a) The Eastern Entrance building must have an architectural character that is complementary in its detail and finishes with the overall identity of Central Station and enhances its streetscape.
- (b) The Eastern Entrance must be recognisable, easily identifiable, logical and support the inherent functionality of the space;
- (c) All perimeter structures must be located within the Site boundary;
- (d) Both east and west facades must be predominantly glazed at street level between internal walls or structural elements.
- (e) All Eastern Entrance ventilation must be provided through vertical louvres in the façades below the upper slab of the Eastern Entrance building.
- (f) The ground level entry and exit portals of the Eastern Entrance must maximise the opportunity to provide natural daylight, reduce the need for artificial lighting and enhance wayfinding;
- (g) The CSM Contractor must provide a means of preventing accidental or deliberate vehicle access to the Eastern Entrance;
- (h) The CSM Contractor must provide security screen doors to be located at East Concourse level, integrated into the cladding;
- (i) All customer information displays must be protected from weather;
- (j) The CSM Contractor must:

- (i) provide a roof structure over a roof slab to provide for a future OSD, which is capable of supporting construction loadings without impact on the use and occupancy of the Eastern Entrance spaces below; and
 - A. include a weatherproof roof deck over the slab;
 - B. ensure that all building services including drainage do not enter the Eastern Entrance spatial envelope.
- (ii) include a means of securing the Eastern Entrance at street level, which must be;
 - A. operable at all times;
 - B. consistent in design with adjacent wall systems;
 - C. concealed when stored and clear of all circulation and queuing zones;
 - D. complete with CCTV camera coverage
 - E. coordinated with Central Station security (location, clash with bollards etc)

3.11.3.1 Eastern Entrance Awning

- (a) The Eastern Entrance awning must:
 - (i) be provided at the new Eastern Entrance;
 - (ii) provide weather protection to the Eastern Entrance, customer and community information and all queuing zones;
 - (iii) provide protection from wind-driven rain with an angle of 35 degrees to the vertical to the Eastern Entrance, customer and community information, all queuing zones and VT areas;
 - (iv) provide access to natural light that is aligned with circulation routes and VT locations;
 - (v) not obstruct key sightlines or pedestrian movement;
 - (vi) integrate all operational equipment;
 - (vii) respect the adjacent heritage buildings;
 - (viii) have minimal structure elements;
 - (ix) not be permanently fixed to existing heritage structures;
 - (x) sensitively integrate new building(s) into the existing urban environment within both existing and future context with consideration of scale, height, character, massing and material;
 - (xi) have an architectural character that is consistent with of the overall identity of Central Station and its context.;
 - (xii) minimise the edge, fascia depth;

- (xiii) not obstruct key sightlines or pedestrian movement; and
- (xiv) integrate all operational equipment.
- (b) The CSM Contractor must provide an Eastern Entrance awning that:
 - (i) has a minimum depth of 3.0m from the façade;
 - (ii) provides cover to whole extent of the façade; and
 - (iii) appears light in structural form.

3.11.3.2 Eastern Entrance Future OSD

- (a) The Contractor must provide for a future over site development (OSD), built by others and serviced from an adjoining property.
- (b) The CSM Contractor must:
 - (i) provide a roof structure over a roof slab;
 - (ii) provide a roof slab which is capable of supporting construction loadings without impact on the use and occupancy of the Eastern Entrance spaces below;
 - (iii) structurally provide for a residential / commercial development above the Project Works roof (no provision for lateral / stability loads for OSD is required), in accordance with section 2.6 of SWTC Appendix B01;
 - (iv) as a minimum include development provisioning for floor to floor heights of 3.2m;
 - (v) ensure all structural support for the future OSD at ground level is accomplished by the following:
 - A. for the north and south walls adjacent to the existing buildings: columns or walls or any structural support system may be used;
 - B. for the east and west boundaries adjacent to Randle Lane and Chalmers St respectively: only columns may be used with the columns limited to 2 columns per wall (this limit excludes those columns that may be required in the corners/on the ends of the north and south walls);
 - C. providing a maximum of two columns, located off the building perimeter, if they are required; and
 - D. all columns must be sized, located and oriented to minimise the impact upon pedestrian flows;
 - (vi) provide an OSD fire stair, each flight a minimum of 1 meter in width, located in the South East corner of the Eastern Entrance, with direct egress to Randle Lane; and
 - (vii) provide permanent roof access to the roof/interface level.
 - (viii)

3.11.4 Randle Lane Entrance

- (a) The CSM Contractor must provide safeguarding for a future entrance from Randle Lane, which will:
 - (i) provide safety and secure pedestrian exit and entrance to the Central Station via the Eastern Entrance;
 - (ii) include a landing on RL 25.00 with direct access to the street;
 - (iii) include a set of stairs from Randle Lane level to Chalmers Street Level including handrails, balustrades, tactile ground surface indicators and nosing;
 - (iv) be operable at all times;
 - (v) be consistent in design with adjacent wall systems;
 - (vi) be complete with PA system, lights; CCTV camera coverage;
 - (vii) have an awning;
 - (viii) be coordinated with Central Station security (location, clash with bollards etc); and
 - (ix) provide a means of preventing accidental or deliberate vehicle access;

- (b) The CSM Contractor must safeguard for a future pedestrian link of a minimum clear width of 5m under Randle Lane at RL 14.2 and a minimum clear height of 4m extending into the basement of the adjacent sites at 1-7 Randle Street.

3.11.5 Northern ESR Concourse Gateline Unpaid Area

- (a) refer to Contract Schedule A3 – Options for all details

3.11.6 Northern Entrance Unpaid Area

- (a) The minimum extent of work to the Northern Entrance / North Concourse unpaid area is shown on SWTC Drawing NWRLSRT-NWR-SCS-ST-DWG-938153 and:
 - (i) extends to the northern facade of the existing building facing the Eddy Avenue forecourt;
 - (ii) extends to the existing façade of the main building to the west at North Concourse level;
 - (iii) extends to the nearest face of the existing lift to the east and in a straight line to adjacent north and south walls, including the face of the existing retail tenancy;
 - (iv) extends to the end of the existing northern corridor, on the eastern face of the stairs to platforms 16 / 17;
 - (v) excludes the existing open escalators which are to be retained; and
 - (vi) extends to the landing of the new escalators at the western side

- (b) The CSM Contractor must, at the Northern Entrance:
- (i) remove the existing Gateline and replace with a solid wall, providing integrated customer information;
 - (ii) remove the existing PIDS and establish a new Gateline at this location in accordance with section 3.11.8;
 - (iii) retain and protect the external escalators to the eastern face of the main terminus building;
 - (iv) replace floor, wall and ceiling finishes (noting the existing ceiling panels are to be re-used on the Northern Concourse);
 - (v) provide new finishes around the existing columns;
 - (vi) remove all existing advertising, wayfinding and vending machines;
 - (vii) install new signage and wayfinding;
 - (viii) create a space that:
 - A. is inviting to customers, providing a seamless transition between the external and internal spaces;
 - B. provides views to assist wayfinding movements;
 - C. provides an ongoing logical progression to platforms and customer facilities with consistent wayfinding;
 - D. accommodates queuing zones which must not interfere with pedestrian flows or impede circulation spaces;
 - E. is free of recesses and indentations which could hinder passive surveillance;
 - F. maximises natural light to the North Concourse;
 - G. maximises natural ventilation through to the North Concourse and North South Concourse ;
 - H. provides CCTV coverage in accordance with standards; and
 - I. integrates services, customer information and ticketing equipment within the architectural design;

3.11.7 Chalmers Street Entrance

- (a) refer to Contract Schedule A3 – Options for all details

3.11.8 Gateline Elements

- (a) The CSM Contractor must make provision, as per the Interface Schedules, for the minimum number of ticket gates required at each new or modified Gateline as detailed in Table 5 below;

Table 5 – Minimum number of gates required at Gatelines

Location	Minimum number of standard gates	Minimum number of Wide Aisle Gates (WAGs)
Northern Entrance	10	2
Eastern Entrance	11	2

- (b) The CSM Contractor must demonstrate sufficient run-off capacity for a maximum queue at any Gateline.
- (c) The CSM Contractor must locate Gatelines to:
 - (i) minimise cross flow and congestion;
 - (ii) minimise any varying floor levels adjacent to the Gatelines;
 - (iii) accommodate the following customers:
 - A. people with a disability;
 - B. parents with prams; and
 - C. those with luggage and bulky items.
 - (iv) accommodate the run offs noted in Table 4 of this Appendix B03, with no conflict or overlap with other circulation or queuing zones;
 - (v) ensure the Gateline has closed circuit television (CCTV) coverage.
- (d) The CSM Contractor must liaise and coordinate with the Principal's Representative as to where wide aisle gates should be placed within the Gateline array based on considerations in (ii) and (iv).
- (e) Each Gateline must include the following elements:
 - (i) a precise clock facing both entry and exit;
 - (ii) PIDS/SPIs;
 - (iii) wall space for customer and community information;
- (f) Gateline locations must not impede emergency evacuation and the required circulation paths and widths must be in accordance with the CSM Contractor's FLS strategy;
- (g) Gatelines must integrate with adjacent security screens, walls and balustrades.
- (h) Residual width must be preserved for Gateline expansion using glass or a material that can achieve a minimum of 80% transparency in order to maintain clear views.
- (i) CSM Contractor must make provision for supporting infrastructure to the Gateline including:
 - (i) floor trenches;
 - (ii) overhead services;
 - (iii) integration of security screens; and

- (iv) integration of other fixtures adjacent to the Gateline which may impact in-floor services.

3.12 Station Concourses

3.12.1 General

- (a) The CSM Contractor must, for all new concourse areas create a space that:
 - (i) provides an open and spacious appearance with clear sightlines with minimum changes of direction in line with CPTED principles;
 - (ii) provides an ongoing logical progression to and from platforms and customer facilities with consistent wayfinding;
 - (iii) accommodates appropriate queuing zones which must not interfere with pedestrian flows or impede circulation spaces;
 - (iv) provides a gathering space for customer orientation and decision-making;
 - (v) provides spaces free of recesses and indentations which could hinder passive surveillance;
 - (vi) maximises natural light and natural ventilation through the concourse;
 - (vii) integrates services and customer information within the architectural design;
 - (viii) is at RL14.2m to provide a consistent level across the station.
 - (ix) is inviting to customers, providing a seamless transition between the new and existing spaces;
 - (x) provides views to assist wayfinding movements;
 - (xi) balances all the functional requirements ;
 - (xii) provides CCTV coverage in accordance with Interface Schedules;
 - (xiii) is weather protected to all areas including floor drainage at the base of all the stairs and escalators opening to platforms above;
 - (xiv) provide demarcation between primary circulation and passive spaces; and
 - (xv) provide tonal variation in the floor finish for the North-South Concourse and the East Concourse.

3.12.2 Natural Light Access

- (a) The CSM Contractor must provide natural light into the following areas of the Project Works (via full height glazing, glazing, roof lights, skylights, and the like):
 - (i) Intercity Concourse
 - (ii) North Concourse,
 - (iii) North South Concourse,

- (iv) East Concourse, and
- (v) ESR Concourse at the Eastern Entrance;
- (b) The structure for providing natural light access must:
 - (i) provide weather protection to the paid concourse and VT areas;
 - (ii) establish relationship between the rooflight and the VT;
 - (iii) ensure no fittings or fixtures are suspended from the rooflight;
 - (iv) be designed to minimise structural supports and associated visual obstructions;
 - (v) minimise solar heat gain to provide customer comfort;
 - (vi) integrate with the canopy structures;
 - (vii) prevent unauthorised (climbing) access;
 - (viii) provide unobtrusive maintenance access;
 - (ix) minimise the edge and fascia depth;
 - (x) facilitate natural ventilation, smoke and heat dissipation strategies consistent with the CSM Contractor's FLS strategy; and
 - (xi) integrate roof shading devices and appropriate insulation to achieve customer comfort conditions.

3.12.3 North South Concourse

- (a) The CSM Contractor must, at the North South Concourse provide:
 - (i) security shutters or barriers at the top of the Metro Station escalators on the North South Concourse that:
 - A. prevent customers access to the Metro Station platforms;
 - B. are be part of the architectural design;
 - C. do not obstruct sight lines;
 - D. are free of any lowered bulkheads if mounted in the ceiling in a vertical configuration or fully concealed if mounted horizontally across each escalator;
 - E. comply with the CSM Contractor's FLS strategy;
 - F. are concealed when stored (in the open position); and
 - G. are clear of all circulation and queuing zones and integrated with architectural cladding.
 - (ii) lifts and escalators to meet the requirements of section 3.15.
- (b) The CSM Contractor must ensure that the North South Concourse structure:
 - (i) has a finished floor level at RL 14.2m;

- (ii) presents smooth, clean lines and has a minimum structural depth that is consistent with their spans and method of construction;
- (iii) has two continuous and unobstructed passages of 6.0m width along its entire length; and
- (iv) is supported by blade columns or walls that do not impede required clearances.
- (v) has structural and spatial provision for a future portal to a West Concourse in accordance with Appendix B15;
- (vi) provides a passive area of 8m x 7m clear dimension between the void to Metro Station platform and escalator void where the following elements are located:
 - A. waiting areas; and
 - B. station furniture;
- (vii) allows for voids above the escalators to the Metro Station platform with the minimum clear dimensions of 8.2m wide by 12m long.

3.12.4 East Concourse

- (a) The CSM Contractor must, at the East Concourse provide:
 - (i) lifts and escalators to meet the requirements of section 3.14.
 - (ii) rooms in accordance with the Room Schedules; and
 - (iii) customer information elements.
- (b) The East Concourse must contain splays, with the same proportion in length and return angle at:
 - (i) the junction with the ESR Concourse;
 - (ii) the junction of the North South Concourse; and
 - (iii) at the base of each escalator recess;
- (c) The CSM Contractor must ensure that the East Concourse structure has;
 - (i) a finished floor level at RL 14.2;
 - (ii) a centreline as shown on SWTC Drawing NWRLSRT-NWR-SCS-ST-DWG-938151;
 - (iii) two active continuous and unobstructed passages of 6.0m width along its entire length;
 - (iv) has passive area of 7.0m clear width where the following elements are located:
 - A. lifts and waiting areas;
 - B. station furniture;

- C. pop-up and semi-permanent retail;
- D. structure; and
- E. customer information and signage.

3.12.5 Grand Concourse

- (a) The CSM Contractor must ensure that minimal work is required to be done within the Grand Concourse, in order to complete required interfaces.
- (b) The roof structure and cladding of the Grand Concourse must be protected whilst allowing for a continuous cover to be provided with the new adjacent platform canopy.
- (c) Any existing surface or structure affected by the CSM Contractor's Activities must be made good as part of the Project Works.

3.12.6 ESR Concourse

- (a) The CSM Contractor must, provide the following as a minimum in the area shown as works in SWTC Drawing NWRLSRT-NWR-SCS-ST-DWG-938151:
 - (i) new floor;
 - (ii) ceiling and wall finishes;
 - (iii) lights;
 - (iv) replace with new any Sydney Trains equipment removed as part of the Project Works or CSM Contractor's Activities, in accordance with Interface Schedules;
 - (v) finishes, signage and equipment seamlessly integrated with the existing fabric;
 - (vi) the junction of the North Concourse stairs at the Elizabeth Street Entrance to the Chalmers Street Entrance in the southern end; and
 - (vii) the new Gateline at the Eastern Entrance and the junction with East Concourse.
- (b) The CSM Contractor must, in the ESR Concourse:
 - (i) remove the existing ramp and stairs connecting to the Chalmers Street Entrance and replace with new VT;
 - (ii) remove and replace the CENA-5 Communications room;
 - (iii) remove all existing air-conditioning units;
 - (iv) remove the existing suspended metal panel and sheet ceiling systems;
 - (v) remove concealed services and replace with new services overhead;
 - (vi) provide new cladding to existing perimeter walls;
 - (vii) provide new cladding to existing ceiling;
 - (viii) provide new floor tiling to paid areas and extend floor tiling in to the unpaid areas outside the Gatelines; and

- (ix) install new stairs from ESR Concourse level (RL 14.20) to the Southern Concourse level with a MCW of 4.0m.
- (c) The CSM Contractor must, in the ESR Concourse create a space that:
 - (i) allows for finishes to merge seamlessly into the new East Concourse and Eastern Entrance.
 - (ii) fully integrates new and retained services including as a minimum:
 - A. new lighting throughout;
 - B. CCTV and other data;
 - C. PA;
 - D. mechanical and electrical services;
 - E. Fire and Life Safety; and
 - F. wayfinding.

3.12.7 North Concourse

- (a) The CSM Contractor must:
 - (i) remove the existing escalators and stairs to the Grand Concourse;
 - (ii) remove the two existing lifts;
 - (iii) remove existing bounding walls adjacent to the stairs.
 - (iv) remove existing ceiling structure and bulkheads (noting the existing ceiling panels are to be re-used on the Northern Concourse);
 - (v) remove existing signage and wayfinding;
 - (vi) remove existing finishes;
 - (vii) relocate overhead power and data cabling;
 - (viii) remove existing lighting;
 - (ix) arrange with Sydney Trains for the removal of existing vending machines and advertising;
 - (x) remove and replace structure as required;
 - (xi) remove existing CCTV and PA;
 - (xii) provide new Fire Safety Systems;
 - (xiii) regrade the area between the Gateline and the northernmost stairs to platforms 16 and 17 to minimise paving crossfalls;
 - (xiv) retain and protect the platform lifts adjacent and maintain landing threshold levels;
 - (xv) integrate seamlessly between the new North South Concourse and existing concourse areas.
 - (xvi) provide new reticulation of overhead Utility Services;

- (xvii) provide new finishes;
- (xviii) provide new signage and wayfinding; and
- (xix) provide new lighting.

3.12.8 Intercity Concourse

- (a) The CSM Contractor must undertake the works described in section 3.12.8(b), in the area shown in SWTC Drawing NWRLSRT-NWR-SCS-ST-DWG-938152, including:
 - (i) appropriate clear widths are as shown on the SWTC Drawing;
 - (ii) minimum lift waiting zones are provided and do not clash with pedestrian flows;
 - (iii) minimum distance from the escalators to the edge of the existing building and edge of the concourse are as shown on the SWTC Drawing;
 - (iv) the void to the North Concourse does not affect the pedestrian flow.

- (b) The CSM Contractor must:
 - (i) demolish existing stairs and escalators adjacent to platforms 11 and 12;
 - (ii) construct new infill structure at Grand Concourse level to integrate with existing Intercity Concourse;
 - (iii) remove the existing canopy structure;
 - (iv) arrange with Sydney Trains for the removal of the existing telephone;
 - (v) retain and protect existing mechanical vents on the face of the Grand Concourse building;
 - (vi) arrange with Sydney Trains for the removal of existing vending machines;
 - (vii) remove existing balustrades and handrails;
 - (viii) remove fences to the northern ends of platforms 8 to 15 ;
 - (ix) demolish the existing retail kiosk, and terminate services adjacent to platforms 12-13;
 - (x) remove existing lighting, signage and wayfinding;
 - (xi) provide new finishes;
 - (xii) provide new fences, handrails and balustrades;
 - (xiii) provide new drainage; and
 - (xiv) fully integrate new and retained services including as a minimum:
 - A. new lighting throughout;
 - B. CCTV and other data;
 - C. PA;

- D. mechanical and electrical services;
- E. Fire and Life Safety; and
- F. wayfinding.

3.12.9 Intercity Concourse Canopy

- (a) The CSM Contractor must design and build a new canopy to provide continuous cover between the Grand Concourse, the northern end of platforms 8 to 14, and the eastern face of Central Electric Station Building.
- (b) The Intercity Concourse canopy must:
 - (i) provide cover and weather protection over the Intercity Concourse between reinstated platform 14 and platform 8 face line;
 - (ii) be of material that minimises heat gain in the Intercity Concourse;
 - (iii) for the sections over the North Concourse void and the escalator void, be of transparent material to maximise light penetration;
 - (iv) integrate seamlessly with the existing heritage building;
 - (v) integrate seamlessly with the new canopy over platforms 12-14;
 - (vi) provide continuous weather protection for customer movements between platforms 8 to 14, the Intercity Concourse and Grand Concourse;
 - (vii) provide a sympathetic architectural integration with the Grand Concourse heritage fabric, existing canopy over platform 8 to 11 and new canopy for platform 12-14; and
 - (viii) be expandable to the north to allow for a future canopy replacement over the Northern Entrance over the East Deck to allow for cover over the existing escalators and entry to the Grand Concourse.
- (c) The connection of the Intercity Concourse canopy with the existing heritage buildings must allow for clear views of the heritage building by:
 - (i) providing minimum structural connections to the heritage fabric; and
 - (ii) allowing 1m wide glass section adjacent to the heritage buildings.

3.12.10 Void over North Concourse

- (a) The CSM Contractor must create a new void at Intercity Concourse paid concourse at RL 21.340m over the North Concourse which:
 - (i) has minimum clear dimensions of 15m x 9m;
 - (ii) is located centrally in front of and extends to the southern wall of the Central Electrical Station Building;
 - (iii) is lined on three sides with glazed frameless balustrading and handrail of 1500mm height;
 - (iv) admits daylight across its full area on plan, but protected against weather ingress so that no rain will reach the North Concourse below; and

- (v) limits the ingress of direct sunlight and prevents glare to the North Concourse.

3.12.11 Commercial Vending Machines

- (a) The CSM Contractor must:
 - (i) make spatial provision and supporting infrastructure for two commercial vending machines within the Northern Entrance; and
 - (ii) four commercial vending machines within the North South Concourse.
- (b) All commercial vending machines must:
 - (i) be in a safe location in the paid concourse area;
 - (ii) be visible from the Gateline, where possible;
 - (iii) not impede customer flows; and
 - (iv) be recessed within adjacent wall surfaces.
- (c) The queuing areas for commercial vending machines must not overlap with customer circulation paths or other queuing zones.
- (d) Commercial vending machines must have a minimum horizontal separation distance of 10m between units.

3.13 Existing Tunnels

3.13.1 Olympic Tunnel

- (a) The CSM Contractor must retain the eastern section of the Olympic Tunnel for BOH access only.
- (b) The retained portion of the Olympic Tunnel referred to in section 3.13.1(a) above must be fully secured at the ESR Concourse with existing connection to platforms removed.
- (c) At the junction with the ESR Concourse, a set of access controlled double fire rated doors must be provided.
- (d) At the junction with the North South Concourse, an access door, landing and stairs compliant with AS1657 must be provided at the end of the Olympic Tunnel to align with the North South Concourse level.
- (e) Existing and to Suburban Platforms must be removed and tunnel walls reinstated to support infill of the platform surface over the former openings.
- (f) New stairs from the Olympic tunnel to Platforms 20/21 and 22/23 (refer to SWTC Section 2.4 Temporary Works) must be decommissioned by the CSM Contractor with:
 - (i) the temporary steel and concrete stairs, landings and balustrades must be demolished;
 - (ii) the Olympic Tunnel wall must be reinstated to support tunnel wall backfill material. Tunnel Walls must comply structurally with Table 4-1 Design Life in SWTC Main Body;

- (iii) the stair voids must be covered and made good structurally and aesthetically and a new concrete slab constructed at platform level with finishes to match the platform;
- (iv) temporary shaft lining including rock bolts, shotcrete, and concrete must be retained in place.

3.13.2 Southern Suburban Baggage Tunnel

- (a) The CSM Contractor must:
 - (i) allow for the northern section of the Southern Suburban Baggage Tunnel to become a secure BOH tunnel separated from public access at each end;
 - (ii) provide a set of access controlled double fire rated doors at the junction with the ESR Concourse;
- (b) Existing stairs to Suburban Platforms must be removed and tunnel walls reinstated to support infill of the platform surface over the former openings.
- (c) The existing electrical board/ room at the western end of the tunnel must be retained.

3.13.3 Southern Suburban Interchange Tunnel

- (a) The CSM Contractor must:
 - (i) retain the Southern Suburban Interchange Tunnel as an operational public thoroughfare connecting platforms 16 to 23;
 - (ii) retain a BOH connection between the new North South Concourse and the Southern Suburban Interchange Tunnel including:
 - A. stairs and landing at the junction with the North South Concourse;
 - B. provide a fire door and wall at the junction with the North South Concourse;
 - C. safeguard for future public access;
 - D. safeguard for a lift for future demand;
 - (iii) maintain the current width and height as a minimum.
 - A.

3.13.4 Southern Intercity Interchange Tunnel

- (a) The CSM Contractor must upgrade a portion of the Southern Intercity Interchange Tunnel, as shown on SWTC Drawing NWRLSRT-NWR-SCS-ST-DWG-938151, under platforms 10 and 11 to achieve a connection for customer access to the North South Concourse.
- (b) A graded floor transition no steeper than 1:20 slope is required to connect differing existing floor levels.
- (c) The floor transition must be tiled to match existing finishes and slip resistance.

- (d) Existing walls, ceilings and soffits must be made good where the tunnel intersects the new North South Concourse opening.

3.13.5 Devonshire Street Tunnel

- (a) The Devonshire Street Tunnel must be returned to its current functional and spatial state including:
 - (i) drainage reinstatement;
 - (ii) finishes installation, to match or blend with existing fabric, aligned with existing levels and to be of a standard equivalent to the finishes existing at the date of the Contract;
 - (iii) maintaining the existing Devonshire Street Tunnel MCH and MCW;
 - (iv) reinstating all existing systems and Utility Services, including CCTV and other data, PA, mechanical and electrical cabling, FLS systems; and
- (b) CSM Project Works undertaken in the Devonshire Street Tunnel must be in accordance with the Planning Approval.

3.14 Central Station Vertical Transport

3.14.1 Lifts

- (a) The CSM Contractor must install lifts in Central Station, including all required:
 - (i) shafts and pits;
 - (ii) steel frame and glazed lift enclosures;
 - (iii) curved glazed corners to each enclosure;
 - (iv) penetrations through the existing concrete canopies and other structures;
 - (v) concrete upstands and slabs over lift overruns, including hanging points;
 - (vi) mechanical equipment; and
 - (vii) electrical equipment, including controls and monitoring requirements.
- (b) All passenger lifts must be 27-person capacity and comply with the lift specifications provided in Appendix C2;
- (c) The CSM Contractor must install double-sided lifts between the North South Concourse and:
 - (i) platform 12/13: one lift; and
 - (ii) platform 14: one lift.
- (d) The CSM Contractor must install double-sided lifts between the East Concourse and:
 - (i) platform 16/17: one lift;
 - (ii) platform 18/19: one lift;
 - (iii) platform 20/21: one lift; and

- (iv) platform 22/23: one lift.
- (e) The CSM Contractor must install double-sided lifts between the following concourse level changes:
 - (i) North South Concourse to North Concourse to Intercity Concourse levels: two lifts;
 - (ii) ESR Concourse level change: one lift;
 - (iii) Eastern Entrance from ESR Concourse level to Chalmers Street level to Randle Lane level: two lifts.

3.14.1.2 Lift Car Finishes

- a) All sills must be hollow stainless steel fabrication.
- b) All Central Station lifts must be provided with digital information screens. The screens must be a minimum 15" high resolution colour monitors.
- c) All Central Station lifts cars must have a minimum of two car operating panels of 2mm thick brushed stainless steel, securely fastened with hidden fixings, which must be demonstrably vandal resistant.
- d) All Central Station lift car operating panels must have received endorsement from the wayfinding and branding working group.
- e) Central Station lifts car finishes must be as follows:
 - (i) car side walls: framed glass with lower section under handrail to be protected with grating;
 - (ii) ceiling: stainless steel with number 4 finish.
 - (iii) shadow line junctions around the perimeter of the ceiling.
 - (iv) perimeter LED vandal resistant downlights to ceiling;
 - (v) skirting: brushed stainless steel.
 - (vi) flooring: to match the adjacent public areas flooring or non-slip heavy duty vinyl sheet;
 - (vii) car doors: framed glass.
 - (viii) handrails: brushed stainless steel.

3.14.2 Escalators

- (a) The CSM Contractor must install escalators in Central Station that comply with Appendix C3 and the following requirements:
 - (i) heavy duty operational environment;
 - (ii) full outdoor operation environment at 30 degree inclination;
 - (iii) transit type escalators;
 - (iv) minimum overall width of 1.6m, with clear step width of 1m ; and

- (v) extended landing transition length.
- (b) The CSM Contractor must provide escalators at each change in level along a path of travel, that meet the following requirements:
 - (i) for a rise of up to 6.6m, stairs and/or escalators must be used; and
 - (ii) for a rise over 6.6m, escalators must be used.
- (c) The CSM Contractor must provide the following escalators from the East Concourse to the surface platforms in one single rise:
 - (i) platform 12/13: four escalators, including:
 - A. two facing north from the East Concourse; and
 - B. two facing south from the East Concourse.
 - (ii) platform 14: four escalators, including:
 - A. two facing north from the East Concourse; and
 - B. two facing south from the East Concourse.
 - (iii) platform 16/17: four escalators
 - A. two facing north from the East Concourse; and
 - B. two facing south from the East Concourse.
 - (iv) platform 18/19: four escalators, including:
 - A. two facing north from the East Concourse; and
 - B. two facing south from the East Concourse.
 - (v) platform 20/21: four escalators, including:
 - A. two facing north from the East Concourse; and
 - B. two facing south from the East Concourse.
 - (vi) platform 22/23: three (3) escalators, including:
 - A. two facing north from the East Concourse; and
 - B. one facing south from the East Concourse.
- (d) The CSM Contractor must provide a minimum of four escalators from the North Concourse level to the Intercity Concourse level in one single rise.
- (e) The CSM Contractor must provide three escalators in the Eastern Entrance from the street level to mezzanine level under Randle Lane; and
- (f) The CSM Contractor must provide three escalators in the Eastern Entrance from the mezzanine level under Randle Lane to the ESR Concourse level.

3.14.3 Stairs

- (a) The CSM Contractor must provide stairs at each change in level along a path of travel, except where a continuous graded transition of 1:20 or less exists.

- (b) The CSM Contractor must also install two flights of stairs between the North South Concourse and the North Concourse, each with a MCW of 6m. Escalators may be accepted as a partial substitute for stairs provided that the CSM Contractor demonstrates the required LoS.
- (c) Public stairs must have a MCW of:
 - (i) 2m if predominantly used for unidirectional flow; and
 - (ii) 2.4m if predominantly used for bidirectional flow.
- (d) All emergency egress stairs used by customers must incorporate resting points outside of the circulation and customer flow, with a minimum depth of 900mm, such that the vertical rise between the resting points does not exceed 6m;
- (e) Stairs must have:
 - (i) a minimum 150mm and a maximum 165mm high risers; and
 - (ii) a minimum 275mm and a maximum 300mm deep goings.

3.15 Metro Station Vertical Transport

3.15.1 Lifts

- (a) The CSM Contractor must install two double-sided lifts as follows:
 - (i) one lift between the Metro Station platform and the North South Concourse in a continuous single rise;
 - (ii) one lift between the Metro Station platform, the North South Concourse and the BOH levels, as appropriate, with access control; and
 - (iii) Limit the glass enclosure to 4m height above FFL of the Metro Station platform.
- (b) The location of the lifts must be as shown on SWTC Drawing NWRLSRT-PBA-SCS-AT-DWG-938154.
- (c) The lifts must be 27-person capacity and in accordance with the lift specifications provided in Appendix C1.
- (d) The CSM Contractor must provide all required:
 - (i) shafts and pits;
 - (ii) steel frame and glazed lift enclosures;
 - (iii) curved glazed corners to each enclosure on concourse level only;
 - (iv) lined concrete or masonry walls on concealed faces;
 - (v) shaft extensions to structure above, including hanging points.
 - (vi) mechanical equipment; and
 - (vii) electrical equipment, including controls and monitoring requirements.

3.15.1.2 Lift Car Finishes

- (a) All sills must be hollow stainless steel fabrication.
- (b) All Metro Station lifts must be provided with digital information screens. The screens shall be a minimum 15" high resolution colour monitors.
- (c) The Metro Station lift doors must comply with the typical arrangement shown on SWTC Drawing 620/T/000/MTR/N82/003.
- (d) All Metro Station lifts cars must have a minimum of two car operating panels of 2mm thick brushed stainless steel, securely fastened with hidden fixings, which must be demonstrably vandal resistant.
- (e) All Metro Station lift car operating panels must have received endorsement from the wayfinding and branding working group.
- (f) Metro Station lifts car finishes must be as follows:
 - (i) car side walls: framed glass with lower section under handrail to be protected with grating;
 - (ii) ceiling: stainless steel with number 4 finish;
 - (iii) shadow line junctions around the perimeter of the ceiling;
 - (iv) perimeter LED vandal resistant downlights to ceiling;
 - (v) skirting: brushed stainless steel;
 - (vi) flooring: to match the adjacent public areas flooring or non-slip heavy duty vinyl sheet;
 - (vii) car doors: framed glass; and
 - (viii) handrails: brushed stainless steel.

3.15.2 Escalators

3.15.2.1 General Requirements

- (a) The CSM Contractor must provide escalators to Metro Station that comply with the specification in Appendix c1
- (b) The location of the base of the escalators must be as described on SWTC Drawing NWRLSRT-PBA-SCS-AT-DWG-938154.

3.15.3 Egress Stairs

- (a) The CSM Contractor must provide fire-isolated egress stairs at each end of the Metro Station platform, accessed directly from the platform. The clear width of the fire stairs is to comply with the CSM Contractor's FLS strategy.
- (b) The clear width of the doors from the platform to the fire stairs and the final discharge doors must not result in an egress flow rate that is less than that of the fire stairs.
- (c) Doors to the fire stairs must open into the stair, with the exception of the final discharge door(s) which open outwards. The door swing, through all points of the swinging arc must not intrude on the clear path of travel within the stair.

- (d) Fire egress stairs that require a continuous ascent, ignoring stair landings, of greater than 15m, measured vertically, must provide rest areas outside of the clear path of travel such that the vertical rise between the resting points does not exceed 6m. The size of the rest area is to comply with the CSM Contractor's FLS strategy

3.15.4 Wheelchair refuge

- (a) Wheelchair refuge space must be provided on each level that can be accessed by a wheelchair bound occupant. The wheelchair refuge space must:
 - (iii) be fire separated from public access areas and plant areas with a minimum FRL of (120)/120/120;
 - (iv) have direct access to a fire isolated stair or dedicated emergency escape lift;
 - (v) provide sufficient space for the number of wheelchairs determined by the CSM Contractor's FLS strategy;
 - (vi) have a minimum footprint dimension of 900mm x 1,400mm for each wheelchair and a MCH of 2,000mm;
 - (vii) be in a configuration and position which allows a person sitting in the wheelchair to readily observe activities (i.e. not facing a wall); and
 - (viii) allows wheelchairs when in the parked position, to not intrude on the clear path of travel to a fire stair.

3.16 Intercity Platform and Suburban Platform requirements

3.16.1 General

- (a) All modifications to the existing Central Station platforms must be in accordance with ASA monitoring and control standards.
- (b) The new and modified Central Station platforms must:
 - (i) have good sightlines, be open and have spacious customer circulation and waiting areas;
 - (ii) have carefully aligned placement of furniture and removal of non-required enclosures and other redundant fixtures to assist in decluttering the platform spaces;
 - (iii) be accessible for the whole extent;
 - (iv) have minimal gaps between platform edges and trains;
 - (v) be configured to allow for level access to trains in accordance with ASA Standards;
 - (vi) provide features to assist all customers who may be unfamiliar with the Central Station environments;
 - (vii) contain a minimum of platform obstructions, located in a neat and orderly manner in the central width of each platform;

- (viii) enable passengers to board and alight from trains in a safe and efficient manner;
- (ix) have no obstructions to pedestrian movement or sightlines along platforms from equipment, components or wayfinding elements ;
- (x) have a level finish that does not fall towards platform edges;
- (xi) include tactile paver and coping line pavers;
- (xii) allow for a safety zone and accessible paths;
- (xiii) provide efficient wayfinding and signage;
- (xiv) in new platforms, have a consistent width along its entire length, where possible and not constrained by the existing platform 12 track alignment;
- (xv) enable CCTV coverage in accordance with Appendix B04a;
- (xvi) provide sufficient space for:
 - A. customers to wait for trains in relative comfort;
 - B. customer circulation to, from and along the platform; and
 - C. inclusion of a range of operational and passenger facilities.
- (c) The CSM Contractor must:
 - (i) provide services including data and electrical connections to support staff kiosks on Suburban Platforms 16 – 23;
 - (ii) intercity Platforms 12 – 14; and
 - (iii) liaise and consult with the Principal's Representative for final locations staff kiosks.
- (d) The CSM Contractor must provide windbreaks which:
 - (i) are integrated into the new canopy structure for new platforms 12-14;
 - (ii) allow for adequate protection to designated wheelchair / pram parking positions;
 - (iii) do not impede passenger circulation paths and queuing areas;
 - (iv) do not restrict operational and passive surveillance sightlines;
 - (v) coordinate with seating requirements (in exposed areas, passenger seating may be arranged behind windbreaks);
 - (vi) coordinate with station identification elements where both windbreaks and signage are required in close proximity;
 - (vii) where possible are integrated with seating into canopy structures or if designed as standalone elements, are consistent with the architectural detailing of new and retained elements; and
 - (viii) allow for station signage;
- (e) Existing windbreaks on Suburban Platforms must:

- (i) be retained or replaced in the same quantity as existing;
- (ii) provide shelter to passenger seating areas; and
- (iii) be dismantled, cleaned, repainted and reassembled.

3.16.2 Platforms 9 to 14 Alterations

- (a) The CSM Contractor must:
 - (i) alter the northern ends and extend the southern ends of platforms 9,10 and 11, to extend the Intercity Concourse, to have a minimum clear platform length in accordance with Appendix B02 Attachment 1;
 - (ii) the southern end of each platform is to be reconstructed including refuge spaces and egress steps; and
 - (iii) the extension areas to platforms must be tiled with the existing reclaimed tiles.
- (b) Where platforms 9, 10 and 11 are extended at the northern end, the platform structure must be infilled to the new end alignment and achieve structural integrity with the remainder of the Intercity Concourse.
- (c) All paving tiles which are to be removed from the ends of platforms 9 to 12 and the adjacent Intercity Concourse areas must be carefully removed, protected and retained for reuse on site, in accordance with Appendix B06.
- (d) The CSM Contractor must reconstruct platforms 12, 13 and 14 on completion of the Metro Station structure and must achieve the following criteria:
 - (i) platforms 12 and 13 must have a minimum clear platform edge length in accordance with Appendix B02 Attachment 1;
 - (ii) platform 12 must have a straight edge alignment;
 - (iii) maintain as a minimum the existing platform areas of each platform available to customers at the date of the Contract;
 - (iv) platform 14 must have a minimum clear platform edge length in accordance with Appendix B02 Attachment 1 and taper to the existing track centreline alignment, with a minimum clear width of 3.3m from the platform edge to any obstruction; and
 - (v) in the area from the east of platform 14 to the existing retaining wall facing platform 16, a landscaped edge zone of at least 1m wide must be formed. The landscape zone must include drained and irrigated planters between the new escalators and the Metro Station service buildings at the southern platform end.
- (a) The CSM Contractor must install a security fence around at the southern end of platform 14 landscape zone which must:
 - (i) be 2400mm high palisade fence with lower concrete plinth;
 - (ii) be powder coated matte black;
 - (iii) be non-climbable;

- (iv) contain secure access gates to the rear of the Metro services building; and
- (v) be in accordance with ASA standard T HR CI 12160 ST.

3.16.3 Platforms 16 to 23 Alterations

- (a) The CSM Contractor must undertake the following works to platforms 16 to 23:
 - (i) removal of all existing overhead services and replacement with new services and fittings;
 - (ii) provide and install new architectural multiservice ducts suspended under the existing canopy structures to integrate all overhead services;
 - (iii) remove and replace existing platform tiling, edge coping tiles, edge warning strips and tactile ground surface indicators;
 - (iv) removal and replacement of all platform-end security fences;
 - (v) strip back, treat and repair all the existing stair balustrade metalwork with non-abrasive treatment and application of anti-corrosion coatings;
 - (vi) fully seal the junction between the Central Walk lifts and the existing concrete roofs;
 - (vii) removal and replacement of existing downpipes with stainless steel downpipes;
 - (viii) provision of platform voids for:
 - A. escalator penetrations, being a maximum size of 25 m² per single escalator and maximum size of 45 m² per double escalator;
 - (ix) inspect and repair platform edges and ensure structural integrity upon Construction Completion;
 - (x) repaint all concrete canopy soffits and fascias and exposed steelwork including canopy columns. Surface preparation to remove existing flaking and/or corroded areas where required to allow for adequate cohesion new paint work;
 - (xi) protect from damage and remove existing platform furniture, transport from Site to the Principal's storage facility within 30km of the Site as advised by the Principal's Representative;
 - (xii) remove all other platform fixtures including signage, customer information elements and enclosed rooms on each platform;
 - (xiii) repaint the southernmost stair enclosures; and
 - (xiv) retain protect and reuse the main black and white Heritage Central Signage on each platform.
- (b) The CSM Contractor must re-level the surface of platforms 16 to 23 to:
 - (i) achieve a level junction with the top tread of retained stairs;

- (ii) establish falls from the track edge to new grated surface drains in the centre of each platform and connect this drainage to underground drainage lines;
 - (iii) establish uniform platform edge levels 1200mm above rail levels along each edge; and
 - (iv) establish precise landing levels for new lifts and escalators to suit the platform falls.
- (c) The CSM Contractor must:
- (i) Provide and install a lift overrun roof structure on the suburban lines which is a profiled metal sheet roof decking to match the roof of the new platform canopies over platforms 12 to 14.

3.16.4 Passenger Information Display Systems (PIDS)

- (a) The CSM Contractor must provide for PIDS displays to comply with specifications in Interface Schedules, and in accordance with TfNSW Wayfinding Planning Guide at the following locations:
 - (i) on each Intercity Platform and Suburban Platform;
 - (ii) in each concourse;
 - (iii) on the approach to each Gateline; and
 - (iv) at each station entrance.
- (b) The CSM Contractor must engage an industrial designer to develop a concept design for the integration of PIDS displays, to be agreed with TfNSW during Design Stage 1.
- (c) The CSM Contractor must provide:
 - (i) for PIDS displays to be integrated into the canopy structure for platforms 12/13 and 14;
 - (ii) cable containment for PIDS; and
 - (iii) break out point locations to enable PIDS cabling and installation.

3.16.5 Platform Canopies

3.16.5.1 General Requirements

- (a) The CSM Contractor must:
 - (i) provide continuous weather protection to all new and altered Intercity Platforms and Suburban Platforms;
 - (ii) make allowance for future canopy extension integrated to the new canopy over platforms 8 to 11;
 - (iii) alter existing heritage listed canopies to platforms 16 to 23 to accommodate new lift shaft overruns; and

- (iv) construct a new canopy over the reinstated platforms 12-14.
- (b) Platform canopies must:
 - (i) be of elemental construction which permits the replacement of localised components, if damaged;
 - (ii) be easily maintained and cleaned;
 - (iii) be designed to deter non-authorized access to the roof surface;
 - (iv) provide safe roof access to all items requiring maintenance, including gutters;
 - (v) integrate building services zones, concealed where possible;
 - (vi) integrate acoustic panels to achieve sound attenuation;
 - (vii) provide controlled overhead daylight within the canopy to improve platform luminance and achieve visual comfort;
 - (viii) integrate renewable energy technology in accordance with Appendix B07;
 - (ix) support operational equipment;
 - (x) accommodate wayfinding and customer information;
 - (xi) present a fine level of detail where in close view of the customer; and
 - (xii) have downpipes concealed within structural columns and gutters concealed from view from all parts of the stations accessible by customers.
- (c) The new canopy over platform 12 / 13 and 14 must:
 - (i) be extendable to provide cover over remaining Intercity Platforms;
 - (ii) allow seamless integration with the heritage Grand Concourse roof structure; and
 - (iii) have minimised edge, fascia depth.

3.16.5.2 Platform Canopy Structure

- (a) The platform canopy structures must:
 - (i) Provide cover to the new platforms 12 to 14, with platform edge setback as described below and as required by Codes and Standards.
 - (ii) allow for an integrated connection of future canopies to platforms 1 to 11;
 - (iii) engage any new solid enclosures constructed on those platforms to provide continuous platform cover;
 - (iv) have minimised column supports and associated visual obstructions;
 - (v) not obstruct important existing views, whilst recognising and enhancing important vistas and visual connections;
 - (vi) have soffits integrated with all operational equipment, including OHW and OHWS;

- (vii) have integrated mountings and wiring reticulation for signage and any other suspended equipment for customer information;
 - (viii) have integrated new platform furniture;
 - (ix) be designed considering views from adjacent properties onto roof elements in terms of colour, glare and detailing;
 - (x) provide protection from wind-driven rain with an angle of 35 degrees to the vertical to the rear face of platforms;
 - (xi) have a MCH of 3300mm;
 - (xii) have a minimum of 2700mm clearance above finished floor level to any item suspended from the canopy;
 - (xiii) have a width clear of the danger zone at the platform edge or as close as possible considering transit space, OHW and other safety requirements;
 - (xiv) provide for safe access, inspection and maintenance addressing the issues of undertaking tasks within proximity to the live operating rail environment and possible rail occupation;
 - (xv) have a safe walkway defined for regular maintenance access across the roof with roof finishes suitably protected;
 - (xvi) have a minimum of 1300mm from the vertically projected line of the edge of the platform. Exceptions may occur where:
 - A. a 1300mm setback will not achieve adequate weather protection (particularly at narrow platforms);
 - B. the line of an existing canopy is less than 1300mm from the edge of the platform, thus requiring a track possession for maintenance; and
 - C. the canopy roof edge has no gutter and therefore minimum maintenance requirements.
- (b) Platform canopies where located adjacent heritage platform canopies must:
- (i) not diminish the heritage values of the existing structures;
 - (ii) not be permanently fixed to existing heritage structures; and
 - (iii) provide continuous weather protection between existing and new canopies.
- (c) New platform canopies must:
- (i) cover the whole customer journey from the concourse to platform waiting area clear of VT and run-off zones;
 - (ii) extend for a minimum of 15m beyond the end of the VT on the platform; where lift doors face platform edges;
 - (iii) provide protection from wind-driven rain with an angle of 35 degrees to the vertical to the queuing areas in front of lifts, for the full width of the lift shaft.
 - (iv) have minimal the edge and fascia depth;

- (v) incorporate hearing loops; and
 - (vi) provide at 80% of platform coverage as a minimum on to platforms 12 to 14;
 - (vii) provide for platform drainage;
 - (viii) provide for lighting, PA, CCTV, integrated mountings, wiring reticulation for signage, and equipment for customer information; and
 - (ix) provide for future canopy extensions full canopy coverage over new platforms after contract completion.
- (d) Platform areas without canopies must:
- (i) incorporate hearing loops;
 - (ii) provide for lighting, PA, CCTV, integrated mountings, wiring reticulation for signage, and equipment for customer information; and
 - (iii) provide for future canopy extensions full canopy coverage over new platforms after contract completion.

3.16.5.3 Canopy Design for Sustainability

- (a) The contribution to urban heat island effects must be minimised at Central Station, Metro Station, Station Precinct and Public Domain.
- (b) The CSM Contractor must limit solar heat gain and UV penetration where enclosing or providing covered shelter to achieve thermal comfort and provide the following minimum requirements:
 - (i) vertical glazing (in the absence of any applicable BCA Section J requirements): U-Value <6, SHGC <0.65;
 - (ii) building awnings: SHGC <0.5; and
 - (iii) roofs / canopies: SHGC <0.35.
- (c) In the absence of any BCA Section J requirements, the following minimum performance must be achieved for regularly occupied enclosed spaces:
 - (i) external walls achieve a minimum Total Thermal Resistance of 1.5
 - (ii) roofs achieve a minimum Total Thermal Resistance of 2.0.
- (d) Refer to Appendix B07 for all other sustainability requirements.

3.17 Metro Station Platform Spatial Requirements

3.17.1 General

- (a) The CSM Contractor must construct a new Metro Station island platform that:
 - (i) is a minimum of 170m long;
 - (ii) has a uniform width for the length;

- (iii) is free of columns or other structural elements within the publicly accessible zones; and
- (iv) complies with SWTC Drawing NSRLSRT-PBA-SCS-AT-DWG-938154.

3.17.2 Metro Station Void

- (a) A continuous void is to be established at the northern end of the Metro Station platform on the centreline of the Metro Station, linked only by void structure and VT elements between the following levels:
 - (i) platforms;
 - (ii) basement levels B1 - B3; and
 - (iii) North South Concourse where voids must enclose the escalator landings only.
- (b) In the void area between basement levels B2 and B3 there must be a MCH of 6m at the centreline of the Metro Station platform;
- (c) The dimensions of the Metro Station void must comply with table 6:

Table 6 Void dimensions

Level	LENGTH	WIDTH
Basement Level 1	132 m	8.2m
Basement Level 2	132 m	8.2m
Basement Level 3	170 m	8.2m

3.17.3 Passenger Information Display System PIDS

- (a) The CSM Contractor must provide PIDS displays that comply with the specification requirements in the Interface Schedules, at Metro Station located on the Metro Station platform above each PSD door and in accordance with TfNSW Wayfinding Planning Guide
- (b) The CSM Contractor must provide:
 - (i) PIDS displays integrated into PSDs;
 - (ii) PIDS displays recessed and flushed into the screen of the PSD;
 - (iii) cable containment for PIDS; and
 - (iv) break out point locations to enable PIDS cabling and installation.

3.17.4 Platform Screen Doors (PSDs)

- (a) The CSM Contractor's responsibilities regarding PSDs are outlined in the Interface Schedules.

3.17.5 Passenger Emergency Key Switch (PEKS)

- (a) The CSM Contractor's responsibilities regarding PEKS are outlined in SWTC Appendix F06.
- (b) The CSM Contractor must:
 - (i) allow spatial provision for 8 PEKS to be installed on the platform;
 - (ii) locate the PEKS on the wall enclosures under the Metro Station platform escalators;
 - (iii) minimise edge and trim profiles;
 - (iv) ensure PEKS are securely fixed and discreetly detailed with concealed fixings; and
 - (v) integrate the PEKS with any cladding.

3.17.6 Staff Protection key switch

- (a) The CSM Contractor's responsibilities regarding SPKS are outlined in SWTC Appendix F06.
- (b) The CSM Contractor must:
 - (i) make spatial provision for 2 SPKS at each end of the platform;
 - (ii) locate the SPKS on the wall at each end of the Metro Station platform;
 - (iii) minimise edge and trim profiles;
 - (iv) ensure PEKS are securely fixed and discreetly detailed with concealed fixings; and
 - (v) integrate the SPKS with any cladding.

3.17.7 Sydney Metro City & Southwest Tunnel Access

- (a) The CSM Contractor must provide an elevated tunnel walkway extending from the tunnel portal to the platform ends, for both trackways at both ends of the Metro Station.
- (b) The elevated tunnel walkway must comply with the Sydney Metro Fire Life Safety Strategy and the CSM Contractors Fire Life Safety Strategy.
- (c) The tunnel elevated walkway must:
 - (i) interface and integrate with the tunnel elevated walkway being provided by the Interface Contractor for the running tunnels;
 - (ii) provide level access to the platform through a door in the PSD ;
 - (iii) provide a minimum clear walking width of 850mm measured between the trackside edge of the walkway and the handrail;

- (iv) provide a minimum clear height of 2,000mm for the full 850mm width of the walkway, free of all obstructions;
- (v) provide a continuous handrail along the wall side of the walkway at a height of 1.0m above the walkway measured from the centre of the handrail to the walkway floor level;
- (vi) not have handrails or kick-plates on the track side of the walkway;
- (vii) include a ladder between the trackway and the elevated walkway near the platform end, compliant with AS1657, and which does not encroach on the 850mm clear width;
- (viii) be located outside of the Kinematic Envelope (KE) plus 100mm;
- (ix) have emergency lighting providing:
 - A. a minimum 5 lux at the elevated walkway;
 - B. a minimum 5 lux within the trackway;
 - C. a minimum 4 hours backup power supply;
- (x) have reflective marking along the open, trackside edge of the walkway; and
- (xi) have a non slip- floor surface.

3.17.8 Advertising

- (a) Digital advertising screens and illuminated advertising screens within the Metro platform area must be at least 10m from the fire stair entry doors and at least 10m from the base of escalators.

3.18 Public Seating

- (a) The CSM Contractor must provide seating, including:
 - (i) on island platforms, a minimum of six bench type seats each capable of seating four people, in groups of two back to back, located on the centreline of each platform and evenly distributed along the platform length:
 - (ii) on single-sided platforms, a minimum of four bench type seats, each capable of seating four people, located at the back edge of platforms and evenly distributed along the platform length :
 - (iii) for all platforms one of the allocated bench type seats must be a priority seat located near to a lift:
 - (iv) on new concourses, as required by DSAPT and Premises (Disability) standards, evenly distributed along the concourse length :
- (b) Seating must be customised design, based on leading available industry products and capability, to achieve a high quality unique solution for Central Station and Metro Station.
- (c) Seating design and placement must be sensitive to heritage detailing on the existing surface platforms.

- (d) The location of the seating and windscreens must not impede circulation.
- (e) At least two allocated spaces in each area or 5% of seat spaces must be provided for wheelchair users or customers with prams.
- (f) Seating must be carefully located so as not to encourage loitering.
- (g) Where possible the seating must be integrated into the canopy structure or if stand-alone elements, must have a consistent architectural language.
- (h) Lean bars must be provided for the comfort of waiting customers at platforms and be:
 - (i) integrated with the architectural design;
located in front of void openings on the centreline of platforms and spaced at least 2m apart to occupy not more than 25% of the clear length of the platform, excluding all other fixtures;
 - (ii) clear of pedestrian flows so that Platform Clearance criteria can be achieved;
 - (iii) not in front of train door opening locations; and
 - (iv) not against transparent walls.

3.19 Help Points

3.19.1 Metro Help Points

- (a) The CSM Contractor's responsibilities regarding Help Points are outlined in the Interface Schedules, Schedule C1 - Appendix E1.8.
- (b) Public emergency alarm and Help Points must be:
 - (i) allowed to be installed in a consistent manner across the stations;
 - (ii) located in accordance with the Wayfinding Planning Guide Introduction and applicable legislation. Locations are to be confirmed with the Principal's Representative;
 - (iii) located to maximise visibility and lighting from the surrounding area while minimising the number of units that need to be installed;
 - (iv) positioned so they are clearly identifiable;
 - (v) on platforms; and
 - (vi) at lift entries.

3.19.2 Sydney Trains Help Points

- (a) The CSM Contractor must provide Help Points as a minimum in the following location:
 - (i) Platform 16 to 23 and 12 to 14;
 - (ii) Eastern Entrance paid area;
 - (iii) Northern Entrance paid area;

- (iv) East Concourse; and
- (v) North-south Concourse.
- (b) Public Help Points must be:
 - (i) installed in a consistent manner across the stations;
 - (ii) located in accordance with the Wayfinding Planning Guide Introduction and applicable legislation. Locations are to be confirmed with the Principal's Representative;
 - (iii) located to maximise visibility and lighting from the surrounding area while minimising the number of units that need to be installed;
 - (iv) positioned so they are clearly identifiable;
 - (v) in the paid concourse areas adjacent to the Gatelines;
 - (vi) on platforms and adjacent to the night safe zone;
 - (vii) at lift entries;
 - (viii) in all egress routes and egress refuge areas.
 - (ix) centrally located along the typical passenger circulation; and
 - (x) adjacent the public toilets.

3.20 Infotainment Systems (IS)

- (a) The CSM Contractor must, subject to the requirements of the Wayfinding and Signage Guidelines:
 - (i) provide a standalone IS to enhance pedestrian travel within the Project Works;
 - (ii) experience through the provision of versatile and entertaining media including:
 - A. visual entertainment;
 - B. PA speakers; and
 - C. piped music.
- (b) The CSM Contractor must ensure that the IS has an interface with the 'Fire Panels' and the Project Works visual display units must be capable of use for local evacuation signage;
 - (i) consist of LED visual display units;
 - (ii) centralised media server ;and
 - (iii) control workstation.
- (c) The head-end equipment must be installed in the Project Works communications equipment room.

- (d) Refer to the Appendix B13 for LED display screen sizes and locations.
- (e) Provide data connectivity for the IS via third party networks and the facility for local playback in order to ensure the security and integrity of the RailCorp ICT network.
- (f) The IS must allow for a means of downloading the media contents both locally and or remotely via the third party network from the vender remote media server.
- (g) The visual display unit must be designed in mind with vandal proof housings, be aesthetically pleasing and able to blend in with the finishes, fixtures and Central Station surrounding.

3.21 Light Line Elements

- (a) The CSM Contractor must incorporate the following items from the Sydney Metro North West Public Art Plan with the view of reinforcing a line wide identity and in particular Station Colour in the Metro Station;
 - (i) Application of an LED coloured floor light adjacent to the PSD/PEB along the full length of the Metro Station platform except at doors. The light is to be programed to respond to train arrivals and departures;
 - (ii) Application of a coloured interlayer to escalator balustrade or fall restraint glazing and lift glazing to two faces in the Metro Station; and
 - (iii) Reinterpretation of colour to skylights providing natural light to the Metro Station.

3.22 Fire Compartmentation

- (a) Fire compartmentation is to be provided to comply with:
 - (i) the requirements of the BCA;
 - (ii) the Contractor's FLS strategy; and
 - (iii) the following additional requirements:
 - A. Back-of-house plant and storage areas must be fire separated from public areas with a minimum FRL of (120)/120/120.
 - B. Rooms for main switchboards, power supply equipment, HV equipment, traction power supply substations, battery rooms, switch rooms, and electrical cupboards in public areas must be fire separated with a minimum FRL of (120)/120/120. Any penetrations must have a -/120/- fire rating unless more onerous requirements are required by the services provider.
 - C. Existing fire and smoke rated compartmentation in areas adjacent the Central Station Works and Central Walk Works must be inspected and any deficiencies rectified.
 - D. The existing BOH rooms adjacent the North Concourse and the ESR Concourse must be fire separated from the concourses with a minimum FRL of (120)/120/120.

3.23 Bollards

- (a) Bollards must:
- (i) be used only where necessary to separate pedestrians and streetscape elements from vehicles;
 - (ii) be stainless steel or cast aluminium;
 - (iii) be a minimum 900mm high; and
 - (iv) be a maximum cross sectional dimension of 300mm.

3.24 Cleaning

- (a) Building and civil and structures finishes must be graffiti resistant and easily cleaned by high production cleaning methods.
- (b) Finishes are to be specified that maintain their appearance and do not deteriorate quickly with regular cleaning.

3.25 Acoustic Criteria

- (a) All materials, finishes and fixings must achieve the acoustic criteria requirements and ensure PA/EWIS achieve speech intelligibility index required by ASA Standard T-MU-TE-61005-ST and AS1670:2015 'Fire detection, warning, control and intercom systems - System design', installation and commissioning - Sound systems and intercom systems for emergency purposes.
- (b) For acoustic comfort for customers, the design reverberation time in all public areas must be minimised in accordance with AS2107.
- (c) Noise criteria for service equipment must not exceed the values set out in the following tables when the Station mechanical services are in Normal Operation and the Station is unoccupied.

Table 7 Acoustic criteria

Room/ Area / Zone type	Noise Criteria, LAeq
Paid concourse, Gateline and platform areas (normal fan operation)	55dBA
Paid concourse, Gateline and platform areas (congested fan operation)	65dBA
Paid concourse, Gateline and platform areas (emergency fan operation)	75dBA
Escalators	55dBA
Lifts	55dBA

- (d) The CSM Contractor must design and construct internal spaces of the Project Works (other than those listed in Table 7 and excluding plant rooms) with lower sound levels and reverberation times than the maximum design sound levels and reverberation times stated in AS/NZS 2107.

- (e) The noise criteria for the design of all service systems equipment, as measured in any public areas and within any lifts, must not exceed an Leq of 55 dBA, during normal fan operation and must not exceed an Leq of 75 dBA, during emergency fan operation.
- (f) Verification of the acoustic design within pedestrian areas must be carried out by acoustic computer modelling with the proposed internal finishes, extent of acoustic insulation, PA/EWIS loudspeaker locations and types in order to demonstrate the proposed design will satisfy the reverberation time requirements and speech intelligibility of the PA / EWIS.
- (g) The CSM Contractor must provide acoustic modelling for the whole of the stations area to confirm system coverage for general public and emergency announcements.
- (h) Nuisance overspill of PA noise must be minimised.
- (i) The CSM Contractor must design the PA system based on the outcome of the acoustic modelling.
- (j) In addition to the noise criteria in Planning Approvals, the CSM Contractor must comply with the requirements set by AS/NZS2107, and the internal noise criteria listed in the table below.

Table 8 Internal Noise Criteria

Space / Area	Maximum acceptable noise Level dBA (Leq)
Plant rooms (excluding tunnel ventilation and trackway exhaust fan rooms)	85
Equipment rooms and electrical rooms	75
Customer service desk/office	45
Staff room	40
Locker room	50
Store room	50
Garbage room	65
Ticket sales areas	50

- (k) The above criteria listed in Table 8 do not apply to systems or components of systems, operating in emergency mode. During emergency mode, noise generated by the systems or their components must not exceed levels that affect speech intelligibility in egress paths, evacuation assembly areas, or operational or emergency control rooms or areas.
- (l) Noise from systems or components operating in emergency mode must not exceed 85dBA when measured at 1m from any air intake or discharge point, including internal registers (intake grilles) and grilles.

- (m) In addition to the requirements of Planning Approvals, the CSM Contractor must meet ground-borne continuous and intermittent vibration goals in accordance with the requirements of the NSW EPA Assessing Vibration – A Technical Guideline (2006).

3.25.2 Stations and Station Precincts (internal noise levels)

- (a) The CSM Contractor must design the architectural finishes in all public areas of the Station to enable the public address (PA) system and system for intercom and emergency purposes to achieve speech intelligibility index of 0.5 in accordance with and required by AS1670.4 and the requirements of ASA standard T MU TE 61005 ST.
- (b) The reverberation time in all public areas of the Project Works must be minimised in accordance with AS2107.
- (c) Noise criteria for service equipment must not exceed the values set out in the following Tables (see below Tables 9 to 12) when the Project Works' mechanical services are in Normal Operation and the Central Station Works areas and Metro Station Works areas of the Project Works are unoccupied.

3.25.3 Airborne Noise Requirements

- (a) In addition to the requirements of Planning Approvals, the CSM Contractor must meet the maximum airborne noise requirements.
- (b) The CSM Contractor must, in relation to airborne noise:
- (i) include verification and justification that the mitigation and maintenance measures nominated are feasible and have been used in other equivalent systems effectively; and
 - (ii) meet the noise criteria provided in the NSW EPA Industrial Noise Policy and associated reference notes and standards to that policy.

3.25.4 Ground-borne vibration

- (a) In addition to the requirements of Planning Approvals, the CSM Contractor must meet the ground-borne vibration goals in Table 9.

Table 9 Continuous vibration goals

Location	Trigger
Residential	Day: 106 dB _V (0.2 mm/s)
	Night: 103 dB _V (0.14 mm/s)
Commercial	112 dB _V (0.4 mm/s)
Educational	112 dB _V (0.4 mm/s)
Place of worship	112 dB _V (0.4 mm/s)
Industrial	118 dB _V (0.8 mm/s)
Theatres	106 dB _V (0.2 mm/s)

Location	Trigger
Other critical spaces (e.g. the Dental Hospital located on Chalmers St)	Generic Vibration Criterion (VC) curves in Institute of Environmental Sciences and Technology (IEST) industry Standard IEST-RP-CC012.1 Considerations in Clean Room Design (2007).

3.25.5 Vibration Dose Values

- (a) In addition to the requirements of Planning Approvals, the CSM Contractor must meet the maximum vibration dose values when assessing vibration. The maximum vibration dose values are provided in Table 10 below.

Table 10 Vibration Dose Values (m/s^{1.75})

Location	Day-time criteria	Night-time criteria
Critical areas	0.20	0.20
Residences	0.40	0.26
Offices, schools, educational institutions and places of worship	0.80	0.80
Workshops	1.60	1.60

3.25.6 Tunnel Ventilation

- (a) Within tunnels, the maximum noise levels from any tunnel fan or tunnel fan shaft connection must not exceed the noise limits listed in Table 11.

Table 11 Noise criteria for tunnel fans and fan shaft connections

Measurement location	Noise criteria, L_{Aeq}
Less than 10 m from tunnel fan or fan shaft connection	90dBA
More than 10 m from tunnel fan or fan shaft connection	85dBA

3.25.7 Noise via draught relief

- (a) The CSM Contractor must design the draught relief shafts so that maximum noise levels from train movements in the tunnels do not exceed the noise limits in Table 12 when measured at the nearest residential and commercial premises. The L_{Amax} noise level refers to the 95th percentile train passby event.

Table 12 Noise criteria for draught relief shafts

Usage	Noise criteria, $L_{Amax(95\%, fast)}$
Residential	55dBA
Commercial	65dBA

3.25.8 Testing and Measurements - General

- (a) The CSM Contractor must test and commission the Project Works systems in accordance with the requirements below in section 3.25.9.
- (b) In addition to the requirements of SWTC Appendix B03 the Project Works systems must undergo the following specific noise and vibration testing and commissioning activities below in section 3.25.9.

3.25.9 Measurements - Commissioning tests to demonstrate compliance with operational noise and vibration criteria in the EIS and SWTC

- (a) During commissioning of the CSM Project, the CMS Contractor must undertake noise and vibration measurements to confirm full compliance with the OpNV3 Mitigation Measure in the EIS and all applicable standards, policies and guidelines referred to in the SWTC, including Schedule B.03 Clause 3.25 of the EIS and identify if any additional mitigation measures are required to be implemented prior to the commencement of operations.
- (b) The CSM Contractor must nominate measurement sites which must be selected and submitted with a measurement plan for review and endorsement by TfNSW at least six weeks prior to undertaking the measurements. The measurements shall cover all operational noise and vibration performance requirements covered in the SWTC, including environmental noise, internal noise and vibration from plant and equipment, internal reverberation time and the internal acoustic performance and environmental noise spill from all new public address systems.
- (c) TfNSW must be given the opportunity to witness the measurements. The CSM Contractor must give the Principles Representative at least 3 business days notice when giving this opportunity.
- (d) A report covering the measurements must be submitted for review by TfNSW no later than four weeks after the measurements are completed, and must include 1/3 octave band noise and vibration levels for all measured events, in both electronic (Excel) and hard copy formats.
- (e) Details of the measurement locations and details of noise generating plant and operations must be provided.
- (f) The measurement results must be compared with the applicable noise and vibration criteria and comments provided on whether the noise and vibration criteria are likely to be complied with when operations commence.
- (g) An assessment of additional feasible and reasonable mitigation measures must be undertaken if measurements indicate that applicable criteria are exceeded.
- (h) The report must fully describe the measurements and predictions to enable it to be independently verified by a noise and vibration expert.

3.25.10 Operational noise and vibration compliance testing to demonstrate compliance with Planning Approvals

- (a) Operational noise and vibration compliance testing must be undertaken to meet the requirements contained in the Planning Approvals.
- (b) The proposed measurement locations must be submitted, together with a measurement plan, for review and endorsement by TfNSW at least 12 weeks prior to undertaking the measurements.

- (c) TfNSW must be given the opportunity to witness the measurements. The CSM Contractor must give the Principles Representative at least 3 business days notice when giving this opportunity.
- (d) A draft report covering the measurements must be submitted for review by TfNSW not later than 6 weeks after the measurements are completed. The reporting format must be consistent with the requirements in the Planning Approvals.
- (e) Following receipt of comments from TfNSW and other stakeholders, a final operational noise and vibration compliance testing report must be submitted to TfNSW which is suitable for submission to the Director-General and the EPA as required by the Planning Approvals.

3.26 Pest, Bird and Vermin Protection

- (a) The CSM Contractor must include appropriate measures in the Metro Station, Central Station, Station Precinct and Public Domain to prevent opportunities for winged species to nest or roost and to prevent vermin infestation. Refer also section 4.11.1.
- (b) The CSM Contractor must prepare a pest bird, bat and vermin management strategy describing approach for mitigation of the negative impacts of the presence of pest bird and bat populations on the Metro Station, Central Station, Station Precinct and Public Domain.
- (c) The strategy must assess and report on;
 - (i) potential pest bird, bat and vermin species;
 - (ii) negative impacts of each species; and
 - (iii) strategies to prevent and control each species.
- (d) The CSM Contractor must appoint an ecological expert within 30 days of the commencement of construction, to prepare the pest bird, bat and vermin management strategy. The ecological expert must have experience gained in Australia of pest bird, bats and pest management of infrastructure, public transport and public building projects.
- (e) The CSM Contractor must submit the pest bird, bat and vermin management strategy to the Principal's Representative for approval within 90 days of the commencement of construction.
- (f) The CSM Contractor must demonstrate implementation of the pest bird, bat and vermin management strategy within the Design Documentation for Design Stage 2.
- (g) The CSM Contractor must update the pest bird, bat and vermin management strategy and include it in Design Documentation for Design Stage 3.
- (h) The CSM Contractor must provide a management and maintenance plan for on-going pest bird, bat and vermin management and control by Sydney Trains and the Operator.

4 Station and buildings finishes, fittings, fixtures and Technical Requirements

4.1 General

- (a) This Section 4 defines the minimum workmanship and quality requirements for materials and trades to be used by the CSM Contractor.
- (b) The requirements of this Section 4 supplement those contained in the Room Schedules and Room Data Sheets.
- (c) The CSM Contractor must ensure all the material, finishes, fixtures and fittings for Metro Station, Central Station Precinct and Public Domain are consistent and co-ordinated.
- (d) All material, finishes, fixtures and fittings must:
 - (i) be fit-for-purpose with a focus on meeting customers' needs;
 - (ii) minimise discoloration, leaching, mould growth and deterioration due to wildlife, weathering and UV light;
 - (iii) enhance spatial quality, visual surveillance, permeability, and encourage natural light entry;
 - (iv) minimise hazards to customers, such as slip, trip and fall, rips and cuts;
 - (v) support the CPTED principles and enhance passive surveillance and perceived customer and public levels of safety;
 - (vi) be easily cleaned and maintained without disruption to operations or material performance;
 - (vii) be able to be spot repaired in the case of minor damage and be easily replaced without the removal of adjacent materials and components;
 - (viii) discourage vandalism through material selection and provide a high level of resistance to vandalism and graffiti;
 - (ix) be well-considered in form, application and function to minimise dirt and dust build up from the surrounding environmental conditions;
 - (x) avoid horizontal surfaces and ledges that collect dust, dirt and soiling;
 - (xi) resist damage from train-generated vibrations;
 - (xii) achieve and maintain accessibility requirements for customers and employees;
 - (xiii) be durable and meet the agreed benchmarked standards contained in CSM Contractor's Tender Design.

- (e) The CSM Contractor must comply with all relevant Codes and Standards, including but not limited to fire hazard properties specified in the BCA and CSM Contractor's FLS strategy;
- (f) Fire stairs and associated transfers and corridors and public areas must have linings that as a minimum comply with:
 - (i) Wall and ceilings – Group 1 as defined in BCA; and
 - (ii) floors – minimum critical rate of heat flux of 2.2 KW / m² as defined in BCA
- (g) Any acoustic panels or sound absorption materials in trackways or on platforms must comply with the requirements for Group 1 as defined in the BCA.
- (h) The CSM Contractor must install and assemble all materials in accordance with manufacturer's published instructions;
- (i) The CSM Contractor must use an industrial designer for the design of all public area and customer-facing components;
- (j) Where materials and finishes are used to provide enclosed or covered shelter they must be water-tight and water and weather-proof.
- (k) Standardisation must be provided to achieve a repetitive cladding and flooring geometry, and soffit arrangement within the Metro Station;
- (l) All wall, soffit, floor, base plate fixings must be concealed;
- (m) Any visible fixings must be countersunk and recessed flush or recessed within a shadow gap; and
- (n) Unless specified otherwise all anti-slip finishes must have a minimum slip resistance in accordance with HB197 and AS/NZS 4586.

4.2 Public Area Flooring

- (a) All flooring used throughout the Project Works including set out, joints, expansion joints and access covers must be consistent throughout public areas and integrated within the overall design concept.
- (b) The CSM Contractor must not use asphaltic concrete as a floor finish.
- (c) Floor finishes must withstand maintenance equipment loading.
- (d) Vertical tolerances (of floor finishes) must meet AS1428.1.
- (e) The floor finish must withstand differential surface temperatures. Any movement must not result in permanent deformation.
- (f) Expansion joints must be 304 grade stainless steel strips and be spaced to suit expected structural movement and dimensional change in the flooring material.
- (g) Floor finishes in public areas allowing for occasional water or wash down water throughout must have a non-slip textured finish compliant with AS 4586, AS 1428.1, AS 1428.2, and interpreted by HB 197.
- (h) Any junction between a floor and wall/column must facilitate the cleaning of the floor and ensure no damage to the floor and wall.

- (i) Floor finishes must resist staining, enable easy cleaning and maintenance, be water resistant, hard wearing and durable.
- (j) Floor threshold into plant rooms must be level.
- (k) Floor tiles must be square edged.
- (l) Floor grouting colour must match the tile colour.
- (m) Stone flooring must be impervious and sealed.
- (n) All hard flooring must be laid on a stabilised grout bed of a nominal 40mm thickness, with jointing extended through the substrate to the base structure.
- (o) The CSM Contractor must select from the following range of materials and finishes for public area floors:
 - (i) granite tiles;
 - (ii) bluestone tiles;
 - (iii) ceramic tiles; and
 - (iv) insitu terrazzo.
- (p) The CSM Contractor must ensure that the Chalmers Street Entrance and concourse finishes integrate with the street paving to create a seamless connection between the Chalmers Street Entrance and the public realm.

4.2.2 Surface Drainage

- (a) Surface drain covers must:
 - (i) be 316 grade, number 4 linish stainless steel;
 - (ii) be set flush with the adjacent flooring; and
 - (iii) have compliant slip resistance ratings equivalent to that of adjacent flooring.
- (b) Grates and drains must not be located in primary pedestrian routes where possible.
- (c) Grates and drains must not create hazards for high heels, bicycle wheels or wheelchair wheels.

4.2.3 Access Hatches

- (a) Access hatches must:
 - (i) be set flush with the adjacent finished level;
 - (ii) be discreetly located; and
 - (iii) incorporate a discreet 316 grade, number 4 linish stainless steel edge trim.
- (b) Access hatch materials and finishes must match the adjacent material, alignment and detailing.

4.2.4 Wet Area Flooring

- (a) The CSM Contractor must select from the following materials and finishes for wet area flooring:
 - (i) vitrified ceramic tiles; and
 - (ii) tiles to match the adjacent public area flooring.

4.2.5 Tactile Ground Surface Indicators

- (a) Tactile ground surface indicators must:
 - (i) be selected and applied in accordance with AS1428.4.1;
 - (ii) be placed consistently;
 - (iii) not be installed in front of Platform Screen Doors in the Metro Station; and
 - (iv) have a luminance contrast to the background surface meeting clause 2.2 of AS1428.4.1 in both wet and dry conditions.
- (b) Tactile ground surface indicator joints must align with floor tile joints.
- (c) Integrated tactile indicators must:
 - (i) be pavers of the same material as the adjacent paving; and
 - (ii) be aligned where feasible with the adjacent paving pattern to minimise cut pavers.
- (d) Discrete indicators must:
 - (i) be mechanically fixed to pavement surfaces;
 - (ii) if stainless steel, not use carborundum infill; and
 - (iii) be fixed away from edge of pavement to avoid cracking
- (e) The CSM Contractor must select from the following range of materials and finishes for tactile ground surface indicators:
 - (i) ceramic, concrete tiles or natural stone tiles; and
 - (ii) stainless steel metal studs with contrasting inner fill colour achieving an anti-slip co-efficient as defined in AS/NZS4586 and interpreted by HB197.

4.3 Public Area Wall Cladding

4.3.1 General

- (a) The cladding zone between the floor level and a minimum of 2700mm high in public areas must be suitably robust to resist impact deformation and vandalism.
- (b) Wall finishes in locations where routine cleaning cannot be easily undertaken must have surface characteristics that do not show accumulated dirt and dust.
- (c) Finishing materials must have a diffuse reflectance not less than 30%.

- (d) Acoustic treatment must be integrated with wall and column finishes, and be positioned above 2700mm from finished floor level.
- (e) Acoustic treatments must be integrated within overall assemblies and materials and be capable of withstanding ambient conditions.
- (f) The CSM Contractor must select from the following range of materials and finishes for wall cladding:
 - (i) 316 grade stainless steel finish incorporating solid sheet metal, fully backed;
 - (ii) vitreous enamel;
 - (iii) glass and curtain wall glazed systems;
 - (iv) colourback glass panels;
 - (v) terracotta or glazed ceramics;
 - (vi) natural stone;
 - (vii) timber panels or battens;
 - (viii) pre-cast concrete panels with Class 2CX finish as per AS3610;
 - (ix) glass reinforced concrete (GRC); and
 - (x) aluminium panels or battens incorporating solid sheet metal that is fully backed.

4.3.2 Wet Area Walls

- (a) The CSM Contractor must use floor to ceiling wall tiles on all wet area walls.
- (b) Where wet areas have ceilings then tiling must extend a minimum of 150mm above ceiling line.
- (c) Tile grouting must match the adjacent wall tiles.
- (d) The CSM Contractor must select from the following range of materials and finishes for Station wet areas:
 - (i) glazed or vitrified ceramic tiles.

4.3.3 Skirtings

- (a) Skirtings must be finished flush with the wall lining and be easily cleaned and maintained.
- (b) Skirting material must resist the following without noticeable change in surface appearance:
 - (i) vandalism;
 - (ii) heavy impacts; and
 - (iii) abrasion from cleaning methods, cleaning machines and maintenance systems.

- (c) The CSM Contractor must select from the following range of materials and finishes for skirting in public areas:
 - (i) 316 grade, number 4 finish stainless steel; and
 - (ii) material to match floor finish.

4.3.4 Louvres and Grilles

- (a) Louvres and grilles must:
 - (i) be integrated into building facades and cladding systems in terms of proportion, colour, and finish;
 - (ii) be responsive to context and communities;
 - (iii) be modular in size;
 - (iv) be removable or hinged to permit equipment access;
 - (v) be flush and not protrude beyond the building envelope; and
 - (vi) provide weather protection.
- (b) The CSM Contractor must select from the following range of materials and finishes for louvres and grilles:
 - (i) anodised or powder coated aluminium;
 - (ii) 316 grade, number 4 finish stainless steel; and
 - (iii) terracotta or ceramic battens.

4.4 Anti-vandal Treatment

- (a) The Project Works must be designed to be vandal and tamper resistant.
- (b) Any operating panels and removable elements must only be capable of being opened or removed using specialist tools or machinery.
- (c) An anti-graffiti coating must be applied to the surfaces of all walls, structures and barriers to a minimum height of 3m above the adjacent finished surface level or any accessible foothold or area of the structure that is accessible from above.
- (d) Graffiti must be able to be removed without damage to the surface.
- (e) The application of an anti-graffiti coating must have a consistent appearance and must minimise any difference in the visual appearance of the treated and untreated parts of the structure.
- (f) The anti-graffiti coating must be capable of being reapplied when required in order to maintain the performance characteristics of the coating

4.5 Trackside Walls

- (a) The trackside walls must:

- (i) Be easily accessible for the replacement of electrical components without removing fittings from their mounting, or disassembling adjacent construction;
 - (ii) have all visible fixings countersunk and tamperproof;
 - (iii) be suitable to environmental conditions such as humidity, salinity, corrosive environments and avoid supporting electrolytic action (eg from groundwater);
 - (iv) be detailed to prevent discolouration (e.g. from water ingress via z-bar holes), leaching and mould growth; and
 - (v) be detailed to minimise and mask the accumulation of dirt and dust.
- (b) Shotcrete must not be used as a finish.
- (c) The trackside wall CSR (and its containment) must not be located above the Metro Station platform RL.
- (d) The CSM Contractor must select from either of the following products for trackside walls which must be built with a Class 2CX finish as per AS3610:
- (i) off-form concrete; or
 - (ii) pre-cast concrete panels.
- (e) All exposed concrete that is visible from the Metro Station platform must be treated in accordance with section 4.4 above.

4.6 Public Area Ceilings and Soffits

4.6.1 General

- (a) Ceiling joints must be coordinated with the placement of lighting, signs, and access to mechanical and electrical systems and other equipment, as well as acoustic treatments.
- (b) Ceiling materials must have a diffuse reflectance not less than 30%.
- (c) Acoustic treatment must be integrated with ceiling types and colours.
- (d) Ventilation grilles must be integrated with ceiling types and colours.
- (e) The CSM Contractor must select from the following range of materials and finishes for ceilings and soffits:
 - (i) panelised prefinished metal;
 - (ii) timber panels or battens with clear sealer;
 - (iii) glass and curtain wall glazed systems;
 - (iv) natural stone;
 - (v) glass reinforced concrete (GRC);
 - (vi) Class 2CX pre-cast or off-form concrete; and
 - (vii) ceramic or aluminium tubes or battens systems.

4.6.2 Wet Area Ceilings

- (a) Wet area ceilings must be moisture resistant.
- (b) The CSM Contractor must select from the following range of materials and finishes for wet area ceiling materials:
 - (i) prefinished metal tiles;
 - (ii) fully sealed 6mm compressed fibre cement sheet lining with paint finish and
 - (iii) set 13mm water resistant plasterboard with paint finish.

4.6.3 Bulkheads to Voids and New Platform Openings

- (a) Bulkheads to new openings in the public concourses and platform escalator voids must comply with ceiling requirements described above in section 4.6.1.

4.7 Canopy Soffits

4.7.1 General

- (a) Soffits must be designed to allow a visually integrated system of jointing, services, and acoustic treatments.
- (b) Suspended ceiling systems must provide access to concealed services and have suitable structure and mechanical fixings to withstand air uplift and downdrafts from train movements.
- (c) The CSM Contractor must select from the following range of materials and finishes for visible ceilings and soffits:
 - (i) Class 2CX finished pre-cast concrete;
 - (ii) panelised prefinished metal system;
 - (iii) engineered composite boards with sealed timber veneer; and
 - (iv) ceramic or aluminium panels, tubes or batten systems
- (d) The design of the soffit must prevent birds and other vermin from roosting or nesting.
- (e) Additional vermin deterrent measures (such as spikes) may be used only where hidden from view and must be approved by the Principal's Representative.

4.7.2 Canopy Water Catchment & Drainage

- (a) All new canopies must collect rainwater and connect to the existing Central Station water reuse system.

4.8 Staff Office and BOH Flooring

- (a) The CSM Contractor must ensure that flooring in BOH store, garbage and cleaner rooms are:

- (i) sealed concrete finish which is impervious to attack from concentrated cleaning chemicals; and
- (ii) non-slip floor surface, with good drainage to a floor waste with no liquid ponding.
- (b) The CSM Contractor must select from the following range of materials and finishes for BOH office flooring not covered by section 4.8(a) or section 4.8(c):
 - (i) carpet with heavy duty underlay;
 - (ii) vinyl ; and
 - (iii) rubber.
- (c) The CSM Contractor must select from the following range of materials and finishes for plant and BOH areas excluding metal raised floor systems where specified on Room Data Sheets:
 - (i) concrete with oil resistant sealer (clear penetrating sealer);
 - (ii) vinyl; and
 - (iii) rubber.
- (d) Where scheduled in Room Data Sheets, the CSM Contractor must provide a proprietary raised access floor system that:
 - (i) comprises 600x 600 mm steel removable panels with resilient floor covering;
 - (ii) has concealed lock screws between panels;
 - (iii) has threaded adjustable seats system able to support a 600 deep floor cavity;
 - (iv) has smoke seals to the perimeter; and
 - (v) is able to support a minimum 5kPa loading.
- (e) For raised access floors, the CSM Contractor must, in addition to requirements in MR-T, provide with Design Documentation:
 - (i) a complete layout design for each space;
 - (ii) shop details of the assembly; and
 - (iii) finishes samples.

4.9 Staff Office and BOH Wall Cladding

- (a) The CSM Contractor must select from the following range of materials and finishes for BOH wall cladding:
 - (i) cement render with an integral colour;
 - (ii) fully sealed 9mm compressed fibre cement sheet lining with paint finish; and
 - (iii) concrete or blockwork with a high quality protective paint.

4.10 Staff Office and BOH Ceilings and Soffits

- (a) The CSM Contractor must select from the following range of materials and finishes for BOH ceilings:
 - (i) acoustic grid ceiling system with prefinished mineral fibre tiles;
 - (ii) set 10mm plasterboard sheet lining with paint finished;
 - (iii) off-form class 2 concrete as per AS3610 with a penetrating oil resistant sealer; and
 - (iv) fully sealed 9mm fibre cement or compressed fibre cement.
- (b) The CSM Contractor must select from the following range of materials and finishes for over track areas:
 - (i) off-form class 2 concrete as per AS3610 with clear sealer.
- (c) Ventilation grilles must be integrated, set flush and colour match the adjacent ceiling finish.

4.11 Service Buildings Fabric

4.11.1 Exposed Structures

- (a) The CSM Contractor must ensure the design of exposed structures prevents birds and other vermin from roosting and nesting.
- (b) Additional deterrent measures (such as spikes) must be used only where hidden from customer view.
- (c) Corrosion protection systems and finishes to structural elements such as steel and concrete must be capable of recoating in situ to match adjacent finish, sheen, texture and colour.
- (d) Any exposed structural connections must be well considered and of a high architectural standard in composition and detail to compliment the architectural language of the stations.
- (e) The CSM Contractor must select from the following range of materials and finishes for exposed structures:
 - (i) painted / pre-finished mild steel;
 - (ii) stainless steel; and
 - (iii) concrete with clear sealer.

4.11.2 Service Building Walls

- (a) Service buildings must be designed with consideration of the surrounding streetscape environment and surrounding architectural materiality and language;
- (b) The CSM Contractor must select from the following range of materials and finishes for service buildings walls:
 - (i) precast concrete panels to a Class 2CX finish, with an integrated surface modulation and pattern. Concrete panels must be arranged with vertical

- joint lines and with a single panel spanning from ground level to roof parapet;
 - (ii) recycled brick reclaimed from the demolished buildings and platforms at Central Station;
 - (iii) textured masonry elements integrated with items (i) and (ii);
 - (iv) graffiti resilient 316 grade stainless steel cladding;
 - (v) vitreous enamel cladding;
 - (vi) natural stone;
 - (vii) glass-reinforced concrete (GRC); and
 - (viii) aluminium panels or battens incorporating solid sheet metal.
- (c) The CSM Contractor must optimise opportunities for vegetation and vertical green walls to provide graffiti resilient walls and surfaces.

4.11.3 Services Building Roofs

- (a) Flashings and edge trims on service building roofs must be discreet.
- (b) The CSM Contractor must select from the following range of materials and finishes for service building roofs:
 - (i) concrete with waterproof membrane; and
 - (ii) zincalume metal deck with a Colorbond ® Ultra marine grade finish.
- (c) PV systems, refer section 4.12, may be installed on service building roofs.

4.11.4 Gutters and Downpipes

- (a) Gutters and down pipes must:
 - (i) be integrated with the canopy structure;
 - (ii) be concealed wherever possible; and
 - (iii) have minimal bends.
- (b) Any exposed gutters or down pipes and fittings must be stainless steel or copper.
- (c) Gutters must be integrated with operation and maintenance walkways where applicable.

4.12 PV System

- (a) The CSM Contractor must provide a photovoltaic (PV) array(s) at Central Station to achieve the Appendix B07 requirements and as described in Appendix B04a and obtain maximum peak array power output associated with utilising either:
 - (i) integrated photovoltaic array(s) provided on new or reinstated canopies; or roofs that are integrated with the canopy roof envelope to form the finished roofing material (for example integrated glass PV that functions as the canopy roof); or

- (ii) roof mounted photovoltaic array(s) provided on new or reinstated canopies or roofs that are mounted parallel to the roof pitch.
- (b) The photovoltaic arrays must:
 - (i) utilise consistent panel design and maximised module/panel size within the array(s);
 - (ii) include UV coatings, films or frits as required to achieve a SHGC <0.35 and reflectance of <20% where non-opaque canopies are utilised;
 - (iii) be designed to conceal junction boxes where possible;
 - (iv) be designed to conceal inverters an appropriate distance from the PV array to reduce system losses;
 - (v) are trafficable for maintenance; and
 - (vi) utilise toughened glass encapsulation.

4.13 Stairs and Ramps

- (a) Stairs and ramps must:
 - (i) be positively drained to ensure no pooling or ponding of water;
 - (ii) use handrails;
 - (iii) be provided with minimum 200mm wide concrete kerb edge or restraint wall to each edge;
 - (iv) comply with AS1428.1 and AS1428.2,
 - (v) not have open risers.
- (b) Public access stairs must provide a going of 300mm and a riser of 150mm.
- (c) Materials and finishes for stairs in public areas must match the adjacent public area flooring, jointing and grouting.
- (d) The CSM Contractor must select from the following range of materials and finishes for stair nosings:
 - (i) anti-slip and anti-wear stainless steel or aluminium;
 - (ii) ceramic or stone: and
 - (iii) cast metal with abrasive anti-slip coloured inserts.
- (e) Egress and maintenance access stairs must be in accordance with the CSM Contractor's FLS strategy.
- (f) The CSM Contractor must select from the following range of materials and finishes for egress stairs:
 - (i) concrete with an anti-slip finish; and
 - (ii) steel.

4.14 Handrails, Balustrade and Screens

- (a) Handrails on stairs and ramps must comply with AS1428.1 and AS1428.2, with no hooked end detail.
- (b) Handrails must be 316 grade, number 4 finish stainless steel with outer diameter between 40mm and 50mm.
- (c) Handrails and balustrades must have seamless joints.
- (d) Balustrades must have a minimum height of 1200mm above finished floor level.
- (e) Throw screens and safety barriers around openings must be a minimum of 1500mm high.
- (f) Balustrades on stairs must prevent objects from falling to the level below.
- (g) Balustrade and throw screen framing must be electrolytically-spray painted or pre-finished mild steel or 316 grade, number 4 finish stainless steel.
- (h) Balustrade framing must be painted or pre-finished mild steel or 316 grade, number 4 finish stainless steel.
- (i) The CSM Contractor must select from the following range of materials for balustrade infill:
 - (i) clear low-iron safety glass; and
 - (ii) 316 grade, number 4 finish stainless steel woven mesh.

4.15 Doors and Doorways

- (a) Doors and doorways must comply with AS1428.1 clause 13. This includes circulation and intermediate lobby arrangements.
- (b) Door hardware must meet AS1428.1 clause 13.5.
- (c) The CSM Contractor must use stainless steel materials and finishes for door facings in public areas.
- (d) All doors must use durable and cleanable materials and finishes for door facings in public areas.
- (e) Non-fire-rated doors must be finished flush with adjacent wall surfaces with a matching finish.

4.16 Seating

- (a) The CSM Contractor must engage an industrial designer to design the station seats and fixtures as customised designs, based on leading available industry products and capability, to achieve a high quality unique solution for Central Station and Metro Station.
- (b) All seating types must:
 - (i) be designed as a common suite of elements;
 - (ii) use consistent detailing, use a consistent palette of materials, finishes, fixings and fittings;

- (iii) have concealed footings and fixings; and
 - (iv) provide a minimum 30% luminance contrast to the background environment.
- (c) Seating must:
- (i) incorporate back rests where the seats are adjacent to other objects;
 - (ii) not incorporate back rests where the seats are located with double sided access;
 - (iii) have a stainless steel or cast aluminium frame and posts;
 - (iv) have any slats running parallel to the front edge of the seat;
 - (v) be a minimum length of 1800mm and a minimum width of 400mm;
 - (vi) be installed horizontally level with a height above ground level in accordance with clause 27.2 Note 1 in AS1428.2; and
 - (vii) be securely fixed with concealed fixings.
- (d) Seating must be non- combustible with concessions as permitted in the BCA clause C1.12.
- (e) Seats must comply with the requirements of AS1428.2 and DSAPT including:
- (i) variety of seating with and without armrests; and
 - (ii) seats with armrests and back rests.

4.17 Rubbish Bins

- (a) The CSM Contractor's industrial designer must design customised rubbish bins based on leading available industry products and capability, to achieve a high quality unique solution for Central Station and Metro Station.
- (b) Rubbish bins must:
- (i) be part of a common suite of elements to compliment seating;
 - (ii) use consistent detailing, and a consistent palette of materials, finishes, fixings and fittings;
 - (iii) have a lockable enclosure;
 - (iv) be pest and vermin resistant;
 - (v) be made with vandal resistant and robust materials;
 - (vi) be clearly identifiable;
 - (vii) be transparent (support structure and bags);
 - (viii) incorporate clear labelling for waste and recyclables;
 - (ix) incorporate chute heights in accordance with AS1428.2; and
 - (x) be mounted with concealed fixings.

- (c) Rubbish bins on the Metro Station platform must be at least 10m from the fire stair entry doors and at least 10m from the base of the escalators.

4.18 Barriers and Security Line

- (a) The CSM Contractor must design a barrier for all station entrances that integrates into the station building.
- (b) The barriers must:
 - (i) meet the requirements of the Sydney Metro Security Management Plan;
 - (ii) ensure vehicles cannot be driven into station entrances;
 - (iii) make use of public domain elements to prevent vehicle access;
 - (iv) not be a series of bollards;
 - (v) be integrated into public domain design; and
 - (vi) must not obstruct the flow of customers.

5 Station & buildings materials requirements

5.1 General

- (a) This section 5 defines the minimum workmanship and quality requirements for materials and trades to be used by the CSM Contractor.
- (b) Materials must be capable of maintaining required fire resistance properties and fire ratings including the performance of individual materials and performance of whole assembly.
- (c) The CSM Contractor must ensure the compatibility of systems, components, materials, assemblies and work sequencing so that performance requirements of materials continue at interfaces with adjacent work and construction.
- (d) The Project Works must be vandal and tamper resistant.
- (e) Materials must be capable of attaining required fire resistance properties and fire rating as defined in the CSM Contractor's FLS strategy.

5.2 Concrete

5.2.1 General

- (a) Formwork design and construction for formed surface finishes must be in accordance with AS3610.
- (b) All finishes to exposed cast in-situ concrete elements in public areas must be Class 2CX.
- (c) All finishes to exposed pre-cast concrete in public areas must be Class 2CX.
- (d) Class 2CX precast concrete is defined as follows: Concrete with finish of uniform quality and texture, in accordance with AS 3610 including the following requirements:
 - A. surface finish: Class 2CX steel mound formwork;
 - B. sealed joints to comply with the criteria in Table 13 below:

Table 13 Class 2CX criteria:

Acceptable Quality of Surface Finish- Class 2CX	
Quality of Finish	Class 2CX
1. Blowholes visual quality at lease equivalent to (AS 3610):	AS 3610 Photo B1 (a) and B1 (b) (Class 1)
2. Form face deflection (not greater than)	Lesser of 3mm or span/270
Maximum tolerance of straight elements with smooth surface, in mm	

Percentage of reading:	90%	100%
3. <u>Face step:</u>		
(a) within the element	2mm	2mm
(b) at in situ construction joint	2mm	3mm
4. <u>Surface undulations:</u>		
(a) I-300 (a-b)<=/	2mm	2mm
(b) I-1500 (a-b)<=/	3mm	5mm
5. <u>flatness:</u>		
(a) 1.25m grid	5mm	6mm
(b) at 5m over 10m (not applicable to precast concrete)	6mm	10mm
6. <u>Out of plumb:</u>		
(c) Height <3m	4mm	6mm
(d) 3<height<8m (not applicable to precast concrete)	8mm	10mm

- (e) Refer also to notes detailed in AS 3610 Section 3.3.2:
 - (i) Sample Panel to be provided of dimension 2 x 2 metres.
 - (ii) Colour Control: Final selections must be developed during detailed design and reviewed by the Principal's Representative.
 - (iii) Surface face: Smooth.
 - (iv) Applied Surface Finish: as per section 4.4(c) of this SWTC.
- (f) The CSM Contractor must use smooth, undamaged, unrepaired steel formwork or silicone rubber formwork.
- (g) The CSM Contractor must provide finishes to formed and unformed concrete surfaces which are:
 - (i) appropriate to the importance (visual or physical) of the concrete elements;
 - (ii) compatible with subsequent trades and finishes; and
 - (iii) compatible with the uses and functions.

5.2.2 Finishes and Tolerances

- (a) Unformed surface finishes must be as per Table 14.
- (b) Formed finishes must be to finish classes as per Table 15.

Table 14 Unformed concrete finishes schedule – insitu concrete

Location or related final finish	Concrete substrate finish as laid	Surface tolerance class in accordance with AS3610	Surface modifier
Insitu Internal Floors			
Under sheet or liquid applied waterproof membrane	Steel trowel unless otherwise recommended by the membrane manufacturer	A	Nil
Under carpet and timber floating floor finishes	Steel trowel	A	Nil
Under resilient floor sheet or tile, vinyl rubber or similar finish	Steel trowel	A	Nil
Under seamless liquid applied floor finishes	Steel trowel	A	Nil
Set-downs for thick floor finishes: bedded tile etc: – As a substrate for liquid applied waterproof membrane or debonded topping slabs	Steel trowel unless otherwise recommended by the membrane manufacturer	B	Nil
– As a substrate for bonded bedding or topping slabs, or where no particular requirement	Screeded	C	Nil
Granolithic topping (monolithic on fresh concrete substrate)	Steel trowel	A	Non-slip granules to stair treads, landings and ramps. Non-slip inserts to nosings
Granolithic topping (monolithic on hardened concrete substrate) – Substrate – Topping	Screeded	C	Nil

Table 15 Formed finishes schedules

Location or related final finish	Concrete substrate finish as formed	Applied finish	Tonal scale (AS 3610 Supp 1 Fig B4)
External concrete			

Location or related final finish	Concrete substrate finish as formed	Applied finish	Tonal scale (AS 3610 Supp 1 Fig B4)
Exposed concrete for exterior building surfaces – where not covered by any further applied finish	Off-Form, Smooth Class 2	Nil	Grey Scales 2-5
– where covered by a specified clear coating finish	Off-Form, Smooth Class 2	Clear coating	Grey Scales 2-5
– where covered by a specified opaque coating finish	Off-Form, Smooth Class 2	Opaque coating	Nil
Concealed concrete substrate under waterproof membrane	Off-Form, Smooth Class 3	Membrane	Nil
Concealed concrete substrate under render/plaster or concealed behind other construction elements	Off-Form, Class 4	Various	Nil
Internal concrete			
Exposed concrete for interior building surfaces of public – where not covered by any further applied finish	Off-Form, Smooth Class 2CX	Nil	Grey Scales 2-5
– where covered by a specified clear coating finish	Off-Form, Smooth Class 2CX	Clear coating	Grey Scales 2-5
– where covered by a specified opaque coating finish	Off-Form, Smooth Class 2	Opaque coating	Nil
Exposed concrete for services and utility spaces and all non-public areas e.g. plant rooms, store rooms.	Off-Form, Smooth Class 3	Nil	Nil

- (c) Shotcrete must be Class 2 finish with scribed joints in accordance with AS 3600 and CIA Z5 Shotcreting in Australia.
- (d) Shotcrete must:
 - (i) be concealed from public view;
 - (ii) not be used as a final finish; and
 - (iii) when visible, be painted black.

5.2.3 Colour and Consistency

- (a) Concrete must be uniform in colour and texture with no discolouration.
- (b) Coloured concrete must be cured in accordance with AS/NZS3799.

- (c) To prevent surface blemishing the CSM Contractor must not cure with plastic sheeting, intermittent wetting and drying, membranes, paper, wet hessian sheet, sodium or fluoro-silicate hardeners and other compounds which can cause discolouration.

5.2.4 Concrete Walls

- (a) Concrete walls must:
 - (i) be provided with a 25mm chamfer to exposed edges;
 - (ii) be provided with a 50mm high x 50mm deep shadow-line at ground level;

5.3 Brick and Block Masonry

5.3.1 Standards

- (a) The CSM Contractor must meet the requirements for clay brickwork and concrete blockwork standards as below:
 - (i) masonry units requirements in accordance with AS/NZS4455.1.
 - (ii) materials construction and detailing in accordance with AS3700.

5.3.2 Performance criteria

- (a) The minimum age for clay bricks must be seven days before bricklaying.
- (b) The minimum value of characteristic unconfined compressive strength must be:
 - (i) for concrete blocks used in unreinforced non-loadbearing masonry: 4MPa;
 - (ii) for concrete blocks used in unreinforced load bearing masonry: 10MPa.
 - (iii) for concrete blocks used in reinforced masonry: 15MPa; and
 - (iv) for clay bricks: 20MPa.
- (c) Concrete blocks must have a mean coefficient of residual drying contraction of not more than 0.6mm/m.
- (d) Clay bricks must have a mean coefficient of expansion of not more than 0.8mm/m.
- (e) Connectors and accessories in accordance with AS/NZS2699.1, AS/NZS2699.2 and AS/NZS2699.3.
- (f) Mortar must be tested in accordance with AS3700.
- (g) Flashings and damp-proof courses in accordance with AS/NZS2904.
- (h) Brick block and masonry walls including all connectors, fixings, and supports must be capable of maintaining required fire resistance properties and fire ratings for the whole assembly.
- (i) Brick block and masonry walls including all connectors, fixings, and supports must be capable of maintaining structural integrity for the whole assembly under design loads applicable to each application.
- (j) The CSM Contractor must protect masonry materials and components from ground moisture and contamination.

- (k) The CSM Contractor must ensure the compatibility of systems, components, materials, assemblies and work sequencing so that performance requirements continue at interfaces with adjacent work and construction.
- (l) For steel door frames, the CSM Contractor must fill the backs of jambs and heads solid with mortar as the work proceeds.
- (m) The CSM Contractor must keep the top surface of blockwork covered to prevent the entry of rainwater and contaminants and protect all construction materials from adverse conditions.
- (n) The CSM Contractor must clean progressively as the work proceeds to remove mortar smears, stains and discolouration including;
 - (i) by the use of acid solutions; and
 - (ii) not eroding joints if using pressure spraying.

5.4 Waterproofing

5.4.1 General

- (a) The CSM Contractor must design and install waterproofing systems to protect all new and affected areas in the Project Works, including:
 - (i) new subsurface tunnels and concourse areas;
 - (ii) the Metro Station box; and
 - (iii) exposed surfaces of existing structures were affected by the Project Works.
- (b) The CSM Contractor must provide samples of:
 - (i) each type of membrane, on a representative substrate where necessary;
 - (ii) geotextile fabric;
 - (iii) miscellaneous accessories such as reinforcing fabric, sealant, fixings, primers, adhesives, caulking and protective sheeting; and
 - (iv) layered membrane, stepped to indicate the different layers.

5.4.2 Warranty

- (a) The CSM Contractor must, prior to Construction Completion, obtain a written warranty against defects in labour and/ or materials and provide it to the Principal's Representative.
- (b) The warranty must:
 - (i) be issued jointly by the membrane supplier and the applicator and include unqualified responsibility for the correctness and sufficiency of the materials, detail design, and installation workmanship
 - (ii) be for the benefit of TfNSW;

- (iii) cover:
 - A. materials and labour generally;
 - B. incidentals such as sealants, flashings, drainage cell and reinforcing;
 - C. the identification and location of defects; and
 - D. rectification at no cost to TfNSW of damage resulting from membrane deficiencies.

5.4.3 Slip Resistance and Slip Resistance Testing

- (a) Installed surfaces must be stable, safe and minimise risk of slipping or tripping due to slippery surfaces. Slip resistance must comply with AS 4586.
- (b) Slip resistance test certificates must be provided in accordance with the relevant Codes and Standards, including AS 4586, AS 4663, HB 197 and HB 198, to confirm slip resistance ratings are compliant for each relevant membrane. Batch testing may be carried out in accordance with the requirements of AS 4586 and certification that the material supplied has been tested not more than 12 months prior to their installation.
- (c) Where no slip resistance criteria is specified, evidence that materials comply with HB 197 and HB198 recommendations for specific usages must be submitted.
- (d) The CSM Contractor must submit in Design Stage 2, all wet and dry slip test results for all paving materials options to verify compliance with the relevant Codes and Standards and this SWTC. Tests must be undertaken in situations and conditions that are similar to the final as built locations.
- (e) The CSM Contractor must submit in Design Stage 3, all wet and dry slip test results for final paving materials selected for the project to verify compliance with the relevant Codes and Standards and this SWTC. Tests must be undertaken in situations and conditions that are similar to the final as built locations.
- (f) The CSM Contractor must submit, following installation, all wet and dry slip test results for final paving materials installed to verify compliance with the relevant Codes and Standards and this SWTC.

5.5 Cladding

5.5.1 General

- (a) Cladding must meet the requirements of AS/NZS4284.
- (b) The CSM Contractor must provide external wall and soffit cladding and associated work which:
 - (i) integrates required outlets for services and fixtures, in a manner which is flexible for future change and upgrade;
 - (ii) integrates power and data supplies for connections at a datum of 2400mm above finished floor levels for overhead services;

- (iii) allows for individual panels to be removed for access to concealed services;
 - (iv) satisfies the product performance requirements;
 - (v) provides control joints to accommodate thermal and any other movements;
 - (vi) has fixings as required to withstand the ambient conditions;
 - (vii) complies with the recommendations of SA publication HB 39;
 - (viii) provides for a coordinated and integrated appearance. All associated componentry such as trims, joints and flashings must be compatible in terms of performance and appearance; and
 - (ix) has graffiti protection applied to all visible surfaces.
- (c) The CSM Contractor must ensure that all non-load-bearing facing cladding:
- (i) is individually supported by means of structural stainless steel fixings; and
 - (ii) provides control joints to accommodate thermal and any other movements.
- (d) The CSM Contractor must ensure that all cladding materials and systems meet the following tolerances:
- (i) face dimensions: ± 2 mm;
 - (ii) squareness (difference between diagonals): not more than 1.5 times the tolerance on a long edge;
 - (iii) thickness: ± 3 mm;
 - (iv) flatness: ± 1.5 mm per metre;
 - (v) edge straightness: ± 0.5 mm per metre; and
 - (vi) anchor hole locations: ± 1 mm;
 - (vii) maximum bow or twist in finishes: ± 1.5 mm in 1200 mm; and
 - (viii) maximum bow or twist in natural riven faces: ± 10 mm in 1200 mm.
- (e) All stainless steel sheet, timber panels, stone, terracotta, ceramic and vitreous enamel cladding systems must use 316 grade, number 4 finish stainless steel fixings, which are:
- (i) adjustable in 3 directions;
 - (ii) designed to deflect water from within the cavity;
 - (iii) designed to attach to substrate wall using stainless steel masonry anchors; and
 - (iv) not to be fixed using block liners or resin-bonded fixings.

5.5.2 Performance Criteria

- (a) Design loads on cladding include incidental loads that may occur as those resulting from manufacture, transport, and installation.

- (b) The CSM Contractor must provide for deflections, displacements and other movements:
 - (i) within the cladding systems;
 - (ii) between the cladding systems;
 - (iii) with the building structure (including fire stop and smoke flashing connections if applicable);
 - (iv) from all other adjoining façade elements; and
 - (v) caused by ambient temperature changes, wind loads, design dead and live loads and shrinkage.
- (c) The CSM Contractor must provide cladding systems that accommodate movements silently and without permanent deformation, reduction of performance or other detrimental effects such as:
 - (i) damage to or undue stress on structural elements, fixings and panels/sheets; and
 - (ii) failure of joint seals.
- (d) The CSM Contractor must provide for differential movement between the cladding systems and the building caused by building movements, including:
 - (i) edge beam or slab deflections under applied dead and live loads;
 - (ii) column or frame shortening (elastic, creep, shrinkage etc.); and
 - (iii) lateral deflection under wind load.
- (e) The CSM Contractor must provide for differential movement between the cladding system and adjoining façade elements e.g. curtain wall systems and precast concrete panels or masonry walls.
- (f) Movement joints must meet the following requirements:
 - (i) where movement joints are to be provided within or between structures or structural elements, provision must be made to ensure the movements can be accommodated by the cladding system without damage or distortion; and
 - (ii) movement jointing systems must be visually compatible in finish and material with overall system.

5.5.3 Materials and Products

- (a) The CSM Contractor must isolate dissimilar metals to prevent electrolytic corrosion.
- (b) Aluminium sheet must be powder coated perforated aluminium sheet cladding in accordance with AS 3715:2002 and AS 4506 - 2005;
- (c) Aluminium metal blades / battens must meet the following requirements:
 - (i) powder coat finish in accordance with AS 3715 and AS 4506 - 2005; and
 - (ii) minimum wall thickness of aluminium 4mm BMT.

- (d) Stainless steel sheet must meet the following requirements:
 - (i) 316 grade, number 4 finish facing to BS1449 or equivalent, minimum 1.6mm thickness and
 - (ii) fully bonded to minimum 12mm exterior structural grade plywood – all edges protected.
- (e) Woven wire mesh be 316 grade, number 4 finish stainless steel wire..
- (f) Solid timber cladding must be either timber boards or battens with a minimum 19mm thickness, clear finished;
- (g) Timber panel lining must be of a proprietary prefinished exterior-grade plywood type with slotted face and including black backing scrim to preserve and conceal fixings and acoustic backing where required. Where veneers are used, they must be of veneer quality A.
- (h) Timber batten linings must meet the following requirements:
 - (i) proprietary system of solid factory-finished timber battens complete with rails, clips and other required accessories;
 - (ii) tested in accordance with AS/NZS1080 parts 1-3 for moisture content, grain and density; and
 - (iii) finished with a clear sealer.
- (i) Terracotta or ceramic battens or panels must be:
 - (i) designed and installed to the requirements of BS8298;
 - (ii) a non-watertight proprietary system of terracotta panels and/ or battens, glazed or unglazed finish;
 - (iii) supported on extruded aluminium furring channels (black painted) complete with all accessories and incidentals for complete installation; and
 - (iv) where backing or support wall is masonry, provided with a liquid applied membrane.
- (j) Flush soffit linings must be a minimum of 9mm fibre cement, using a proprietary system of sheets and accessories specially formulated for external use.
- (k) Natural stone cladding, both internally and externally, must:
 - (i) be a minimum of 40mm thick;
 - (ii) be mechanically fixed to substrate with stainless steel pin fixings;
 - (iii) be cavity filled to 1200mm high above FFL with inert grout mix;
 - (iv) be sourced from NSW;
 - (v) be designed and installed to the requirements of BS8298; and
 - (vi) comply with the following property tests.
 - A. unconfined compressive strength (dry and saturated): intact rock core specimens - Test Standard ASTM D7012

- B. unconfined compressive strength (dry and saturated): dimension stone – Test Standard ASTM C170
 - C. surface absorption rate – Test Standard ASTM C97
 - D. porosity – Test Standard ASTM C97
 - E. wet and dry density – Test Standard ASTM C97
 - F. modulus of rupture – Test Standard ASTM C99
 - G. sodium sulphate soundness
 - H. flexural strength – Test Standard ASTM C880
- (l) Vitreous enamel panels must:
- (i) be a proprietary, panelised system of ceramic (vitreous enamel) coated steel;
 - (ii) have concealed fixings and allow for individual panel replacement;
 - (iii) have coating applied to all sides; and
 - (iv) be fully backed to ensure flatness required.
- (m) GRC add info

5.5.4 Architectural Louvres

- (a) Steelwork for architectural louvres must be in accordance with AS/NZS4680.
- (b) Aluminium work for architectural louvres must be in accordance with the following standards:
 - (i) AS/NZS1866;
 - (ii) AS3715; and
 - (iii) ISO11600.
- (c) The architectural louvres must resist the working loads and be fit for purpose to withstand all dead and live loads on the metal cladding and louvre elements and fixings.
- (d) Architectural louvres and grilles must:
 - (i) be integrated into building facades and cladding systems in terms of proportion, colour, and finish;
 - (ii) be responsive to context and communities;
 - (iii) be modular in size;
 - (iv) be removable or hinged to permit equipment access;
 - (v) be flush and not protrude beyond the building envelope; and
 - (vi) provide weather protection where appropriate.
 - (vii) use angled weatherproof blades
 - (viii) be of chevron construction when open above to reduce transparency

- (e) The CSM Contractor must select from the following range of materials and finishes for architectural louvres and grilles:
 - (i) anodised or powder coated aluminium;
 - (ii) electrolytic-applied powder painted mild steel;
 - (iii) 316 grade, number 4 finish stainless steel;
 - (iv) hot dipped galvanised mild steel; and
 - (v) terracotta or ceramic battens.
- (f) Architectural louvre materials must meet the following requirements:
 - (i) aluminium extrusions and sheet for architectural profiles to support glazing;
 - A. sections: select suitable aluminium alloys in profiles, sizes and grades, structural applications and applied finishes to suit the functional requirements and conditions in accordance with AS/NZS1664-1 and AS/NZS 1664-2;
 - B. extrusions generally: to be aluminium alloy grade 6063 temper T5 or T6, in accordance with AS1866;
 - C. blade mullions: to be grade 5083 aluminium;
 - D. sheet: unless otherwise indicated alloy must be grade 5005 temper H34 in accordance with AS1734. Thicknesses of sheet material must not be less than 4mm;
 - (ii) not have direct contact between incompatible metals by suitable means, including separation layers, sleeves or gaskets of plastic film, bituminous felt, mastic, paint coatings and the like. Separation materials must not be visible on exposed surfaces; and
 - (iii) mild steel must be hot dipped galvanised where not exposed painted in accordance with AS1627.0-4.
- (g) The CSM Contractor must complete fabrication, and drill fixing holes before applying coatings.
- (h) The CSM Contractor must remove paint, grease, flux, rust, burrs and sharp edges before applying coatings.

5.6 Window, Curtain Walling, Glazed Screens and Glazed Doors

5.6.1 Codes and Standards

- (a) Windows, curtain walling, glazed screens and glazed doors must meet the following Codes and Standards:
 - (i) AS1428.1 and 1428.2;
 - (ii) windows in accordance with AS2047;
 - (iii) stress analysis of members in accordance with AS/NZS1664.1 or AS/NZS1664.2;

- (iv) glazing thickness, materials, and installation in accordance with AS1288;
- (v) hardware in accordance with AS4145.1 Appendix D;
- (vi) flashings in AS/NZS 2904; and
- (vii) glass types and quality: AS/NZS 4667.
- (viii) aluminium sheet and plate: in accordance with AS 1734;
- (ix) aluminium alloy sections: in accordance with AS 1866; and
- (x) architectural coatings: in accordance with AS1231 and AS 4506

5.6.2 Performance Criteria

- (a) The CSM Contractor must design and construct window systems and associated work, which must:
 - (i) provide adequate means of dealing with vapour pressure, condensation and corrosion;
 - (ii) provide adequate means of dealing with thermal movement and differential movement of the building structure;
 - (iii) provide and maintain the design lines, section profiles and stiffness of components; and provide for deflections, displacements and other movements:
 - A. within the window and door assemblies;
 - B. between the window and door assemblies and the building structure (including fire stop and smoke flashing connections if applicable), and all other adjoining façade elements (e.g. cladding, masonry); and
 - C. caused by ambient temperature changes, wind loads, design dead and live loads and shrinkage.
- (b) The CSM Contractor must provide windows and doors to accommodate movements silently and without permanent deformation, reduction of performance, or other detrimental effects such as:
 - (i) damage to or undue stress on structural elements, fixings, glass and panels;
 - (ii) failure of joint seals; and
 - (iii) loss of normal function in operable elements (e.g. doors and window sashes).
- (c) The CSM Contractor must provide within windows and doors assemblies that must not:
 - (i) reduce the glass "bite" to less than 75% of the design dimension; or
 - (ii) reduce the clearance between framing members and non-structural infill units (e.g. glass) or between framing members and operable units (e.g. sashes, doors) to less than the minimum specified by the respective unit manufacturers.

- (d) Where movement joints are to be provided within or between structures or structural elements, provision must be made to ensure the movements must be accommodated by the window and door systems without damage or distortion.

5.6.3 Material and Components

- (a) All framing must be heavy duty, commercial grade.
- (b) Minimal wall thickness of any component (except beads) must be 2.5mm.
- (c) Flashings and weatherings must be corrosion resistant, compatible with the other materials in the installation, and coated with a non-staining compound where necessary. Visible flashings and weatherings must be of the same materials and finishes as the exposed framing members of the window and door systems unless otherwise specified.
- (d) Fasteners and fastener spacing must conform to the recommendations of the manufacturer.
- (e) Fasteners must be concealed.
- (f) Joints must be accurately fitted tight joints so that neither fasteners nor fixing devices such as pins, screws, adhesives and pressure indentations are visible on exposed surfaces.

5.7 Glazing

5.7.1 General

- (a) Glazing for exterior and interior building elements must meet the following standards:
 - (i) AS/NZS1866;
 - (ii) AS1288;
 - (iii) AS/NZS2208;
 - (iv) AS3715;
 - (v) ISO 11600; and
 - (vi) AS/NZS4667.
- (b) The glazing including facades, windows, walls, glazed entry doors, roof lights, balustrade, integrated components and other glazed elements must:
 - (i) minimise dirt and litter build-up and streaking;
 - (ii) be self-cleaning low iron glass except internal glass not exposed to the weather;
 - (iii) must be blast resistance glass if required:
 - A. by the Sydney Metro Security Management Plan; or
 - B. to concourse areas for smoke control.
 - (iv) have crowd loading and structural stability; and

- (v) where glass is within a public reach zone, it is required at a minimum to include a proprietary film to help prevent scratch damage or vandalism.

5.7.2 Performance Criteria

- (a) The CSM Contractor must ensure that in designing for thermal loads the following are considered:
 - (i) thermal stability: no glass must suffer from thermal fracture; and
 - (ii) thermal analysis: carry out a thermal analysis for all ordinary annealed glass applications, demonstrating that the glass will not suffer from thermal fracture. The analysis must consider, orientation, glass type, glazing method, framing material, framing colour, framing shading, external shading and blind/drape types.
 - (iii) the glazing including facades, windows, walls, glazed entry doors, roof lights, balustrades, integrated components and other glazed elements must:
 - A. limit solar heat gain and UV penetration where enclosing or providing covered shelter.
 - B. minimise dirt and litter build-up and streaking;
 - C. be self-cleaning low iron glass;
 - D. be designed within a blast-resistant assembly including glass and framing; to conform to ASA TN 066: 2016
 - E. have a thermal performance of SHGC (shading coefficient) of 0.7 or lower; an insulation factor of 2.5 or less; and a daylight transition coefficient of 40% or higher;
 - F. have a maximum reflectivity of 20%; and
 - G. where installed in overhead locations, be finished with a ceramic frit pattern with minimum 30% obscurity to conceal dirt or water marks.
- (b) The CSM Contractor must ensure that in designing for displacement limits glass deflection due to horizontal loads from serviceability wind pressure including operational air pressures due to running trains and ventilation requirements, as installed and without permanent deformation, must not exceed
 - (i) for 4-sided support: span/90 or 20mm whichever is smaller; and
 - (ii) for 2-sided support: span/90 or 35mm whichever is smaller.
- (c) The CSM Contractor must ensure that in designing for movements:
 - (i) provision is made for deflections, displacements and other movements within the glazed assemblies including but not limited to movements caused by deflections of building structure, ambient temperature changes, wind loads, and design dead and live loads; and

- (ii) provision is made for glazing to accommodate movements silently and without permanent deformation, reduction of performance, or other detrimental effects.

5.7.3 Materials and Components

- (a) The CSM Contractor must ensure that:
 - (i) all glass panels in public and external areas are laminated, and in combination with annealed, heat strengthened, or toughened as required by specific applications; and
 - (ii) glass and glazing materials provided are of a thicknesses to comply with AS1288.
- (b) All glazing in public areas must be designed to minimise fragmentation and panel separation associated with the threat protection requirements of the Sydney Metro Security Management Plan.
- (c) Glass and glazing materials must:
 - (i) for glass, be free from impurities e.g. nickel sulphide, or other defects which detract from appearance or interfere with performance under normal conditions of use;
 - (ii) for glazing plastics, be free from surface abrasions, and warranted by the manufacturer (for the design life) against yellowing or other colour change, loss of strength and impact resistance, and general deterioration;
 - (iii) have glass tolerances (size, squareness and flatness) in accordance with AS/NZS2208;
 - (iv) have plate and sheet:
 - A. for roller wave: maximum 0.15 mm. The peaks and troughs of the roller wave must run horizontally in the installed glass panes;
 - B. for float glass quality: glazing select quality q3 in accordance with ASTM C 1036;
 - (v) meet safety glass standards in accordance with AS/NZS2208;
 - (vi) have a permanent standards mark;
 - (vii) have heat soaking where required for all toughened and heat strengthened glass exposed to the exterior;
 - (viii) for insulating glass units (double glazed units), comply with AS/NZS4666 2012;
 - (ix) have a blast resistant film as required by the Sydney Metro Security Management Plan; and
 - (x) for opacified glass, must comply with ASTM C 1048.
- (d) Glazing materials (including glazing compounds, sealants, gaskets, glazing tapes, spacing strips, spacing tapes, spacers, setting blocks and compression wedges) must be appropriate for the conditions of application and the required performance.

- (e) Structural glazing materials must be provided where glass is not secured by other physical means.
- (f) Jointing materials must be compatible with each other and with the contact surfaces and non-staining to finished surfaces. Bituminous materials must not be used on absorbent surfaces.
- (g) Elastomeric sealants must meet the following requirements:
 - (i) sealing compound (polyurethane, polysulphide, acrylic);
 - (ii) single component: Type II, Class A;
 - (iii) multi component: in accordance with ASTM C920;
 - (iv) sealing compound (silicone);
 - (v) single component: Class A; and
 - (vi) multi component: in accordance with ASTM C920.
- (h) Pile weather strips must meet the following requirements:
 - (i) materials: polypropylene or equivalent pile and backing, low friction silicone treated, ultra violet stabilised; and
 - (ii) finned type: a pile weather seal with a central polypropylene fin bonded into the centre of the backing rod and raised above the pile level.
- (i) Extruded gaskets and seals must meet the following requirements:
 - (i) type: non cellular (solid) elastopressive seals;
 - (ii) material:
 - A. rubber products (neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber): to BS4255:1; and
 - B. flexible polyvinyl chloride (PVC): To BS2571, E type compounds, colour fastness grade B.
- (j) The CSM Contractor must apply manufacturer's recommended primer to the surfaces in contact with sealant materials.
- (k) Movement joints must meet the following requirements:
 - (i) depth of elastomeric sealant: one half the joint width, or 6 mm, whichever is the greater;
 - (ii) foamed materials (in compressible fillers and backing rods): closed-cell or impregnated types that do not absorb water; and
 - (iii) bond breaking: backing rods, and other back-up materials for sealants that do not adhere to the sealant.

5.8 Roofing

5.8.1 Roof Cladding Materials

- (a) The CSM Contractor must design and install sheet roof and wall metal cladding in accordance with AS1562.1.
- (b) The CSM Contractor must design and install roof drainage systems in accordance with AS/NZS3500.3.
- (c) The CSM Contractor must select from the following range of materials and finishes for all new and modified canopy structure:
 - (i) zinalume metal deck with a Colorbond ® Ultra marine grade finish;
 - (ii) zinc; and
 - (iii) copper or similar high quality alloy.
- (d) The CSM Contractor must select from the following range of materials and finishes for canopy fascia:
 - (i) painted mild steel with protective paint coating system;
 - (ii) solar performance or UV rated glass; and
 - (iii) formed metal cover panel- for the Eastern Entrance only.

5.8.2 Performance Criteria

- (a) The CSM Contractor must provide roofing systems and associated works that:
 - (i) are durable and remain intact, weatherproof and waterproof under the ambient in-service atmospheric and climatic conditions of the installations;
 - (ii) withstand the specified imposed loads without damage or impairment of performance;
 - (iii) provide adequate means of dealing with vapour pressure, condensation and corrosion;
 - (iv) provide adequate means of dealing with thermal movement and differential movement of the building structure; and
 - (v) provide and maintain the design lines, section profiles and stiffness of components.
- (b) The CSM Contractor must ensure that design loads:
 - (i) for roofing include the most severe loading or load combination from the design loads specified herein; and
- (c) are established from AS/NZS1170.1 incorporating amendments or in accordance with statutory regulations, whichever are the most stringent. The CSM Contractor must ensure that wind load pressure coefficients are established in accordance with AS/NZS1170.2.
- (d) The CSM Contractor must ensure that earthquake loads for architectural components are established in accordance with AS/NZS1170.4.

- (e) The CSM Contractor must ensure that incidental and maintenance loads:
 - (i) accommodate all permanent and temporary incidental stresses that may arise during both the service life and construction phases. Such stresses must include those due to manufacture, transport, installation and in-service maintenance; and
 - (ii) comply with building regulations and statutory requirements regarding imposed loadings as applicable.
- (f) The CSM Contractor must ensure that the thermal performance of roofing in conjunction with insulation and vapour barriers must achieve the minimum thermal properties specified in BCA section J.
- (g) The CSM Contractor must ensure that measures are taken to prevent drumming effect from rainfall on metal roofing.
- (h) Roof penetrations must:
 - (i) where supports or fixings penetrate metal roofing materials, have suitable flashings such that roofing remains weatherproof and watertight;
 - (ii) be located such that roof water does not become trapped in pans between ribs;
 - (iii) use flexible Ethylene Propylene Diene Monomers (EPDM) polymer overflashings or equivalent; and
 - (iv) form to the profiles of the penetrating elements and roofing and seal with neutral-cure silicone mastic.
- (i) The CSM Contractor must ensure that:
 - (i) supported items are separated from roofing by means of flexible mounts or isolator strips;
 - (ii) roof loads are distributed such that roofing material is not caused to distort; and
 - (iii) electrolytic corrosion is prevented.

5.8.3 Quality

- (a) The CSM Contractor must ensure that the design and installation of metal roofing is in accordance with AS1562.1.

5.8.4 Roof Plumbing

- (a) The CSM Contractor must ensure that the design and installation of roof drainage systems is in accordance with AS/NZS3500.3.
- (b) The CSM Contractor must ensure that roof plumbing components, including flashings, cappings, gutters, rainwater heads, overflows, outlets, downpipes, and incidentals necessary to complete the roof system are free of distortions.
- (c) Metal rainwater components must be in accordance with AS/NZS2179.1.
- (d) Flashing and capping materials must be in accordance with AS/NZS2904.

- (e) Flashing and capping sheet metal types must be folded profiles, according to case material and colour to match the main roofing type.
- (f) Roof plumbing materials and systems must be compatible with rainwater harvesting in accordance with Appendix B07.

5.8.5 Glazed Roofing

- (a) For glazed roofing including glazing and framing requirements refer to section 5.7.
- (b) The CSM Contractor must select solar performance or UV rated glass use for glazed roofing, skylights and the like.
- (c) The CSM contractor must demonstrate an effective strategy for cleaning, repair, roof safety, and maintenance of the proposed material.

5.8.6 Translucent Roof Cladding

- (a) Design, supply and installation of translucent roof cladding must be by a specialist installer.
- (b) Translucent roofing product must be:
 - (i) Safety glass; or
 - (ii) ETFE closed cell sheet membrane.
- (c) The translucent roofing configuration must provide extruded continuous aluminium edge stiffeners to permit fixing to steel structure as necessary using stainless steel fixings concealed wherever possible using lapped profile sheeting.

5.8.7 Roof Access

- (a) The CSM Contractor must provide roof access and safety for roofing in accordance with:
 - (i) access for maintenance: AS1657;
 - (ii) industrial fall-arrest systems and devices: AS1891 Parts 1-4;
 - (iii) design loads: AS 1170; and
 - (iv) any other specific requirements of WorkCover.
- (b) Ladders, walkways and platforms must conform to the following requirements:
 - (i) materials and components must be fabricated as required and continuous welded;
 - (ii) finishes of:
 - A. internal items must be painted in accordance with requirements in section 5.17; and
 - B. external items must be hot dip galvanised to ASTM A653, after fabrication.
- (c) The fall arrest system must:

- (i) provide visually unobtrusive roof fall arrest and façade access systems integrated with roof access;
- (ii) have all connections and attachments to structural members;
- (iii) include components, anchor points and static lines, all in accordance with the requirements of statutory authorities;
- (iv) be 316 grade stainless steel, number 4 finish; and
- (v) maintain the waterproofing integrity of roofing and cladding without damage or distortion.

5.9 Wall and Ceiling Linings

- (a) Fabrication and installation tolerances must meet the following requirements:
 - (i) joint alignment tolerance must :
 - A. for panel sizes < 600mm be +/- 2mm;
 - B. for panel sizes > 600mm be +/- 3mm;
 - (ii) flatness tolerance must:
 - A. have no visible oil canning;
 - B. for panel sizes < 600mm be +/- 1mm from design profile; and
 - C. for panel sizes > 600mm be +/- 2mm from design profile.
- (b) Lining must have Fire Hazard Properties that:
 - (i) comply with BCA clause C1.10 and related BCA Specification C1.10a. Verify by prescribed testing; and
 - (ii) comply with requirements of the CSM Contractor's FLS strategy;
- (c) Plasterboard must meet the requirements of AS/NZS2588:
- (d) Fibre cement must:
 - (i) comply with AS/NZS2908.2;
 - (ii) for wall and ceiling linings, be type b category 3; and
 - (iii) have recessed edge for flush-set plaster joints;
- (e) Compressed fibre cement must:
 - (i) comply with AS/NZS 2908.2; and
 - (ii) for compressed lining/cladding, be type a category 5.
- (f) Plywood must:
 - (i) for interior use, comply with AS/NZS2270;
 - (ii) for exterior use:
 - A. generally comply with AS/NZS2271. bond quality type A;

- B. for marine quality, comply with AS/NZS2272;
- (iii) high pressure decorative laminate sheet, comply with AS/NZS2924.
- (g) Particleboard must:
 - (i) comply with AS/NZS1859.1;
 - (ii) be classified according to fitness for purpose in the subject location(s) in accordance with the following:
 - A. general non-air conditioned and air conditioned areas: moisture resistant, general purpose; and
 - B. humid/wet areas: high performance.
- (h) Dry-processed fibreboard (also referred to by common industry term "medium density fibreboard (MDF)") must:
 - (i) comply with AS/NZS1859.2;
 - (ii) be classified according to fitness for purpose in the subject location(s) in accordance with the following:
 - A. general non-air conditioned and air conditioned areas: moisture resistant medium density fibreboard;
 - B. humid/wet areas: high performance medium density fibreboard.
- (i) Ceramic tiles installation must comply with AS3958.1 and BS5385-3 and adhesives be tested in accordance with AS/ISO13007.

5.10 Plastering and Rendering

- (a) Gypsum plaster must be a proprietary product containing calcium sulfate hemihydrates with additives to modify setting.
- (b) Lime render must be limes for building in accordance with AS1672.1.
- (c) Lime putty must meet the following requirements:
 - (i) stand dry hydrate of lime in accordance with AS1672.1 and water for 24 hours or more without drying out; and
 - (ii) stand quicklime and water for 14 days or more without drying out.
- (d) Metal lath must be expanded metal in accordance with AS1397.

5.11 Suspended Ceilings

5.11.1 General

- (a) Suspended ceilings must be coordinated with structural and services requirements and installed to manufacturer's recommendations.
- (b) Suspended ceilings must meet the following standards:
 - (i) suspended ceilings: in accordance with AS/NZS2785; and
 - (ii) luminaire and air diffuser interface: in accordance with AS 2946.

- (c) Suspended ceilings must satisfy strength, serviceability, stability and durability requirements of AS/NZS2785.
- (d) Suspended ceilings must meet the following requirements:
 - (i) dead, live, wind and earthquake loads in accordance with AS/NZS2785 and AS1170;
 - (ii) wind loads in accordance with AS/NZS1170.2. The CSM Contractor must take into account all relevant variable local and project exposure factors and their respective multipliers:
 - A. importance level (BCA table B1.2a): 3;
 - B. annual probability of exceedance: 1 : 1000;
 - C. regional wind speeds v 1000 (ultimate): 46 m/s;
 - D. basic wind speed v 20 (serviceability): 37 m/s;
 - E. region: A2; and
 - F. terrain category: 3;
 - (iii) fire resistance in accordance with the CSM Contractor's FLS strategy;
 - (iv) earthquake loads:
 - A. architectural components in accordance with AS1170.4;
 - B. provide ceiling systems that resist the effects of changes in temperature and humidity;
 - C. corrosive atmosphere effects resistance; and
 - D. provide ceiling systems that resist the effects of corrosive atmospheres.

5.11.2 Materials and Components

- (a) Supports and trim for coated steel must be:
 - (i) hot dip galvanised in accordance with AS1397; and
 - (ii) coating class: Z200 or AZ150 as applicable.
- (b) Supports and trim for aluminium must be:
 - (i) in accordance with AS 1866; and
 - (ii) architectural quality finish.
- (c) Panels and linings must meet the following requirements:
 - (i) fire resistance:
 - A. fire hazard properties: comply with BCA clause c1.10 and related BCA specification C1.10a; or
 - B. the CSM Contractor's FLS strategy, whichever results in the more stringent requirement;

- (ii) plasterboard in accordance with AS/NZS2588;
- (iii) fibre cement:
 - A. in accordance with AS/NZS2908.2;
 - B. type: type b, category 2. Recessed edge for flush-set plaster joints;
- (iv) compressed fibre cement in accordance with AS/NZS 2908.2; and
- (v) mineral fibre tiles must be spun mineral fibres pressed together with mineral fillers and binders in accordance with AS/NZS2785.
- (d) Metal panel lining must be coated steel in accordance with AS1397.
- (e) Proprietary systems must meet the following requirements:
 - (i) consistency: provide suspended ceilings as complete proprietary systems, each fabricated by one manufacturer and installed by a specialist installer of demonstrated capacity; and
 - (ii) support: complete proprietary suspension system fixed to the structural framing.

5.12 Tiling and Paving

5.12.1 General

- (a) All tiling and paving materials, components, treatments and proprietary products including membranes, acoustic/impact insulation, admixtures, adhesives, bedding materials, grouts, joint sealants, pre-sealers and finishing sealers and the like, must be compatible when used in association with each other and the substrates.
- (b) Tiling and paving must comply with the manufacturers'/suppliers' published recommendations.
- (c) For the whole quantity of each material or product use the same source or manufacturer and provide consistent type, size, quality and appearance.
- (d) Tiles and accessories must be best commercial quality (first quality) vitrified tiles in accordance with AS/ISO13006 for classifications, characteristics and marking requirements.
- (e) In positions where the edge is exposed purpose-made border tiles with the exposed edge (whether round, square or cushion) glazed to match the tile face must be used.
- (f) Tile accessories must match the composition, colour and finish of surrounding tiles.
- (g) Coves, nosings and skirtings must have matching stop ends and external angle tiles moulded for that purpose. If such tiles are not available, install plastic external corner quad trim of colour to match tiles.

- (h) Skirting tiles with cove must be provided to tiled floors in food and beverage, and wet areas.
- (i) Adhesives must be in accordance with AS2358.
- (j) Premixed mortar must not be used.
- (k) Cement type must be in accordance with AS3972.
- (l) White cement must have iron salts content <%.
(m) Off-white cement must have iron salts content <2.5%.
- (n) Sand must be washed fine aggregate selected for grading and have clay content <5%.
- (o) Lime must be in accordance with AS1672.1.
- (p) Water must be in accordance with AS3958.1.
- (q) Bedding mortar/screed must :
 - (i) be proportioned from the range 1:3 – 1:4 cement: sand, with minimum water and/or appropriate admixtures;
 - (ii) be mixed in accordance with AS3958.1;
 - (iii) be reinforced using 50 x 50 x 2.5mm galvanised wire mesh in accordance with AS3958.1;
 - (iv) have proprietary admixtures that are suitable for purpose for the particular circumstances, limitations and conditions of service;
 - (v) use admixtures in accordance with the manufacturers' published instructions;
- (r) External tiled areas reinforced polymer modified bedding mortar/screed must:
 - (i) be proportioned at 1:4 cement: sand, together with an approved polymer admixture; and
 - (ii) reinforced with 50 x 50 x 2.5mm galvanised wire mesh in accordance with AS3958.1.
- (s) waterproofing wet areas must:
 - (i) for standard wet areas be in accordance with AS3740; and
 - (ii) comply with the waterproofing of wet areas as required by the BCA and AS3740.
- (t) Slip resistance must;
 - (i) be compliant with AS/NZS4586 and interpreted by HB197, allowing for all public surfaces to be wet, and:
 - (ii) be demonstrated compliant by manufacturer's test data including compliant wet pendulum test results from a NATA certified laboratory.

5.12.2 Stone Paving

- (a) Stone paving must have bedding and grouting mortar using a mix which is suitable for the stone type and must contain an admixture which prevents efflorescence and leaching.:
- (b) After paving installation is complete and thoroughly cleaned, a stone surface enhancer and hardener must be applied.
- (c) Stone materials must come from the same area stock within the source quarry.
- (d) Any granite must be in accordance with AS3958 and AS/NZS4455.
- (e) Any blue stone must be in accordance with AS4459.
- (f) Natural stone pavements must be coordinated with structural and services requirements.

5.12.3 Terrazzo floor finishes

- (a) The following tolerances must be met for terrazzo wall and floor finishes:
 - (i) thickness < 15 mm: ± 2 mm;
 - (ii) thickness $\geq 15 < 30$ mm: ± 5 mm;
 - (iii) thickness ≥ 30 mm: ± 10 mm;
 - (iv) flatness: measured under a 3000 mm straightedge laid in any direction on a plane surface: < 3 mm;
 - (v) tile/panel joint alignment < 600mm : ± 1 mm; and
 - (vi) >600mm: ± 2 mm.
- (b) Water for cement matrix terrazzo must be clean and free from any deleterious matter.
- (c) Cement for cement matrix terrazzo must be in accordance with AS3972.
- (d) Fine aggregate for cement matrix terrazzo must be fine, sharp, well graded sand with a clay content less than 5% and free from efflorescing salts.
- (e) Coarse aggregate (in underbeds and cores) for cement matrix terrazzo must be dense natural rock aggregate.
- (f) Facing aggregate for cement matrix terrazzo must be: dense natural rock aggregate.
- (g) Natural stone for cement matrix terrazzo must be angular in shape, as distinct from elongated or flaky, graded within the required sizes, free from dust and free from deleterious material.
- (h) Pigments for cement matrix terrazzo must be:
 - (i) resistant to lime bloom and efflorescence; and
 - (ii) $\leq 5\%$ by weight of cement.
- (i) Reinforcement for cement matrix terrazzo must be in accordance with AS3600 and be galvanized.

- (j) Divider strips for cement matrix terrazzo must be:
 - (i) a proprietary single preformed brass bar strip for insitu applications, with lugs or ribs for mechanical keying of depth appropriate to the topping thickness and such that the strip is anchored firmly in the underbed and set flush with the finished surface;
 - (ii) positioned directly below the closed door where changes of floor finish occur at doorways;
- (k) cement matrix terrazzo mix must be 4 cement: 9 facing aggregate (by weight) with water : cement ratio of 18 L water : 40 kg cement.
- (l) Movement joints for cement matrix terrazzo must be a proprietary expansion joint consisting of a neoprene filler sandwiched between plates with lugs or ribs for mechanical keying, in accordance with AS3958.
- (m) Slide plate divider strips for cement matrix terrazzo must be an arrangement of interlocking metal plates grouted into pockets formed in the concrete joint edges.
- (n) Sealant for cement matrix terrazzo must be one-part self-levelling non-hardening mould resistant, silicone or polyurethane sealant applied over a backing rod, finished flush with the terrazzo surface.
- (o) Trafficable cement matrix terrazzo floors must have shore hardness > 35.
- (p) Backing rods used in cement matrix terrazzo floors must be compressible closed cell polyethylene foam with a bond-breaking surface.
- (q) Slip resistance of cement matrix terrazzo floor finishes must be in accordance with AS4586 – 2013 incorporating Amendment 1 2017 and SA HB 198:2014 Handbook Guide to the Specification and testing of slip resistance of pedestrian surfaces..
- (r) The inclusion of admixtures such as Carborundum to the cement matrix terrazzo mix which may be required to comply with slip resistance levels for stairs, landings and floor areas exposed to wet weather is permitted, noting that the mix colour may be altered for such areas, with a sample of the final terrazzo finishes to be submitted in accordance with MR-T.
- (s) Base preparation for cement matrix terrazzo floors must be:
 - (i) rigid, dry, sound, smooth and free from grease, dirt and other contaminants;
 - (ii) sufficient to permit specified flatness and regularity of finished surfaces, given the permissible minimum and maximum thickness of bedding; and comply strictly to manufacturer's recommendations.

5.13 Resilient Finishes

- (a) Fire Hazard Properties of resilient finishes must:
 - (i) have critical radiant flux in accordance with BCA specification C1.10a-2, Table 1 of 1.2kW/M2; and
 - (ii) comply with the CSM Contractor's FLS strategy.

- (b) Concrete substrates for resilient finishes must be tested for dryness before laying or coating, using the hygrometer test or electrical resistance test described in AS1884 appendix A. the substrate relative humidity must not exceed 70% to ensure adhesion in accordance with AS1580.408.4.
- (c) Slip resistance of resilient finishes must be in accordance with AS/NZS4586.
- (d) Edges of resilient finishes sheets and tiles must be firm, unchipped, machine-cut accurately to size and square to the face, and tile edges are square to each other
- (e) Resilient finish underlays must comply with the supplier and installer’s recommendations and must be compatible with floor covering and associated products and materials.
- (f) Levelling compound for resilient finish substrate must be polymer modified cementitious self-smoothing and levelling compound to achieve even surface.
- (g) Surface tolerances for resilient finishes must be in accordance with AS1884 clause 2.1.1.3.
- (h) The thickness of resilient finishes must be a minimum of 2.5mm.
- (i) Adhesives used in association with resilient finishes must be in accordance with AS1884 and manufacturers recommendations AS3553.
- (j) Linoleum must be in accordance with BS/EN/ISO24011.
- (k) Rubber must be in accordance with BS8203.

5.14 Carpets

- (a) The fire resistance of carpets must have critical radiant flux in accordance with BCA specification C1.10a-2, Table 1 of 1.2kW/M2.
- (b) Carpet tolerances must be in accordance with AS/NZS 1385.
- (c) Carpet laid in a single area must be of a single specified type, quality, colour and design and come from one manufacturing batch and dye lot. For insect resistance, carpets must be treated with insecticide complying with IWS E -10 or Woolmark Specification CP-4:2013 and the approved insecticides in Table 11 below.

Table 16 Approved insecticides

Insecticide	Min level of application (% weight of wool pile fibre)	
	Dyebath application	Scouring application
Eulan U33	0.36%	0.45%
Mitin LP	0.44%	0.54%
Perigen	0.25%	0.32%

- (d) The electrical resistance of carpet must be in accordance with AS4155.6.
- (e) The maximum electrostatic propensity value for carpet must be 2500 V at a relative humidity of 25%.

- (f) Carpet underlays must:
 - (i) for general underlay, be in accordance with AS/NZS2455.1;
 - (ii) for soft underlay, be in accordance with AS4288; and
 - (iii) use adhesives and tapes that comply with AS/NZS2455.1.

5.15 Joinery

- (a) Joinery timber must:
 - (i) if hardwood, be select grade in accordance with AS2796.3. and
 - (ii) if softwood, be in accordance with AS4785.3.
- (b) plywood used in joinery, cabinetwork and associated items must:
 - (i) for interior use generally, be in accordance with AS/NZS 2270; and
 - (ii) for interior use exposed to moisture be in accordance with AS/NZS 2271.
- (c) Wet-processed fibreboard used in joinery, cabinetwork and associated items must be moisture resistant hardboard, in accordance with AS/NZS1859.4.
- (d) Particleboard used in joinery, cabinetwork and associated items must be in accordance with AS/NZS1859.1 and:
 - (i) if in general areas, be moisture resistant for general purpose use; and
 - (ii) if in humid or wet areas, be high performance grade.
- (e) Dry-processed fibreboard (also referred to by common industry term "medium density fibreboard") used in joinery, cabinetwork and associated items must be in accordance with AS/NZS1859.2 and:
 - (i) if in general areas be moisture resistant, medium density fibreboard; and
 - (ii) if in humid or wet areas be high performance, medium density fibreboard.
- (f) Joinery, cabinetwork and associated items decorative overlays must be in accordance with AS/NZS1859.3.
- (g) High-pressure decorative laminated sheets used in joinery, cabinetwork and associated items must be in accordance with AS/NZS2924.1 and:
 - (i) for horizontal surfaces fixed to a continuous background, be 1.2mm thick;
 - (ii) for vertical surfaces fixed to a continuous background, be 0.8mm thick;
 - (iii) for post formed laminate fixed to a continuous background, be 0.8mm thick;
 - (iv) for vertical surfaces fixed intermittently, be 3.0mm thick; and
 - (v) for edge strips, be 0.4mm thick.
- (h) Preservative treatment:
 - (i) Cutting and machining must be completed as far as possible before preservative treatment is applied.

- (j) Extensively processed timber sawn lengthways, thickened, planed, ploughed or similar must be re-treated after processing.
- (k) Surfaces where exposed by minor cutting and/ or drilling must be treated with two flood coats of solution as recommended by treatment solution manufacturer;
- (l) Joinery, cabinetwork and associated items must be:
 - (i) be smooth and even;
 - (ii) have arises eased, unless otherwise specified;
 - (iii) have external components eased with primer or sealer;
 - (iv) be coordinated with painting specifications; and
 - (v) allowed to dry before assembly.

5.16 Doorsets

- (a) Flashings and weatherings must:
 - (i) be in accordance with AS/NZS2904;
 - (ii) be corrosion resistant, compatible with the other materials in the installation, and coated with a non-staining compound where necessary;
 - (iii) be compatible with each other and with the contact surfaces and non-staining to finished surfaces. Bituminous materials must not be used on absorbent surfaces;
 - (iv) be polypropylene or equivalent pile and backing, low friction silicone treated, ultra-violet stabilised; and
 - (v) for finned type, have a pile weather seal with a central polypropylene fin bonded into the centre of the backing rod and raised above the pile level.
- (b) Extruded gaskets and seals must be non-cellular (solid) elastopressive seals in accordance with AS 2047: 1999 and ISO 11600 and:
 - (i) if rubber products (neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber), be to BS4255.1 or ISO11600; and
 - (ii) if flexible polyvinyl chloride (PVC), be to BS 2571 100% solids with high consistency, ultra-violet stabilised.
- (c) Nylon brush seals must be dense nylon bristles locked into galvanised steel strips and fixed in a groove in the edge of the door or in purpose-made anodised aluminium holders fixed to the door with double sided PVC foam tape.
- (d) Aluminium door frames must be assembled from extruded powdercoated aluminium sections (Minimum - Floroset Xtreme), including necessary accessories such as buffers, pile strips, strike plates, fixing ties or brackets and cavity flashing, with suitable provision for fixing specified hardware prefinished with protective coatings, built in or fixed to prepared openings. Include matching suite framed glazed sidelight where occurring.
- (e) Materials, construction and installation for aluminium door frames must be in accordance with AS 2047: 1999 and AS 4506 – 2005.

- (f) Where aluminium door frames include a threshold member, provide a self-draining section with anti-skid surface.
- (g) Provide cavity flashings for external aluminium door frames in cavity masonry.
- (h) For aluminium door frames, provide for fixing hardware including hinges and locksets, using 6mm aluminium backplates and lugs. Mount strike plates, locksets, flush bolts and the like flush with the face of the frame. Provide suitable cutouts and fixing cleats.
- (i) Aluminium doorsets must :
 - (i) be proprietary doorset system comprising aluminium framed glazed doors associated with façade glazing and cladding, if occurring, and inclusive of the necessary hardware and accessories; and
 - (ii) use materials, construction and installation complying with: AS2047.
- (j) Steel door frames must be continuously welded from metallic-coated steel sheet sections, including necessary accessories such as buffers, strike plates, spreaders, mortar guards, switch boxes, fixing ties or brackets, and cavity flashing with suitable provision for fixing hardware and electronic security assemblies, and prefinished with a protective coating
- (k) On steel door frames, grind the welds smooth, cold galvanize the welded joints and shop prime.
- (l) Hardware and accessories on steel door frames for fixing hardware including hinges and closers, must use 4mm backplates and lugs. Screw fix the hinges into tapped holes in the back plates.
- (m) Steel door frame base metal thickness must be a minimum of:
 - (i) for general use, 1.4mm;
 - (ii) for fire rated door sets, 1.6mm;
 - (iii) for security and external doorsets, 1.6mm;
- (n) Metallic-coated steel sheet used in steel door frames must comply with AS1397 and be:
 - (i) coating class Z275 for interior use; and
 - (ii) coating class Z450 for exterior use.

5.17 Painting

5.17.1 General

- (a) Paint coating systems to substrates must be:
 - (i) consistent in colour, gloss level, texture and dry film thickness;
 - (ii) free of runs, sags, brush marks, blisters, or other discontinuities;
 - (iii) if clear finished, at a level of transparency consistent with the product;
 - (iv) fully adhered;

- (v) resistant to environmental degradation within the manufacturer’s stated life span; and
- (vi) compliant with any specified performance requirements.
- (b) Painting processes in their entirety must be carried out in accordance with the published recommendations and instructions of each respective manufacturer.
- (c) Unless recommended otherwise by the manufacturer, each paint system must consist of at least 3 coats, excluding undercoat;
- (d) Mould resistance paints must;
 - (i) have finishes that are properly sealed;
 - (ii) have applied primer; and
 - (iii) 2 or 3 coats, in accordance with the manufacturer’s recommendation, of mould resistance paint.
- (e) Primer or undercoat must be used as a preparatory coating before painting and must:
 - (i) comply with Australian Paint Approvals Scheme specifications; and
 - (ii) as scheduled in the APAS "List of Approved Products".
- (f) Paints from different manufacturers must not be combined in a paint system.
- (g) Paint systems must comply with the requirements of appendix P Uniform Paint Standard to the Standard for the Uniform Scheduling of Drugs and Poisons.
- (h) Anti-graffiti coatings must be applied to substrates as outlined in section 4.4.
- (i) Paint types must conform to the Australian Standard as referenced in Table 12 below.

Table 17 Paint types

Paint type	AS/NZS2311 paint reference no. (Table 4.1)	Australian Standard
Semi gloss solvent-borne: interior	B3	AS3730.5
Full gloss solvent-borne: exterior	B5	AS3730.6 AS/NZS3750.22
Full gloss solvent-borne: interior	B5	AS3730.6
Flat latex: exterior	B6	AS3730.7
Flat latex: interior	B6	AS3730.1
Low gloss latex: exterior	B7	AS3730.8
Low gloss latex: interior	B7	AS3730.3
Semi gloss latex: exterior	B8	AS3730.9
Semi gloss latex: interior	B8	AS3730.2

Paint type	AS/NZS2311 paint reference no. (Table 4.1)	Australian Standard
Gloss latex: exterior	B9	AS3730.10
Gloss latex: interior	B9	AS3730.12
Wood primer, solvent-borne	B10	AS3730.13
Wood primer, latex	B10A	AS3730.17
Metal primer for steel, lead and chromate free	B11	AS3730.21 AS/NZS3750.19
Metal primer, latex	B11A	AS3730.15
Metal primer for metallic-coated surfaces solvent-borne	B12	AS3730.21
Metal primer for metallic-coated surfaces, latex	B12A	AS3730.15
Two-pack etch primer for metals, chromate free	B13	AS/NZS3750.17
Zinc-rich organic binder/primer for steel	B14	AS/NZS3750.9
Concrete and masonry sealer	B15	AS3730.22
Undercoat, solvent-borne	B17	AS3730.14
Undercoat, latex: exterior	B17A	AS3730.18
Undercoat, latex: interior	B17A	AS3730.18
Furniture varnish, one-pack	B19	AS3730.25
Two-pack clear gloss floor finish	B20	AS3730.27
Exterior latex stain, opaque	B22	AS3730.16
Exterior stain, lightly pigmented	B23	AS3730.28
One-pack paving paint for concrete	B24	AS3730.29
Two-pack epoxy enamel	B29	AS/NZS3750.1
Two-pack high build epoxy	B29	AS/NZS 3750.4
Texture finish latex coating for masonry and concrete: exterior	B38	AS/NZS4548 Parts 1 to 4
Texture finish latex coating for masonry and concrete: interior	B38	AS/NZS4548 Parts 1 to 4
Full gloss polyurethane (2-pack) for steel	B44	AS/NZS3750.6

5.17.2 Paint Coatings on Steelwork

- (a) This section describes the minimum acceptable requirements for the provision of high-performance coatings to the following steelwork elements:
 - (i) external steelwork (exposed);
 - (ii) internal steelwork (exposed);
 - (iii) external steel cladding framing (concealed); and
 - (iv) internal steelwork (concealed).
- (b) Paint coatings on steelwork must meet the following standards:
 - (i) surface preparation and coating must comply with AS/NZS2312;
 - (ii) preparation and pre-treatment of surfaces must be in accordance with AS1627.0; and
 - (iii) corrosion protection must be in accordance with AS/NZS2312;
- (c) Paint coatings on steelwork including coating materials and accessories must comply with the manufacturer's published recommendations and instructions for each coating system;
- (d) Protective and decorative coatings must:
 - (i) provide functionality and maintainability;
 - (ii) retain substrate integrity for the Design Life through successive maintenance paintings;
 - (iii) minimise the average cost of service for corrosion protection;
 - (iv) lower risk to personnel, the public and the environment; and
 - (v) retain or enhance aesthetics where required.
- (e) Durability of steel paint coatings must be in accordance with Table 13 below.

Table 18 Durability of steel paint coatings

Condition	Durability to ISO 12944	Environment classification
External steelwork (exposed)	High durability	C3M
Internal steelwork (exposed)	High durability	C1
External steel cladding framing (concealed)	High durability	C3M
Internal steelwork (concealed)	High durability	C1

5.18 Metalwork and Metal Fixtures

5.18.1 General

- (a) Metal fixtures and associated work must:

- (i) comply with relevant Codes and Standards, particularly the BCA;
- (ii) be durable and remain intact and serviceable under the in-service operating conditions of the building;
- (iii) withstand the in-service imposed loads without impairment of performance;
- (iv) provide adequate means of dealing with corrosion;
- (v) provide adequate means of dealing with thermal movement and differential movement of the building structure;
- (vi) provide and maintain the design lines, section profiles and stiffness of components; and
- (vii) satisfy other performance criteria if specified.

5.18.2 Balustrades

- (a) Design loads for balustrades must be in accordance with AS/NZS1170.1 Table 3.3.
- (b) Balustrades and handrails must meet the following standards:
 - (i) AS1231;
 - (ii) AS/NZS1866;
 - (iii) AS1288;
 - (iv) AS1554.1;
 - (v) AS1657;
 - (vi) AS 2074;
 - (vii) AS/NZS2208;
 - (viii) AS/NZS2312; and
 - (ix) AS/NZS4680.
- (c) Balustrades and handrails must be fit for purpose to withstand all dead and live loads on the balustrade elements and fixings.
- (d) Aluminium balustrades and handrails materials and components must be a selection of suitable aluminium alloys in profiles, sizes and grades, structural applications and applied finishes to suit the functional requirements and conditions and comply with AS/NZS1664 and ADCA Aluminium Standards and Data - Wrought products. Extrusions for aluminium balustrades and handrails must be aluminium alloy grade 6063 temper T5 or T6, in accordance with AS/NZS1866.
- (e) Aluminium balustrades and handrails must be anodised in accordance with AS1231, to a minimum coating thickness of 25 microns.
- (f) Glass balustrades must be laminated glass composed of toughened and annealed glass and clear polyvinyl butyral (pvb) interlayer(s).
- (g) Edges of glass balustrades must be flat polished and arrissed. Top edges must be sealed with a flat aluminium strip bonded to the full thickness of the glass using a clear silicone elastomeric glazing sealant.

- (h) Hot-rolled structural bars and sections for steel balustrades and handrails must in accordance with AS3679: 300MPa;
- (i) Stainless steel balustrades and handrails must be butt welded with welds being:
 - (i) for internal welds, category level 2;
 - (ii) for external welds, category class B and continuous;
 - (iii) compatible with metal being welded; and
 - (iv) free from imperfections such as cracks and pits, ground and polished to give required surface finish.

5.18.3 Fencing

5.18.3.1 General

- (a) The materials, details including joints, junctions, and fixings, and placement of support posts, for all fencing must be fully integrated with all other urban elements.
- (b) The CSM Contractor must develop and implement a fencing strategy for Central Station, Metro Station, Station Precinct and Public Domain based on the following typologies:
 - (i) protection screen fences on pedestrian and vehicular bridges;
 - (ii) protection screen fences adjacent to pedestrian and vehicular bridges;
 - (iii) security fences within Station Precinct;
 - (iv) security fences to the Rail Corridor boundary;
 - (v) segregation fences within and around the Sydney Metro City & Southwest Rail Corridor;
 - (vi) protection screens at Metro Station; and
 - (vii) general handrails;
- (c) Fencing design must prevent climbing, providing no footholds.
- (d) Fencing throughout the Central Station, Metro Station, Station Precinct and Public Domain areas must not have dead ends or sight line conflicts.
- (e) Fencing designs must minimise the potential for vandalism and graffiti.
- (f) Fencing located along a pedestrian walkway must be provided with a solid kerb upstand of at least 65mm high.
- (g) Security fencing types must be consistent across the Central Station, Metro Station, Station Precinct and Public Domain and respond to the contextual environment of the Rail Corridor, including provision for high quality fencing at Station Precinct and security fencing protecting rail infrastructure.
- (h) Where bollards are proposed to protect station entrances or Rail Corridor from intrusion, the materials, scale, location and detail design must integrate with the Station Precinct street furniture.

- (i) Fence fixing points must be minimised with bolts, base plates and fixing mechanisms to be detailed in a consistent, rationalised and unobtrusive manner.
- (j) Palisade fencing must be provided to secure the Rail Corridor within the Station Precinct except at bridges and adjacent to station entrances.
- (k) High security fencing must be provided to secure rail service facility locations.
- (l) High security fencing must be located to comply with the Sydney Metro Security Management Plan.

5.18.3.2 Security Fence

- (a) Security fencing must:
 - (i) be a minimum 2400mm high and a maximum 2700mm high to comply with the Sydney Metro Security Management Plan;
 - (ii) be a close spaced welded mesh fence;
 - (iii) be powder coated matte black; and
 - (iv) be in accordance with ASA standard T HR CI 12160 ST.

5.18.3.3 Palisade Fence

- (a) Palisade fencing must:
 - (i) be a minimum 2400mm high and a maximum 2700mm high to comply with the Sydney Metro Security Management Plan;
 - (ii) be powder coated matte black; and
 - (iii) be in accordance with ASA standard T HR CI 12160 ST.

5.18.3.4 High Security Fence

- (a) High security fencing must:
 - (i) be 3000mm high;
 - (ii) be powder coated matte black; and
 - (iii) be in accordance with ASA standard T HR CI 12160 ST.

5.18.3.5 Segregation Fence

- (a) Segregation fencing must:
 - (i) be a minimum 2400mm high and a maximum 2700mm high to comply with the Sydney Metro Security Management Plan;
 - (ii) be powder coated matte black; and
 - (iii) be in accordance with ASA standard T HR CI 12160 ST;

5.18.3.6 Trench grates

- (a) Trench grates must:
 - (i) be a maximum 200mm wide;

- (ii) be pedestrian heel proof; and
- (iii) be 316 grade, number 4 finish stainless steel.

5.18.3.7 Handrails

- (a) Handrails must:
 - (i) be satin finish stainless steel where adjacent to walkways, stairs and ramps; and
 - (ii) have a continuous line to the top rail and not be stepped.

5.18.3.8 Protection Screens

- (a) Protection screens must:
 - (i) comply with the requirements of AS5100 except as noted in this Appendix B03;
 - (ii) be a minimum of 2400mm high above the adjacent finished bridge pavement level;
 - (iii) have integrated junctions with adjacent fencing types to form a continuous visual and secure boundary to the rail corridor; and
 - (iv) be powder coated matte black.

6 Station Precinct and Public Domain spatial and functional requirements

6.1 General

- (a) The CSM Contractor must allow to refurbish and provide supplementary landscape to the Ibero-American Plaza adjacent to the Chalmers Street Entrance.
- (b) The Ibero-American Plaza works must be integrated with the bicycle parking to be provided adjacent to the Chalmers Street Entrance.
- (c) The CSM Contractor must reinstate the affected area of the existing brick wall at the boundary line on the east side of Central Station where altered by the Ibero-American Plaza works.
- (d) The CSM Contractor must make good to the affected areas of Randle Lane and Chalmers Street at the Eastern Entrance where altered by the Project Works, including but not limited to
 - (i) replacement of kerbs, crossovers and full width of footpath where excavated or damaged;
 - (ii) removal or reinstatement of footpath, stormwater crossovers where required; and
 - (iii) replacement of full of bicycle path where excavated or damaged;all in accordance with City of Sydney Public Domain Manual and any other Council requirements or approvals.
- (e) The CSM Contractor must design for low speed traffic (vehicle and bicycle) environments to the Station Precinct to ensure a safer pedestrian environment.
- (f) The CSM Contractor must provide suitable kerb and surface finishes as well as tactile ground surface indicators to assist people with disabilities, as required by AS1428.4.1.
- (g) The CMS Contractor must make good to the affected areas of the SYAB entry where impacted by the Project Works, including but not limited to:
 - (i) reinstatement of kerbs, crossovers and full width of footpath in the Public Domain where excavated or damaged:
 - A. with the exception of areas to be landscaped in accordance with the requirements of Section 9; and
 - B. in accordance with City of Sydney Public Domain Manual and RMS or Council requirements or approvals;
 - (ii) reinstalment of security fences;
 - (iii) reinstalment of services, street furniture, signage and wayfinding elements; and

- (iv) repair of any damage to retaining walls, driveways and pavements within the Station Precinct .

6.2 Bicycle Movement

- (a) The CSM Contractor must provide bicycle parking at the Chalmers Street Entrance, as a minimum.
- (b) Where bicycle parking is provided, the CSM Contractor must:
 - (i) comply with all Austroads requirements for dedicated and shared bicycle paths and facility design; and
 - (ii) provide clear and consistent signage to bicycle parking facilities from all networks.
- (c) Bicycle paths must be fully integrated within the Station Precinct and connect with Council of the City of Sydney strategies for existing and planned bicycle paths.
- (d) Bicycle paths must be legible, with a distinct and identifiable character separate to the pedestrian and vehicular network, where feasible to do so.
- (e) Conflicts between pedestrians and cyclists must be minimised generally and particularly at high activity zones.
- (f) Bicycle paths within the Interchange, adjoining roads and open spaces must accommodate modelled volumes/demands in accordance with Australian Standards and Austroads Guidelines and consider TfNSW modal hierarchy, Sydney's Cycling Future and the Central Station Interchange Access Plan.
- (g) The Project Works must incorporate safe access for bicycle riders in accordance with the TfNSW modal hierarchy. This includes external elements such as placement and operation of crossings facilities, cycling connections and access.

6.3 Streets

- (a) Refer to Appendix B01 Civil and Structural Works for civil and structural requirements for vehicular traffic planning and streets.
- (b) Any new or altered shared zones must be designed and constructed in accordance with 'TD 2016/001 Technical Direction – Traffic management and road safety practice', RMS, February 2016. Service and emergency access
- (c) Streets must be well presented with street lighting and tree lighting which do not interfere with existing or future utility provision.
- (d) The CSM Contractor must ensure the Station Precinct, Public Domain and service facility areas meet the CSM Contractor's FLS strategy.
- (e) Service vehicle (all vehicle classes) access for all Station Precinct functions must be addressed to comply with Central Station Interchange Access Plan.
- (f) Movement paths for service and emergency vehicles must be legible to both vehicle drivers and pedestrians.
- (g) Service and emergency vehicle movement paths must be efficient and minimise movements and impacts on the pedestrian and bicycle movement functions.

- (h) Parking requirements for service and maintenance vehicles must be accommodated on-street or within a secured service facility area and must not be located within or adjacent to pedestrian plaza areas.
- (i) Adequate space at emergency assembly areas and emergency egress points must be provided to ensure they are free of clutter and remain accessible at all times.
- (j) The CSM Contractor must ensure that firefighting and emergency equipment such as hydrants and boosters are:
 - (i) integrated into the built form of the Station Precinct;
 - (ii) are unobstructed by other Station Precinct functions; and
 - (iii) do not obstruct other Station Precinct functions.

7 Station Precinct and Public Domain Finishes, Fittings, Fixtures and Materials

7.1 General

- (a) The CSM Contractor must ensure the finishes, fittings, fixtures and materials are consistent and co-ordinated across the Station Precinct and Public Domain areas where affected by the Project Works.

7.2 Pavements

- (a) Station Precinct and Public Domain pavements must be designed to satisfy the requirements of Appendix B09 Customer Centred Design.
- (b) Station Precinct and Public Domain pavements must integrate with adjoining pavements and be consistent with the Public Domain materials palette of the adjoining area, or to the Council of the City of Sydney's proposed materials for the adjoining areas where upgrade works are proposed.
- (c) All Station Precinct and Public Domain pavement types must:
 - (i) provide a positively drained surface with no pooling or ponding;
 - (ii) use planar grading with runoff directed to planting beds and trench drainage;
 - (iii) have a minimum slip resistance classification (Class): W - as classified by AS/NZS 4586, with the exception of gravel pavement areas;
 - (iv) use a bedding, base and subgrade suitable for required design loads;
 - (v) have 3-4mm flexible mortar filled joints between pavement units;
 - (vi) be square edged; and
 - (vii) be sealed with a impregnator penetrating sealant.
- (d) All unit and granular pavements in the Station Precinct and Public Domain must be provided with a flush stainless steel restraint to all edges adjacent to planting and turf areas.
- (e) Service access pits in Station Precinct and Public Domain pavement areas must be aligned to the pavement pattern orientation and have pavement infill access covers, with adjacent pavements type and patterns continued and aligned through the cover.
- (f) The CSM Contractor must not use asphaltic concrete as a pedestrian pavement finish in any street verges.
- (g) The CSM Contractor must provide a minimum 3m unobstructed paved circulation space behind street furniture and shelter structures in pedestrian plaza areas.

- (h) Station Precinct and Public Domain pavement design must meet the requirements of clauses 6 and 7 of AS1428.1.
- (i) The CSM Contractor must provide resting points in accordance with the Disability Standards for Accessible Public Transport (DSAPT) 2002 and AS1428.2.
- (j) Pedestrian areas must have a maximum crossfall of 2.5%. Longitudinal fall must meet the requirements of AS 1428:2010 'Design for access and mobility, along disability routes'.
- (k) Natural stone used in Station Precinct and Public Domain pavements must be selected, handled, prepared and laid in accordance with the requirements of the Australian Stone Advisory Association Natural Stone Design Manual.
- (l) All natural stone pavements used in the Station Precinct and Public Domain must be sourced from quarries located in Australia, and all concrete unit pavers must be manufactured in Australia. The CSM Contractor must provide evidence of the point of origin of the sourced stone material, and the location of manufacture of any concrete unit pavers.
- (m) Granite pavements used in the Station Precinct and Public Domain must have the following quality requirements:
 - (i) a minimum flexural strength (wet/dry) of 9.5MPa / 11.1MPa;
 - (ii) a maximum water absorption rate of 0.14%;
 - (iii) a minimum compressive strength (wet /dry) of 193MPa / 217MPa; and
 - (iv) a minimum bulk specific gravity of 2.90 tonnes/m³.
- (n) Bluestone pavements used in the Station Precinct and Public Domain must have the following quality requirements:
 - (i) a minimum flexural strength (wet/dry) of 14MPa / 14MPa;
 - (ii) a maximum water absorption rate of 1.6%;
 - (iii) a minimum compressive strength (wet /dry) of 100MPa / 100MPa; and
 - (iv) a minimum bulk specific gravity of 2.50 tonnes/m³.
- (o) Concrete unit pavements used in the Station Precinct and Public Domain must as a minimum have the following quality requirements:
 - (i) a minimum breaking load of 5kN;
 - (ii) a maximum moisture content and water absorption of 7%; and
 - (iii) a minimum compressive strength of 35MPa.

8 SYAB Works Requirements

8.1 General

- (a) The CSM Contractor must implement the final landscape works in accordance with the SYAB Landscaping document and as defined in the following:
- (b) The CSM Contractor must as a minimum:
 - (i) undertake landscape works at the Public Domain outside the SYAB entrance including;
 - A. tree planting; and
 - B. verge establishment.
 - (ii) undertake landscape works within the SYAB entrance including;
 - A. tree planting;
 - B. garden planting;
 - C. extend retaining walls to same standards as SYAB;
 - D. extend irrigation system to same standards as SYAB; and
 - E. additional security lighting;

8.2 Tree and Planting Procurement

8.2.1 General

- (a) The CSM Contractor must ensure that the following planting procurement requirements are achieved for all trees and planting:
 - (i) trees and planting must be grown to NATSPEC 'Specifying Trees – a guide to assessment of tree quality' by Ross Clarke and Australian Standard 2303:2015.
 - (ii) trees and planting must be procured in a timely manner accounting for growing seasons, so to ensure the required container size is achieved at time of planting.
 - (iii) the tree and planting supplier must ensure that the trees and plants conform to the following requirements:
 - A. encourage and maintain healthy growth for the duration of the contract, and provide a suitable potting up, irrigation, pruning, fertiliser and monitoring program for all trees;
 - B. take all precautions required to safeguard the health and wellbeing of all trees to and including their delivery to the Site;

- C. ensure that the soil potting mixes and fertilisers are determined by a soil scientist and is complementary to the soil mixes being supplied to the tree pits and planting beds for the respective trees and plants;
- D. ensure at time of delivery the trees have foliage size, texture and colour consistent with the foliage, size, texture and colour shown in healthy specimens of the nominated species;
- E. trees must be free of disease and insect adults, eggs, pupae, or larvae;
- F. trees must have healthy root systems and must be free from physical damage or other conditions that would prevent thriving growth;
- G. tree trunks must be straight and well tapered. Trees with multiple leaders, unless specified, must be rejected;
- H. trees must have extension growth consistent with that exhibited in vigorous specimens of the species nominated;
- I. trees must be free from damage and restricted habit due to growth in nursery rows. Damaged, cut, or crooked leaders, including bark, bark abrasions, sunscald, disfiguring knots, mould and prematurely opened buds, or cuts of limbs over 2cm diameter that are not completely callused are cause for rejection;
- J. trees must be free from stress resulting from inadequate watering, excessive shade or excessive sunlight experienced at any time during their development;
- K. trees must be grown and hardened off to suit the conditions that could reasonably be anticipated to exist on the Site at the date of delivery;
- L. trees must be free of any indication of having been restricted or damaged; and
- M. the root system of the trees and plants must be well proportioned in relation to the size of the plant material, conducive to successful transplantation, and be free of any indication of having been restricted or damaged.

8.2.2 Topsoil and Mulch

- (a) Testing of the existing topsoil in the Site must be undertaken by a soil scientist with the following qualifications: National Association of Testing Authorities (NATA) registration, Certified Professional Soil Scientist (CPSS) accreditation, The Australasian Soil and Plant Analysis Council (ASPAC) certification, as well as urban horticultural and revegetation experience.
- (b) Soil scientist reports must include the following minimum data for soil testing: pH and electrical conductivity, salinity, sodium, chloride, cation balance and ratio, phosphorous saturation, nitrate, phosphate, potassium, sulphate, calcium,

magnesium, iron, manganese, zinc, copper, boron, total organic matter, total nitrogen and carbon / nitrogen.

- (c) The soil scientist must undertake a topsoil paedology survey and analysis of each topsoil landscape and vegetation community type within all disturbed OTS2 Works areas, with a minimum of three samples from each community type. This survey is to be provided in a soil report that is to be used in the design of the proposed landscape tree and planting species selection.
- (d) CSM Contractor must:
 - (i) engage a qualified soil scientist to undertake a topsoil stripping management plan that provides a description of the existing soils within the Site and soil stripping and stockpiling procedures to minimise soil degradation and maximise availability of suitable soils for rehabilitation;
 - (ii) strip and store topsoil for reuse within Site, for reuse in the landscape works, in accordance with soil scientist recommendations;
 - (iii) ensure that A-horizon, B-horizon, and C-horizon topsoil layers for reuse are stripped and stockpiled separately and not mixed, in accordance with soil scientist recommendations;
 - (iv) ensure that topsoil for reuse from different soil or vegetation types is stripped and stored separately and not mixed, in accordance with soil scientist recommendations;
 - (v) ensure the following soil types are not stripped for topsoil reuse: heavy saline, sodic, alkaline clay, and heavy plastic clay;
 - (vi) test each stockpiled topsoil for reuse, with three samples from each stockpile with the test results provided into a soil report and topsoil reuse plan; and
 - (vii) ensure all existing topsoil re-used within landscape works is conditioned or improved to comply with recommendations in the topsoil report by the soil scientist.
- (e) Prior to the placement of topsoil, The CSM Contractor must continuously eradicate weeds in topsoil stored for reuse. When monitoring indicates that weed cover is reduced to less than 5% cover four weeks after the last spray, a final eradication spray must be undertaken.
- (f) Finished subgrade surfaces to planting and turf areas must be cultivated to a minimum of 150mm depth immediately prior to spreading of topsoil.
- (g) All planting areas must be provided with a minimum 100mm depth of organic mulch that is placed so that it is not in direct contact with tree trunks and feather mulched away from trunks at base of root ball.
- (h) All mulch must be free of deleterious and extraneous matter, including soil, weeds, rocks, twigs and the like.
- (i) Topsoil types and depths must be provided in accordance with Table 14 and Table 25.

Table 14 Topsoil types and depth

Soil Mix Type		1	2	3	
Description/intended use		'A' Horizon (Topsoil) Turf Areas	'A' Horizon (Topsoil) General at-grade planting areas	'B' Horizon (Subsoil) Turf areas and General at-grade planting areas	
Station Precinct areas – installation min depth (mm)		200	400	300	
Public Domain areas– installation min depth (mm)		100	300	200	
Riparian zones – installation min depth(mm)		N/A	100	Ameliorate 150	
pH in CaCl ₂ (1:2) ¹		5.8 to 7.2	5.8 to 7.0	5.8 to 7.2	
Electrical Conductivity (1:2) ² (dS/m)		< 0.6	< 0.9	< 0.6	
Cation Balance	Sodium ³	%ECEC	< 5	< 5	< 5
		SAR	< 15	< 15	< 15
	Potassium ³	%ECEC	5 to 15	5 to 15	5 to 15
		mg/kg	N/A	150 to 390	N/A
	Calcium ³	%ECEC	60 to 75	60 to 75	60 to 75
		mg/kg	N/A	1200 to 2400	N/A
	Magnesium ³	%ECEC	15 to 25	15 to 25	15 to 25
		mg/kg	N/A	120 to 365	N/A
Aluminium ³	%ECEC	< 2	<2	<2	
Ca:Mg		3 to 7	3 to 7	3 to 7	
Phosphate ⁴	P sensitive planting (mg/kg)	N/A	1.6 to 5	N/A	
	General plantings (mg/kg)	20 to 50	10 to 30	N/A	
Ammonium + Nitrate ⁵ (mg/kg)		20 to 100	10 to 50	N/A	
Sulphate ⁶ (mg/kg)		20 to 50	20 to 50	N/A	
Micronutrient analysis	Iron ⁶ (mg/kg)	76 to 150	76 to 150	N/A	
	Manganese ¹² (mg/kg)	20 to 50	20 to 50	N/A	
	Zinc ¹² (mg/kg)	6 to 12	6 to 12	N/A	

Soil Mix Type		1	2	3
	Copper ¹² (mg/kg)	7 to 30	7 to 30	N/A
	Boron ¹³ (mg/kg)	1.1 to 2.0	1.1 to 2.0	N/A
Organic Matter ⁷ (% by mass)		2 to 8	5 to 12	< 1
Bulk Density ⁸ (kg/L)		1.0 to 1.4	0.7 to 1.2	1.2 to 1.6
Toxicity Assessment ⁹ (%)		> 70	> 70	N/A
Percentage Clay (<0.002mm) (% by mass)		<8	10 to 20	10 to 20
Maximum Particle Size (mm)		20	50	50
Large Hard Particles ¹⁰	>2mm	% by mass	< 15	< 65
	>20mm		< 5	< 10
	>50mm		0	<1
Permeability ¹¹ (cm/hr)		20 to 60	20 to 60	> 25

Table 15 Topsoil types and depth

Soil Mix Type		4	5	6	
Description/intended use		'A' Horizon (Topsoil) on-structure planting areas	'B' Horizon (Subsoil) on-structure planting areas	'B' Horizon Backfill for tree planting positions	
Station Precinct areas – installation min depth (mm)		400	800	200 around root ball	
Public Domain areas– installation min depth (mm)		N/A	N/A	200 around root ball	
Riparian zones – installation min depth(mm)		N/A	N/A	200 around root ball	
pH in CaCl ₂ (1:2) ¹		6.0 to 6.8	5.8 to 7.2	5.8 to 7.2	
Electrical Conductivity (1:2) ² (dS/m)		< 1.2	< 1.0	<0.6	
Cation Balance	Sodium ³	%ECEC	< 5	< 5	
		SAR	< 15	< 15	
	Potassium ³	%ECEC	5 to 15	5 to 15	5 to 15
		mg/kg	150 to 390	N/A	N/A
	Calcium ³	%ECEC	60 to 75	60 to 75	60 to 75
		mg/kg	1200 to	N/A	N/A

Soil Mix Type			4	5	6
			2400		
	Magnesium m ³	%ECEC	15 to 25	15 to 25	15 to 25
		mg/kg	120 to 365	N/A	N/A
	Aluminium 3	%ECEC	<2	<2	<2
Ca:Mg			3 to 7	3 to 7	3 to 7
Phosphate ⁴	P sensitive planting (mg/kg)		1.6 to 5	N/A	N/A
	General plantings (mg/kg)		20 to 50	N/A	N/A
Ammonium + Nitrate ⁵ (mg/kg)			30 to 100	N/A	N/A
Sulphate ⁶ (mg/kg)			20 to 50	N/A	N/A
Micronutrient analysis	Iron ⁶ (mg/kg)		76 to 150	N/A	N/A
	Manganese ¹² (mg/kg)		20 to 50	N/A	N/A
	Zinc ¹² (mg/kg)		6 to 12	N/A	N/A
	Copper ¹² (mg/kg)		7 to 30	N/A	N/A
	Boron ¹³ (mg/kg)		1.1 to 2.0	N/A	N/A
Organic Matter ⁷ (% by mass)			15 to 25	< 1	<1
Bulk Density ⁸ (kg/L)			0.5 to 1.0	0.5 to 1.0	1.2 to 1.6
Toxicity Assessment ⁹ (%)			> 70	N/A	N/A
Percentage Clay (<0.002mm) (% by mass)			10 to 20	10 to 20	<30
Maximum Particle Size (mm)			30	30	75
Large Hard Particles ¹⁰	>2mm	% by mass	<30	<30	< 65
	>20mm		<8	<8	< 10
	>50mm		0	0	<5
Permeability ¹¹ (cm/hr)			30 to 80	> 30	>25

<p><i>Notes above refer to the following standards:</i></p> <p>¹ AS4419 (2003) Appendix D</p> <p>² AS4419 (2003) Appendix D</p> <p>³ Method 15A1 Rayment & Higginson (1992)</p> <p>⁴ Bray N°2</p> <p>⁵ AS4419 (2003) Appendix D and Bradley et al (1983)</p> <p>⁶ Method 83.1 to 83.5 Black (1983)</p>	<p>⁷ Total C by Leco Furnace</p> <p>⁸ AS4419 (2003) Appendix B</p> <p>⁹ AS4419 (2003) Appendix F</p> <p>¹⁰ SESL method based on BS1377-2 (1990)</p> <p>¹¹ AS4419 (2003) Appendix H</p> <p>¹² Method 83-1 to 83-5 Black (1983)</p> <p>¹³ Method 12C2 Rayment & Higginson (1992)</p>
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8.2.3 Tree Pit Design

- (a) The soil volume of each tree pit must be no less than 1.2m in depth and fifteen cubic metres of volume per tree, for planted trees of 25 litres container size or greater. The following points must be considered in the calculation of available soil volumes:
 - (i) the space occupied by rock or other structural pavement supports must be excluded from the soil volume calculation;
 - (ii) existing site soil must be included in soil volume calculations only if it can be demonstrated that the soil has acceptable physical and chemical qualities to sustain long term tree growth and tree roots have unrestricted access to it; and
 - (iii) the alignment of service trenches, the space they occupy, and their possible restriction of natural root spread and development must be excluded from the soil volume calculation.
- (b) The tree pit system must be developed with consideration of existing Site constraints and the need to provide adequate soil volumes;
- (c) The tree pit design must provide uncompacted soil suitable for tree growth beneath load bearing pavements;
- (d) Consideration must be given to the need for gaseous exchange and aeration of the tree pit soil, as well as future access for the provision of soil treatments or amendments if necessary;
- (e) The tree pit design must allow for the natural growth and development of the trees' structural root systems to ensure their long term structural stability;
- (f) Root barriers must only be used when necessary to protect infrastructure or underground Utility Services;
- (g) Tree pits must be designed and constructed to allow free and natural drainage, and subsoil drainage and connections to storm water infrastructure must be provided; and
- (h) The potential for harvesting surface stormwater and diverting it into the tree pits must be assessed and incorporated into the design whenever feasible.

8.2.4 Planting and Turf

- (a) The CSM Contractor must engage a suitably qualified arborist to assess the condition of any existing trees within the Site and must adopt any recommended treatments and protection measures proposed by the arborist to maximise the health and longevity of retained trees.
- (b) The CSM Contractor must engage a suitably qualified horticulturalist to assess proposed plant species, plant associations, species arrangements, vegetation growing media and growing media volumes and must adopt any assessment recommendations that maximise vegetation health and growing conditions.
- (c) All groundcovers and grasses used must be planted at a density of six plants / m² and have a minimum 140mm diameter container size when planted.

- (d) All shrubs used must be planted at a density of minimum three plants / m² and have a minimum 140mm diameter container size when planted.
- (e) All planted trees within the Station Precinct or Public Domain areas must have a minimum planted container size of 800 Litres when planted.
- (f) Seeding must not be used except for temporary stabilisation.
- (g) Turf species used must satisfy the following criteria:
 - (i) be demonstrably drought tolerant;
 - (ii) be suited to local climatic conditions;
 - (iii) be capable of maintaining a consistent leaf height of 25-50mm;
 - (iv) provide a consistent leaf colour presentation year round; and
 - (v) be hard wearing and suitable for high pedestrian traffic.
- (h) Forest tube stock and/or viro tubes are permissible in bioswale/ wetland/ landscape buffer planting;
- (i) 25L minimum size trees are permissible in landscape buffer planting and/or to supplement planting as described in items (c) and (d).
- (j) All tree, shrub and ground cover sizes must be the minimum container size of trees, shrubs and ground covers at time of planting installation on site.
- (k) Any existing living trees that are removed as part of the Project Works must be replaced in accordance with the Transport for NSW Tree Replacement Strategy.

9 Prototypes, Samples and Quality Benchmarks

9.1 Samples and Prototypes

- (a) The CSM Contractor must provide final samples of materials and finishes in accordance with the requirements of Design Stage 1 as specified in MR-T.

9.1.1 Prototypes

- (a) The CSM Contractor must provide a prototype for the following items, to demonstrate the customer experience:

(i) **Prototype 1 - East Concourse Prototype:**

- A. Minimum 8.5 metre length by at least half of the width of the East Concourse internal fit out, including:
- i. a single typical VT bay entrance to the platforms escalators with a 1m return (escalators not to be included);
 - ii. all finishes, lighting, fittings and fixtures, and wayfinding;
 - iii. escalator voids from East Concourse level to a typical upper platform, including a fixed glazed balustrade at the platform void and side wall cladding;
 - iv. a glazed lift enclosure (excluding lift car) to demonstrate the detailed design resolution, quality of fabrication and installation and architectural character;
 - v. the included elements are to comprise as a minimum, openings / access panels / doors;
 - vi. a hydrant door, fire hose reel enclosure;
 - vii. a typical service cupboard;
 - viii. operable access hatches in walls, ceiling and floor;
 - ix. wall panels with integrated advertising panels;
 - x. an island retail “pop up” shell; and
 - xi. Customer information display panels.
- B. operable elements to demonstrate use of each component.

(ii) **Prototype 2 – Canopy Prototype:**

- A. Minimum 4.0 metre length of full platform width and roof canopy, which must:
- i. include all finishes, fittings and fixtures to demonstrate the detailed design resolution, cleaning and maintenance, minimum acceptable quality of fabrication and installation, and architectural character;
 - ii. demonstrate tiling patterns and interfaces with drains and existing finishes;

- iii. include canopy top surface and soffit finishes, framing, lighting and drainage components; and including a full open end canopy section;
 - iv. include proposed modularisation of canopy elements;
 - v. include customised furniture and fittings;
 - vi. include all overhead services, including services panels. CCTV, wayfinding, lighting and emergency fittings including the method of integration and concealment within the roof structure;
 - vii. include any photovoltaic elements; and
 - viii. include methods of bird and vermin control.
- B. demonstrate all required elements in the final design, but components may be spaced closer together than in the final design.
- C. Prototype 3 – Intercity Concourse Prototype:
- A. Minimum 4.0 metre length by 8.0 metre depth of intercity concourse canopy arch and supporting column, which must include:
 - i. all finishes, fittings and fixtures to demonstrate the detailed design resolution, minimum acceptable quality of fabrication and installation, and architectural character;
 - ii. canopy top surface and soffit finishes, framing, lighting and drainage components;
 - iii. all overhead services, including services panels, CCTV, wayfinding, lighting and emergency fittings including the method of integration and concealment within the roof structure; and
 - iv. methods of bird and vermin control.
- (iii) **Off-form Concrete:** including
- A. A sample of the proposed formwork for Class 2CX and Class 2 finished concrete;
 - B. samples of Class 2CX concrete, complete with form set out and visible form plugs, with colour showing the variation range which will be accepted;
 - C. samples of the following elements:
 - i. architectural concourse column including top connection to beam or equivalent and/or column capital
 - ii. an architectural wall face of 4.8m length and 2.4m height with expressed “V” joints at each form panel point.
- (b) The CSM Contractor must also provide a mock-up of a retail island tenancy, to demonstrate the customer experience.
- (c) The prototypes must be located within CSM Contractor’s premises within 2km from the Site.
- (d) Internal finishes prototypes must be kept in a secure, weather-enclosed environment and provided with lighting equivalent to final design conditions.
- (e) The prototypes must remain in place for the duration of the Contract.

- (f) The prototypes must be completed and available for inspection at the end of Design Stage 2.
- (g) The CSM Contractor must provide prototypes, including supporting Design Documentation and specifications for various elements of the Project Works. The purpose of the prototypes and supporting Design Documentation is to:
 - (i) provide samples and prototypes for review by the Principal's Representative of the proposed material and finishes prior to procurement or construction of the Project Works.
 - (ii) demonstrate that all critical aspects of coordination within the CSM Contractor's Activities have been resolved in the design;
 - (iii) confirm any design decisions usually made through physical inspections, such as colour selection, sizes and textures. The prototype submission must contain all finishes, fittings and fixtures to represent critical elements of the design;
 - (iv) demonstrate through measurements of the horizontal and vertical illuminance that the lighting design complies with the requirements of the scope, performance and technical specifications; and
 - (v) establish design and construction workmanship quality benchmarks for the Project Works.
- (b) Samples and prototypes must be available for viewing on request during normal business hours.

9.1.2 Process

- (a) The CSM Contractor must prepare and submit to Principal's Representative and the Independent Certifier a detailed list of proposed prototypes, samples and quality benchmarks within 60 working days of award of the Contract, for Approval.
- (b) Within 30 working days of the approval of the list of proposed prototypes, samples and quality benchmarks the CSM Contractor must submit to Principal's Representative and the Independent Certifier a detailed prototypes, samples and quality benchmarks plan.
- (c) The prototypes, samples and quality benchmarks plan must include as a minimum for each proposed prototype, sample and quality benchmark:
 - (i) the program;
 - (ii) the location;
 - (iii) the purpose;
 - (iv) the options considered;
 - (v) the design package that it supports;
 - (vi) the testing regime;
 - (vii) the testing organisation;
 - (viii) the outcomes to be derived; and

- (ix) those samples that are subject to independent third party testing; and the like.
- (d) The CSM Contractor must update the prototypes, samples and quality benchmarks plan in all progress reports and at the end of each Design Stage;
- (e) The CSM Contractor cannot change the prototypes, samples and quality benchmarks list or plan without the approval of Principal's Representative and the Independent Certifier;
- (f) Where a sample or prototype is to be tested to destruction then at least one other sample, exactly the same as those tested, is to be kept as a control;
- (g) Where a sample or prototype is to be tested by an independent third party then the CSM Contractor must also undertake the same tests and at least one sample, exactly the same as those tested, is to be kept as a control.

9.1.3 Samples

- (a) The CSM Contractor must prepare samples, materials and finishes boards containing the samples, materials and finishes outlined in Table 16 below.
- (b) Samples, materials and finishes boards must be modified to demonstrate the latest designs as designs develop or are modified.
- (c) Samples, materials and finishes boards must be kept in the agreed location for the duration for the Contract or until a range of accepted installations have been completed which can serve as the ongoing reference installations.
- (d) Samples, materials and finishes boards must be kept in a Site area to be agreed by the Principal's Representative.
- (e) Samples, materials and finishes boards must be made available to the public and stakeholders for the duration of the Contract, with prior arrangement by the Principal's Representative or on request, during normal business hours.
- (f) Samples, materials and finishes boards must be provided to the Principal's Representative at the end of the Contract, if requested by the Principal's Representative.
- (g) Samples, materials and finishes boards not provided to the Principal's Representative in accordance with section 9.1.3(f) above must be disposed of by the CSM Contractor at the end of the Contract.

Table 16 -Schedule of required prototypes and samples including number and areas of each and accessories required:

Metro Station up to the North South Concourse

Item	Minimum quantity to be provided
Prototypes	

Item	Minimum quantity to be provided
(i) Platform, including paving, tactile ground surface indicators, and pit covers;	As described above
(ii) Platform Screen Doors and lining assembly between Platform Screen Doors and ceiling;	As described above
Samples	
(iii) Mechanical gap fillers	One lineal metre
(iv) wall finishes	1m ² of each finish, including joint seals / grout in colour
(v) balustrade (where applicable)	One lineal metre complete with infill & all fixings
(vi) ceiling linings	One 600x600 piece with final finishes applied
(vii) signage	Full size finished sample of each sign type
(viii) PIDS	[not by CSM Contractor]
(ix) lighting fixtures	Full size finished sample of each type
(x) Platform furniture including litter bins, seats and lean bars	Full size finished sample of each type
(xi) supply and exhaust air grilles	One 600x600 piece with final finishes applied and perimeter frame
(xii) any other platform components and fixtures	Full size finished sample of each type
(xiii) all visible building services fixtures such as PA speakers, CCTV cameras, fire hydrant and hose reel cabinets and Help Points	Full size finished sample of each type with final finishes applied
(xiv) acoustic wall or ceiling panels	One 600x600 piece with final finishes applied and perimeter frame
(xv) wall cladding systems	One 600x600 piece with final finishes applied and perimeter frame
(xvi) advertising (where applicable)	[not by CSM Contractor]

Public concourse and elsewhere in scope

Item	Minimum quantity to be provided
(i) all external façade and internal wall cladding and glazed assemblies	1m wide x 2.4m high of each component including operable elements finish, including joint seals
(ii) retaining walls, wall linings and paving	Not applicable? Platform walls:
(iii) entry doors/shutters	One 600x600 piece with final finishes applied and perimeter frame
(iv) roofing, roof lights and awnings	One 600x600 piece with final finishes applied and perimeter frame
(v) gate line	[not by CSM Contractor]
(vi) external louvres	One 600x600 piece with final finishes applied and perimeter frame
(vii) paving and floor finishes;	One square metre of each type and colour
(viii) paving joints	One lineal metre
(ix) tree grates	Not applicable
(x) surface drains	One of each type
(xi) internal wall linings and skirtings	One lineal metre in each finish
(xii) typical recessed ticket vending machine, Customer service workstation, signage and advertising panels	[not by CSM Contractor]
(xiii) balustrades and handrails	One lineal metre complete with infill & all fixings
(xiv) internal ceiling linings	One 600x600 sample
(xv) all visible building services fixtures such as PA speakers, CCTV cameras and help points	One of each type
(xvi) signage	One of each type
(xvii) lighting fixtures	One of each type
(xviii) bench seats, rubbish bins, bicycle hoops, and drinking fountains	One of each type

Item	Minimum quantity to be provided
(xix) advertising panels where part of cladding systems (where applicable)	[not by CSM Contractor]
(xx) public art or graphics panels where part of cladding systems	[not by CSM Contractor]

- Sydney Metro City & Southwest

 - Central Station Main Works**

 - Schedule C1

- Scope of Works and Technical Criteria
Appendix B04a
Electrical Services

PROJECT	Central Station Main Works	DATE	22 February 2018
GROUP	Sydney Metro City & Southwest	STATUS	Final
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1 Overview

- (a) The Project Works has two distinct and separate electrical power systems. One power system for Central Station and Central Walk, and one power system for the Metro Station.
- (b) Central Station, Central Station Works and Central Walk Works must be powered from the electrical network managed by Sydney Trains. Section 2 'Central Station Works and Central Walk Electrical Services' describes the performance and technical requirements for the following electrical services:
 - (i) low voltage (LV) power supply and distribution;
 - (ii) high voltage (HV) network;
 - (iii) cables and cable routes;
 - (iv) substation and substation services; and
 - (v) modifications to the existing power system.
- (c) Metro Station Works must be powered from the from the Sydney Metro City & Southwest electrical network. Section 3 'Metro Station electrical services' describes the Metro Station Works performance and technical requirements for the following electrical services:
 - (i) LV power supply and distribution;
 - (ii) provision for applicable Interface Contractor's HV system, LV connected systems & subsystems and traction power systems;
 - (iii) cables and cable routes;
 - (iv) substation and substation services;
 - (v) DC isolating link rooms and associated services; and
 - (vi) DC energy storage equipment rooms.
- (d) The arrangement of earth conductors and bonding conductors must be implemented as a combined system for all electrical distribution systems within Central Station including Central Station Works, Central Walk Works, Metro Station, Central Station and Metro Station Traction Power Supply and existing Central Station supplies, as described in section 4 'Earthing and bonding, electrolysis protection and electromagnetic compatibility'.
- (e) The performance and technical requirements of the lighting at Central Station, including Central Station Works, Central Walk Works and the Metro Station Works, is described in section 5 'Lighting'.

2 Central Station Works and Central Walk Works electrical services

2.1 General requirements

- (a) The electrical services for the Central Station Works and Central Walk Works must, as a minimum, comply with:
 - (i) all applicable Codes and Standards; and
 - (ii) all applicable Asset Standard Authority (ASA) Standards.
- (b) The CSM Contractor must:
 - (i) segregate the electrical So Far As Is Reasonably Practical (SFAIRP) for the Central Station Works and Central Walk Works, from the Metro Station and other Third Party electrical supply systems, to the satisfaction of relevant stakeholders;
 - (ii) provide Redundancy in the power system to the Central Station Works and Central Walk Works, as required in ASA Standards applicable to underground and tunnel installations;
 - (iii) provide all elements of the electrical power system for Central Station Works and Central Walk Works in accordance with ASA Standards for underground and tunnel installations;
 - (iv) ensure continuity of service to operational critical loads through redundancy of supply and/or provision of alternative sources of power;
 - (v) ensure all functions, facilities and services for Central Station, Central Station Works and Central Walk Works are powered from the electrical distribution network managed by Sydney Trains;
 - (vi) supply all electrical service loads for Central Station Works and Central Walk from the Lee Street and Chalmers Street 33kV and/or 11kV reticulation systems; excluding photovoltaic (PV) generation sources;
 - (vii) provide cables to Central Station Works and Central Walk Works that satisfy the requirements in Australian and ASA Standards applicable to underground and tunnel installations;
 - (viii) protect all electrical services equipment before and after installation;
 - (ix) determine an equipment naming convention in accordance with:
 - A. ASA Standard ESD E001;
 - B. Sydney Trains asset management systems; and
 - C. Sydney Trains maintenance requirements.
 - (x) use ASA type approved electrical services equipment;
 - (xi) provide electrical equipment that is fully rated for its intended purpose and not reliant upon short term or overload ratings; and

- (xii) comply with the Interface Schedules.
- (c) The CSM Contractor must plan the staged Central Station Works and Central Walk Works such that:
 - (i) the supply capacity of the power supply system (LV, 11kV and 33kV) remains adequate for the operation of Central Station and the delivery of electrical power through Sydney Trains distribution network; and
 - (ii) the Redundancy of the power supply system, in and around Central Station and as part of Sydney Trains distribution network, is not reduced.
- (d) The CSM Contractor must embed or conceal all services in public areas in a manner that:
 - (i) ensures that adequate access is permitted for maintenance of the service;
 - (ii) does not diminish the aesthetic appeal of the installation;
 - (iii) does not undermine the integrity of any substrate it is embedded in; and
 - (iv) does not undermine the integrity of any surface it is mounted to.

2.2 Low voltage power supply and distribution

2.2.1 General requirements

- (a) The CSM Contractor must:
 - (i) Augment the LV Central Station supply and distribution system and loads to be adjusted and extended with no disruption to train services, unless otherwise agreed with the Principal's Representative;
 - (ii) establish a power system that operates at a nominal LV system voltage of 400V / 230V AC (at rated transformer load) for new substations and operates at a nominal LV system voltage of 415V / 240V AC (at rated transformer load) for upgraded existing substations. The existing LV power system will remain at the existing voltage to maintain consistency with the functions, systems and services that draw power from the existing system.
 - (iii) provide power factor correction equipment to ensure the Central Station LV supply and distribution system provided as part of the Project Works complies with the requirements of applicable Codes and Standards;
 - (iv) provide power factor correction equipment that is adequately rated and performs its function with the power system operating in any configuration;
 - (v) provide equipment for the Central Station LV supply and distribution system that is suitable to operate within the harmonic distortion and power factor values experienced at the installation; and
 - (vi) submit a power quality report in each Design Stage of the electrical power system that:
 - A. proposes acceptance criteria for power quality in the Central Station LV supply and distribution system;
 - B. identifies how to configure the 11kV network so that the different nominal system voltages are achieved at the new and existing substations when using the same switchgear and transformers;

- C. identifies where there is an interface between new and existing LV systems (systems of different nominal voltage) and what, if any, implications this presents to the operation of the network and the operation and performance of the device(s) drawing power from the network. Provide a solution to ensure safe system operation and to ensure the device(s) perform as required in that system;
 - D. identifies power quality risks associated with Sydney Trains HV supply and distribution system, including recommendations for works by others to ensure suitable power quality for high voltage supply of Central Station Works and Central Walk Works;
 - E. identifies the power quality risks associated with Central Station HV and LV supply and distribution systems, and design and construction of methods and mechanisms to control the power quality on the electrical services for Central Station, Central Station Works and Central Walk Works within acceptance criteria; and
 - F. provides technical advice to other disciplines confirming the power quality of Central Station LV supply and distribution systems to connected systems.
- (vii) deliver the recommendations from the power quality report, the requirements of which are detailed in 2.2.1 (a) (vi).

2.2.2 Redundancy

- (a) The CSM Contractor must:
- (i) ensure supply to existing essential services loads retain the required Redundancy and availability during performance of the CSM Contractors Activities;
 - (ii) implement changes to the existing essential services power system that:
 - A. allow decommissioning of the diesel generator between platforms 15 and 16;
 - B. provide adequate supply Redundancy to satisfy the needs of the loads connected to the existing essential services power system; and
 - C. provide supplies with adequate Redundancy to all existing and new services that require essential supply as per the relevant Codes and Standards.
 - (iii) decommission and dispose of any diesel generators in accordance with applicable Codes and Standards.

2.2.3 LV distribution system

- (a) The CSM Contractor must provide a Central Station LV distribution system such that a failure of any single component does not result in any degradation of the service provided to the public.
- (b) The electrical power LV supply and distribution system provided by the CSM Contractor for Central Station must be powered from an 11kV network.

- (c) The CSM Contractor must consider the use of bus ducts for the connection between the distribution transformer and the main switchboard incomer Alternating Current Circuit Breakers (ACCB). The CSM Contractor must assess and document for the Principal's Representative's review:
- (i) cost comparison between cable and bus duct;
 - (ii) impact on cable routes in the cable room; and
 - (iii) implications on maintenance of power system assets.
- (d) The LV bus-tie must provide Auto-Change-Over (ACO) system that must:
- (i) be implemented using circuit breakers, which provide protection over the bus-tie cable and protection grading with the incomer ACCB;
 - (ii) not use any programmable logic type device (PLC) in its implementation. Using the programmable capability of the relay providing the protection functionality in the circuit breaker is acceptable;
 - (iii) include controls for the incomer and bus-tie circuit breakers for the two main switchboard at the substation;
 - (iv) identify if the circuit breaker has opened due to a fault condition. No circuit breaker must be requested to close after a fault trip;
 - (v) identify if the circuit breaker has opened due to a manual command. No circuit breaker must be requested to close after it is manually opened;
 - (vi) ensure it is not possible to place the two distribution transformers in parallel;
 - (vii) have controls to allow the scheme to be switched "off". No circuit breaker must be requested to close when the ACO scheme is "off";
 - (viii) not interfere with the local or remote controls for any of the circuit breakers;
 - (ix) include local operational and fault status indication that will be beneficial to maintenance personnel; and
 - (x) include remote operational and fault status indication that will be wired to SCADA (for use by the Electrical System Control Officer).
- (e) Any new distribution transformer must:
- (i) be sized (power rating) to supply the full substation load; and
 - (ii) be sized (power rating) such that it has 50% (+/- 10%) of the demand at the time of Completion under normal operating conditions. The allocation of load to each MSB, and hence each transformer, must be between 45% and 55% of the total substation load.
- (f) All new distribution transformers must be the same size (power rating). The power rating shall be one of the approved transformer sizes (power ratings) listed in ASA Standards.

2.2.4 Main LV switchboards and distribution boards

- (a) Central Station LV main switchboards that constitute part of a Redundant supply must be physically segregated with separate busses and housed in separate fire-rated rooms. Bus-tie cables interconnecting the separate busses between bus-tie

circuit breakers are allowable. Sydney Transformer Rooms No.1 and No.2 distribution substations can be combined into one fire rated room.

- (b) Switchboard and distribution boards must be in accordance with Australian and ASA Standards. Equipment that is not type approved is subject to ASA's Type Approval process.
- (c) All switchboards must have at least 30% spare capacity, including:
 - (i) spare spaces for additional circuit breakers that can be directly fitted without modification to the switchboard bus system; and
 - (ii) spare current carrying capacity on all phases.
- (d) The fault withstand capability of the main switchboard must withstand all system faults with the supply configuration listed below:
 - (i) one only distribution transformer (transformers not operating in parallel);
 - (ii) with all 11kV feeders operating in parallel;
 - (iii) dynamic load contribution from connected loads; and
 - (iv) fault withstand time of 1 second type tested in accordance with AS3439.
- (e) Protection requirements for the sub-mains feeders and loads must be designed by the CSM Contractor and grade correctly from load to 11kV ACCB and arc flash hazard levels must be assessed and any controls required identified.
- (f) The CSM Contractor must develop a metering plan for Central Station in conjunction with the Principal's Representative as part of the Design Stage 1 to:
 - (i) identify applicable metering requirements presented in ASA Standards;
 - (ii) recommend which Loads require metering information; and
 - (iii) implement metering in the Central Station main switchboard ACCB in accordance with the Principal's detailed requirements.
- (g) The CSM Contractor must extend the Central Station SCADA monitoring and control to cover the Central Station main switchboard incomer and bus-tie ACCBs.
- (h) The CSM Contractor must ensure that remote operation of the incomer and bus-tie ACCB are under the control of the Central Station electrical system control officer only.
- (i) The CSM Contractor must provide direct monitoring of the status of the incomer and bus-tie ACCB by substation SCADA remote terminal unit (RTU) only. Management systems must obtain ACCB data via a communications link with the substation SCADA RTU.

2.2.5 Uninterruptable power supply

- (a) The CSM Contractor must provide individual uninterruptable power supply (UPS) functions for the Central Station Works and Central Walk Works systems as applicable.

2.2.6 Photovoltaic (PV) System

- (a) The CSM Contractor must provide a renewable electrical power generation source that complies with ASA Technical Note TN031 – ‘Requirements for photovoltaic installations connected via inverters to the RailCorp LV distribution network’.
- (b) Power generated by the photovoltaic (PV) system must be used in the electrical network managed by the Operator that is responsible for the maintenance of the PV system.
- (c) Power generated by the Central Station PV system must be used in the Central Station LV distribution network and must not be exported to the 11kV system.
- (d) The Central Station PV System must:
 - (i) have concealed junction boxes where possible;
 - (ii) have concealed inverters an appropriate distance from the PV array to reduce system losses;
 - (iii) ramp down generation to match demand during daily operation;
 - (iv) be capable of capturing, storing and displaying information communicating the operation of the PV system including set up to enable remote online reading of data; and
 - (v) utilise inverters with a minimum 10 year performance warranty and be on the Clean Energy Council’s list of approved inverters for installation.
- (e) The Central Station PV Array must:
 - (i) achieve the minimum peak array power output as nominated in Appendix B07 Sustainability Requirements;
 - (ii) utilise panels with a minimum 25 year 80% panel output performance warranty;
 - (iii) have a minimum 5 year workmanship/installation/defects warranty;
 - (iv) have a minimum peak power output of 140W/m² (based on manufactured rated panel output);
 - (v) utilise high quality cells; and
 - (vi) have toughened glass.
- (f) The CSM Contractor must produce a report as part of the Design Stage 1 Design Documentation of the Central Station PV system that includes:
 - (i) factors relating to the interaction of the new technology, including cost, implications of new technology for the Operator and non-financial benefits;
 - (ii) configuration options and preferred arrangement;
 - (iii) cost-benefit analysis;
 - (iv) requirement specifications;
 - (v) a study of the implication of installation of the PV system into a canopy structure that is used to support the 1500V OHW system;
 - (vi) installation risk assessment and mechanisms to mitigate risks;
 - (vii) equipment specifications and type approval plan;

- (viii) technical drawings for all the equipment to be used;
- (ix) verification and validation process, including detailed inspection and test tasks;
- (x) operational instruction for the PV system;
- (xi) asset management strategy, including detailed maintenance instructions;
- (xii) training course material suitable to train Operators maintenance personnel on the operation and maintenance of the PV equipment;
- (xiii) safe work practices that will allow maintenance of the PV system on the canopy structure that may support the 1500V OHW system; and
- (xiv) the earthing arrangement of the PV system, confirming that it is consistent with the overall earthing, bonding and Electrolysis strategy of the Project Works.

2.3 High Voltage network

- (a) The type of switching mechanism, operation, protection and remote control functions used in Central Station by the CSM Contractor must satisfy the requirements of applicable Codes and Standards and ASA Standards applicable to underground installations.
- (b) The CSM Contractor must produce proposed operating diagrams, obtain approvals from relevant stakeholders and attend operating diagram committee meetings as required.
- (c) The CSM Contractor must provide a HV protection system that ensures:
 - (i) all HV circuit breakers have two tripping circuits consisting of:
 - A. separate trip coils;
 - B. separate protection relays that are different models;
 - C. separate current transformers that are physically different coils; and
 - D. separate auxiliary supplies from different fuses in the auxiliary supply distribution board.
 - (ii) protection zones overlap such that there are no 'unprotected' areas; and
 - (iii) protection grading must:
 - A. be achieved for all phase and earth fault scenarios;
 - B. be achieved from Sydney Trains 11kV Incomer ACCB (at Lee St and Chalmers St), through all 11kV ACCBs in Sydney Trains Central Walk 11kV network to the LV Incomer ACCB and LV bus-tie ACCB on each MSB; and
 - C. be achieved without the use of any "Blocking Scheme" type functionality.
- (d) The CSM Contractor must produce all proposed staging operating diagrams, obtain approvals from relevant stakeholders and attend operating diagram committee meetings.

- (e) The CSM Contractor must provide its HV design for incorporation into the Sydney Trains Power Study. The CSM Contractor's Design Stage 1 Design Documentation must: , documented in Design Stage 1 that:
- (i) confirm the CSM Contractors proposed 11kV system configuration is acceptable to the Principal and relevant stakeholders;
 - (ii) determine the capacity for 11kV busbars and feeder cables;
 - (iii) identify the operation configuration and switching procedures for the 11kV network; and
 - (iv) confirm the Central Station HV network is capable of providing power to the Central Station Works and Central Walk Works connected equipment with provision for spare capacity and service levels as required by applicable Codes and Standards.

2.4 Cables, cable routes and cable containment

2.4.1 Low voltage system

- (a) The CSM Contractor must design, install, test and commission all new and existing Central Station LV cables, cable routes and cable containment systems in accordance with applicable Codes and Standards and ASA Standards.

2.4.2 High voltage system

- (a) The CSM Contractor must design, install, test and commission all new and existing Central Station HV cables, cable routes and cable containment systems in accordance with applicable Codes and Standards and ASA Standards.
- (b) Cables in the HV network that provide the same network function must be run in diverse cable routes such that cables are:
- (i) located on separate racks;
 - (ii) located in separate cable pits;
 - (iii) located in separate conduits; and
 - (iv) physically separated as far as is practical for the location.

2.5 Substation and substation services

2.5.1 Substation rooms and fire ratings

- (a) The CSM Contractor must provide Central Station substation rooms in accordance with the Room Schedules, Room Data Sheets and the CSM Contractor's FLS strategy.
- (b) The CSM Contractor must provide Central Station substations in accordance with applicable Codes and Standards including ASA Standards, with a minimum fire rating of FRL 120/120/120 for each room containing:
- (i) HV switchboards;
 - (ii) distribution transformers;
 - (iii) LV main switchboards; and
 - (iv) service spaces including cable rooms and basements.

- (c) Central Station main HV switchboards that constitute part of a Redundant supply must be physically segregated into separate busses and housed in separate fire rated rooms. Bus-tie cables interconnecting the separate busses between bus tie circuit breakers are allowable.
- (d) Central Station main LV switchboards that constitute part of a Redundant supply must be physically segregated into separate busses and housed in separate fire rated rooms.
- (e) Bus-tie cables interconnecting the separate busses between bus tie ACCB are allowable.
- (f) The CSM Contractor must ensure substations are accessible for replacement and maintenance of equipment, including access to replace any component within a period of 48 hours following failure.
- (g) The CSM Contractor must ensure any penetrations, access hatches, or other modifications to a new or adjusted substation or FLS system, maintain the required fire protection level.

2.5.2 Auxiliary power supply

- (a) Auxiliary power supply for protection and control functions must be 125V DC.
- (b) The auxiliary 125V DC supply must be used in the rooms forming the substation only.
- (c) Cabling for the 125V DC supply must run through rooms and cable ways inside the substation and immediate cable basement only.
- (d) The auxiliary 125V DC supply must be used only for:
 - (i) control and protection of supplies for Central Station HV ACCBs;
 - (ii) auxiliary supplies for protection and monitoring devices on the distribution transformers;
 - (iii) control and protection supplies for the incomer and bus-tie ACCBs on the main switchboards;
 - (iv) auxiliary supplies for the SCADA RTU; and
 - (v) supplies to 125V DC backed up lights in the substation rooms.
- (e) The configuration of the auxiliary 125V DC supply, the use of single or dual battery systems and the distribution of circuits must be determined by the CSM Contractor from applicable Codes and Standards including ASA Standards for underground installations and Central Station HV system protection.

2.5.3 SCADA

- (a) Equipment used in the Central Station substations SCADA system must be ASA type approved and compatible with and capable of being integrated into the existing Sydney Trains SCADA network.
- (b) The Central Station SCADA systems must provide control and status monitoring for the Central Station HV and Central Station LV network equipment in accordance with Codes and Standards applicable to underground installations.
- (c) The Central Station SCADA system must provide control and status monitoring for switchroom environment, switchroom access and switchroom services equipment.

- (d) The Central Station SCADA system must provide control and status monitoring for the Central Station incomer ACCB's, Central Station bus-tie ACCBs and busbars of the Central Station main switchboards.
- (e) Functions and facilities that are under the control of, and monitored by the Central Station SCADA system must not have direct physical input/output connection to any other control system.
- (f) Information required by other control systems for devices that are monitored by Central Station SCADA must be provided from Central Station SCADA to the other control system via communication links between the other systems and the RTUs in the substation.

2.5.4 Switchroom communications

- (a) Communications facilities at each substation must include, at a minimum:
 - (i) telephone system;
 - (ii) SCADA communications to the RTU, including integration to existing Sydney Trains SCADA system and existing networks; and
 - (iii) pilot wire communications between protection relays on 11kV feeders.
- (b) All communication systems must integrate with existing networks and equipment must be compatible with the equipment used at other distribution substations.
- (c) All communications to a Central Station substation must be over dedicated fibre optic cores that use the existing fibre communications backbone.
- (d) All communications fibre paths must be in dual Redundant pairs (normal and diverse) in hot standby arrangement. Fibre path Redundancy must be achieved by using fibre cores in different cables, having fibre cables run in different routes and ensuring that the fibres share not more than 25% of nodes used along the fibre path.

2.5.5 Lighting and staff access system

- (a) Lighting for the substations must include:
 - (i) normal lighting;
 - (ii) battery backed up lighting;
 - (iii) 125V DC backed up lighting; and
 - (iv) emergency exit lights.
- (b) The application of this lighting covers:
 - (i) all rooms forming the substation;
 - (ii) cable rooms; and
 - (iii) any corridors that provide emergency egress path from the substations.
- (c) An Electronic Access Control System (EACS) must be established in each Central Station substation that is consistent with the arrangement and functionality of staff access systems at other Sydney Trains substations. The staff access system is a control circuitry used to identify when staff access the substation, provide alarms to electrical system control and control the functions of the various types of lighting systems in the substation.

2.5.6 Ventilation

- (a) The CSM Contractor must provide a ventilation system for switchrooms that ensures:
 - (i) the peak operating temperature of any device is less than the maximum operating temperature recommended by the manufacture of that device; and
 - (ii) the time that the switchroom ambient temperature is above limits specified in ASA Standards for equipment is less than 1 hour.
- (b) The CSM Contractor must provide an Equipment Temperature Performance Report in the Design Documentation that:
 - (i) identifies temperature limits for equipment operating in the switchrooms;
 - (ii) identifies typical daily switchroom ambient temperature profile at 90% confidence level when utilising external ambient temperatures in accordance with section 2.1.2 Appendix B04b;
 - (iii) determines that the temperature profile fits the above equipment temperature limits;
 - (iv) identifies the surface touch temperature for all devices, and confirms this temperature is considered safe to touch; and
 - (v) where necessary, include measures to prevent inadvertent contact with hot surfaces as required.

2.6 Adjustments to the existing power system

- (a) All Central Station electrical assets affected by the CSM Contractor's Activities must be either decommissioned, replaced, modified and/or relocated without affecting the operation of Central Station, unless otherwise approved by the Principal's Representative.
- (b) Newly installed 11kV feeders must be sized to meet Sydney Trains network requirements.
- (c) Central Station LV supply and distribution must be reconfigured to ensure yard lighting, and any other identified LV services to be retained after the demolition of the Rolling Stock Officers Building, are resupplied with compliant Central Station LV supply and distribution systems.
- (d) The CSM Contractor must upgrade the existing Lee Street substation to provide additional capacity on the 11kV network at Central Station for additional Loads resulting from the Central Station Works and Central Walk Works. The upgrade must include the provision of:
 - (i) additional 33kV circuit breaker;
 - (ii) new 33/11kV transformer; and
 - (iii) 11kV switchboards.
- (e) The CSM Contractor must provide an 11kV feed from Lee Street substation to a new padmount distribution transformer located in the proximity of the Sydney Yard Access Bridge (SYAB) including:

- (i) design, supply and installation of the new distribution transformer in the proximity of the SYAB;
 - (ii) ensuring the new distribution transformer has the capacity to provide fully redundant LV supplies to SYAB, SY1 & 2 and the Sydney Yard Lighting;
 - (iii) repurposing the existing Ausgrid 200A 415VLV supply to SYAB to provide the backup supply for these loads; and
 - (iv) connection of the fully redundant LV supply to SYAB and the Sydney Yard lighting.
- (f) The CSM Contractor must upgrade Central No. 1 and Central No. 2 Substations located in the ESR including:
- (i) replacing the existing 11kV ring main unit with a new 11kV ACCB switchboard;
 - (ii) replacing both of the existing 1MVA transformers with new transformers rated at a minimum 2MVA continuous rating. The transformer rating must be the same as transformers selected for the new Central Station distribution substation;
 - (iii) replacing 11kV cable from the ACCB to the new transformers;
 - (iv) replacing 415V cable from the new transformers to LV switchboard;
 - (v) upgrading LV switchboard incomer ACCB, Bus-Tie ACCB and Busbar to match the new installed capacity;
 - (vi) upgrading the ventilation system to accommodate an increased heat load;
 - (vii) replacement battery system;
 - (viii) augmenting SCADA Remote Terminal Unit (RTU) to accommodate additional inputs/outputs with mandated spare capacity;
 - (ix) installing a Staff Access System, including upgrade of lighting, consistent with the Staff Access System functionality installed at other Sydney Trains substations;
 - (x) providing phone and LAN connection points at 6 locations in the substations;
 - (xi) configuring substation rooms to achieve:
 - a. a fire rated segregation between HV switchboard, transformer and LV switchboard within each substation room ; and
 - b. a fire rated segregation between the two substation rooms;
 - (xii) repairing the switchroom structure to stabilise walls and ceilings;
 - (xiii) modifying the switchroom structure and ventilation facilities to reduce ingress of dust through provision of positive pressurisation ;
 - (xiv) updating labels on all circuits on the LV switchboard; and
 - (xv) providing documentation (including single line diagram; switchboard arrangements, switchboard schedules and details of switchroom services) that matches the upgraded system following completion of the CSM Contractor's Activities.

- (g) Sydney Transformer Rooms No.1 and No.2 distribution substations must be upgraded, including:
- (i) replacing two existing 750kVA transformers with two (2) new 1MVA transformers in Sydney Transformer Room No. 2;
 - (ii) modifying the protection of the 11kV ACCB feeding the existing transformer to implement protection consistent with governing standards;
 - (iii) replacing the 11kV cable from the ACCB to the new transformer;
 - (iv) replacing the 415V cable from the new transformers to the LV MSB;
 - (v) ensure the 415V incomer ACCB is adequately rated,
 - (vi) updating labels for the switchroom for all feeder circuits on the main switchboard and for all other devices in the room;
 - (vii) installing Staff Access System , including upgrade of lighting, consistent with the Staff Access System functionality installed at other Sydney Trains substations;
 - (viii) providing phone and LAN connection points at 6 locations in the substation;
 - (ix) reviewing the ventilation system capacity to accommodate any increased heat load and, if needed, upgrading the ventilation system accordingly;
 - (x) modifying the switchroom structure and ventilation facilities to reduce ingress of dust through provision of positive pressurisation; and
 - (xi) providing documentation (including single line diagram; switchboard arrangements switchboard schedules and details of switchroom services) that matches the upgraded system following completion of the CSM Contractor's Activities.
- (h) The CSM Contractor must investigate and identify existing system loads in the Devonshire Street Tunnel area and the southern end of the intercity platforms which currently experience non-compliant voltage drop at the Load. The CSM Contractor must implement solutions by either running new cables from the existing supply point; or, relocate the source of supply to a new Central Station substation with suitable cabling, ensuring voltage drop at maximum demand is less than the limits specified in ASA Standard ESB E001.
- (i) No new connections to Sydney Yard West Substation are permitted.

3 Metro Station electrical services

3.1 General

- (a) The CSM Contractor must:
 - (i) segregate the electrical systems so far as is reasonably practical for the Central Station Works and Central Walk Works, from the Metro Station and other Third Party electrical supply systems, to the satisfaction of relevant stakeholders;
 - (ii) ensure continuity of service to operational critical loads through redundancy of supply and/or provision of alternative sources of power; ;
 - (iii) protect all electrical services equipment before and after installation; and
 - (iv) provide electrical equipment that is fully rated for its intended purpose and not reliant upon short term or overload ratings.

3.2 Low voltage power supply and distribution

3.2.1 General

- (a) The LV distribution system for the Metro Station must be supplied from the Sydney Metro City & Southwest HV reticulation system.
- (b) Any Metro Station renewable electrical power generation sources must be connected to the Metro Station HV reticulation and Metro Station LV distribution systems.
- (c) All Metro Station Loads must be supplied from the Metro Station LV distribution system.
- (d) All Metro Station Loads must be defined as Safety Service Loads, Operations Critical Loads or Normal Loads where:
 - (i) Safety Service Loads are as defined by AS/NZS 3000 – Australian/New Zealand Wiring Rules;
 - (ii) Operations Critical Loads means those loads that are required to be kept operational to facilitate normal operations and are not classified as safety service loads; and
 - (iii) Normal Loads means those loads not defined as either Safety Service Loads or Operations Critical Loads.
- (e) All Metro Station LV distribution system equipment must be proven, “off the shelf” technology used successfully for a minimum period of three years in three separate rail systems.
- (f) All Metro Station LV distribution system equipment must be fully rated for its intended purpose and not rely upon short term or overload ratings.
- (g) The CSM Contractor must make provision for capacity, safeguarding and augmentation for the Metro Station LV distribution system and loads to be extended with no disruption to train services.

3.2.2 Redundancy

- (a) The Metro Station LV distribution system must provide a minimum level of N-1 Redundancy up to incoming supplies of Metro Station main LV switchboards.
- (b) The Safety Service Loads and Operations Critical Loads must have the minimum level of Redundancy of N-1 and:
 - (i) Loads which have a battery backup that can maintain the Load for the required time has a Redundancy of N-1; and
 - (ii) any Load used as a mechanical backup for another Load must be supplied from separate bus sections of a Metro Station main LV switchboard.

3.2.3 LV distribution system

- (a) The Metro Station LV distribution system and Load configuration must ensure that no failure of any single component will prevent train services operating.
- (b) The following requirements for 'time to restore' must be incorporated in the design:
 - (i) for Safety Service Loads and Operations Critical Loads, 15 minutes as a maximum; and
 - (ii) for Normal Loads, 24 hours.
- (c) Failed component(s) must be able to be returned to service within one month of the date of failure for all components in an N-1 area.
- (d) The Metro Station LV distribution system must provide an uninterruptible power supply (UPS) to loads that cannot sustain short-term switching outages for the duration of switching outage.
- (e) All Metro Station Main LV switchboard equipment must be contained within a dedicated fire compartment(s) that have a minimum fire resistance level of FRL 120/120/120 except doors which must have a minimum fire resistance level of FRL -/120/30; unless all parts of the equipment dedicated fire compartment(s) are separated by more than 6m from any other fire compartment(s), including adjacent building(s) fire compartments, but excluding BCA Class 10 buildings where fire rating provisions are not otherwise specified.
- (f) The Metro Station LV distribution system must provide a minimum of 20% electrical and spatial spare provision and capacity for general system expansion.
- (g) All Metro Station LV main switchboards must be maintained at a minimum of 0.95 power factor lagging and leading.
- (h) Electricity generated from Metro Station renewable energy sources must be metered.
- (i) Electrical meters must:
 - (i) have an accuracy class of 0.2 over the full power factor range;
 - (ii) be able to provide current, voltage, kWh consumption and maximum demand in real time; and
 - (iii) be installed for reading locally and remotely by either the power control system (PCS) or BMS.
- (j) The CSM Contractor must maximise the energy efficiency of Metro Station HVAC power consumption and operational control.

- (k) The Metro Station LV distribution system must be remotely monitored by the Metro Station BMS and the Metro Station PCS, as detailed within section 3.7 of SWTC Appendix B04b and section 3.6.4 of this SWTC Appendix B04a, respectively.

3.2.4 Main LV switchboards and distribution boards

- (a) All Metro Station main LV Switchboards must be located indoors.
- (b) Indoor switchboards and distribution boards must have a minimum IP rating of IP42.
- (c) Outdoor distribution boards must have a minimum IP rating of IP65.
- (d) Metro Station main LV switchboards must be form 4a as defined in AS/NZS3439.1.
- (e) Metro Station main LV switchboards that require N-1 or N-2 rated supplies must have separate bus sections for these supplies or separate switchboards with a common busbar with mechanically interlocked incoming circuit breakers.
- (f) All Metro Station switchboard and distribution board neutral busbars must be the same size as the phase busbar.
- (g) Electrical metering must be provided on the incoming supplies at each Metro Station LV main switchboard.
- (h) Electrical meters must:
- (i) have an accuracy class of 0.2 over the full power factor range;
 - (ii) provide current, voltage, kWh consumption and maximum demand in real time to the Metro Station BMS; and
 - (iii) be able to be read locally and remotely.
- (i) All Metro Station secondary revenue electrical supplies must have tariff metering.
- (j) Sub-metering must be provided for final loads over 100 kVA connected load.
- (k) The Metro Station main LV switchboard and distribution boards must be monitored by the Metro Station BMS and the Metro Station PCS as detailed within section 3.7 of SWTC Appendix B04b and section 3.6.4 of this SWTC Appendix B04a, respectively. The monitoring must include as a minimum status of Metro Station LV switchboard circuit breakers, distribution boards main switch, local, remote control, metering, healthy incoming supply, protection and power factor.
- (l) Metro Station main LV switchboards must provide the status of main switches to the PCS.

3.2.5 Uninterruptable power supply

- (a) The Contractor must provide a centralized UPS with the following back up time for Interface Contractor systems:
- (i) signalling equipment in control room – 4 hours
 - (ii) communication Systems including loads in tunnels – 6 hours
 - (iii) radio (Including loads in tunnel) - 6 hours
 - (iv) GRN radio -6 hours
 - (v) platform screen doors - 1 cycle
 - (vi) power control system - 6 hours
 - (vii) tunnel ventilation control System - 6 hours

- (b) The Contractor must have a dedicated UPS with the following back up time for:
 - (i) Interface Contractor systems:
 - A. Platform Screen Door - 1 cycle door
 - B. Signalling System -4 hours
 - C. Tunnel Emergency Lighting -2 hrs min
 - D. tunnel fire alarm system -24 hours
 - (ii) CSM Contractor's systems:
 - A. lifts - 4 hours
 - B. escalators - 30 mins
- (c) For all other Metro Station Safety Systems the CSM Contractor must have a dedicated UPS with a minimum back-up time in accordance with applicable Codes and Standards. In all cases the back-up time must support the CSM Contractor's FLS strategy.
- (d) The Metro Station UPS must:
 - (i) be distributed via fixed wiring to special plug tops for portable equipment and direct connection to fixed cabinets;
 - (ii) be industrial grade;
 - (iii) include:
 - A. a maintenance bypass;
 - B. a static transfer switch;
 - C. batteries with minimum design life of seven years;
 - D. monitoring by the Metro Station BMS for emergency lighting and by the Metro Station PCS, for Metro Station systems to provide UPS AC supply or battery power source status and general alarms;

3.2.6 Photovoltaic (PV) system

- (a) The CSM Contractor is not required to provide a PV system in the Metro Station.

3.2.7 Design Documentation

- (a) In addition to the Management Requirements, the CSM Contractor must provide the following specific Design Documentation in relation to the Design Stage 1 for the Metro Station LV distribution system:
 - (i) LV distribution system modelling for all operations activities in all operational modes (i.e. Normal Operations, Abnormal Operations, Degraded Operations and Emergency Operations);
 - (ii) fully dimensioned site plans;
 - (iii) preliminary dimensioned equipment room layouts showing the equipment type and location to be installed within the room;

- (iv) power supply design study to determine which functions of the Metro Station systems require:
 - A. supply from two or more independent sources; and
 - B. UPS.
 - (v) the power supply design study must include:
 - C. the size of the Loads;
 - D. the autonomy time required;
 - E. the recharge time following a blackout; and
 - F. the architecture of the intended UPS systems.
 - (vi) single line diagrams, including an overall system-wide diagram for the system;
 - (vii) maximum demand calculations for each load;
 - (viii) cable route diagrams;
 - (ix) LV distribution equipment sizes;
 - (x) other discipline interfaces approvals from Utility Service owners, Authorities and other relevant stakeholders for relevant operations activities;
 - (xi) confirmation of conformance to applicable Codes and Standards and requirements;
 - (xii) cost benefit analysis of options and final selection; and
 - (xiii) lighting level calculations.
- (b) In addition to the Management Requirements, the CSM Contractor must provide the following specific Design Documentation in relation to Design Stage 2 Metro Station for the LV distribution system:
- (i) LV electrical protection schemes, including discrimination studies;
 - (ii) design studies, including: fault level, voltage drop and cable sizing calculation;
 - (iii) Third Party technical and operational agreements;
 - (iv) designer's risk assessment and traceability;
 - (v) cable selection, cable schedule and cable routing arrangements;
 - (vi) fully dimensioned and confirmed site plans;
 - (vii) fully detailed and dimensioned risers and electrical equipment rooms demonstrating full coordination with all other services and equipment that interface with the riser or equipment room;
 - (viii) equipment installation and replacement methodology and supporting drawings, including crane arrangements (eg load points, lift studies) and large equipment transportation routes;
 - (ix) protection setting calculations;
 - (x) test and commissioning plan;

- (xi) detailed bill of material covering all items;
- (xii) specifications or datasheets for LV distribution items; and
- (xiii) switchboard equipment general arrangement drawings.

3.3 High Voltage network

- (a) The CSM Contractor must:
 - (i) make spatial allowances in the Metro Station for all temporary and permanent infrastructure required to support the new Sydney Metro City & Southwest HV and Traction Power Supply systems;
 - (ii) allow for Sydney Metro City & Southwest HV reticulation equipment to be located in non-public areas of Metro Station, with lockable access for authorised personnel;
 - (iii) provide cable routes and cable containment systems in Metro Station for all temporary and permanent infrastructure required to support the Sydney Metro City & Southwest HV and Traction Power Supply systems in accordance with section 3.5.2;
 - (iv) ensure spaces for the Sydney Metro City & Southwest HV and Traction Power Supply systems is segregated from those required for the Central Station HV network;
 - (v) provide Metro Station substation rooms, DC isolating link rooms and DC energy storage equipment rooms in accordance with the Room Schedule and Room Data Sheets; and
 - (vi) provide Metro Station substation services, DC isolating link room services and DC energy storage equipment room services in accordance with section 3.6 and 3.7 of this SWTC Appendix B04a.

3.4 Cables, cable routes and cable containment systems

3.4.1 Low voltage system

- (a) All Metro Station LV system penetrations must meet the relevant fire resistance level.
- (b) All Metro Station LV system penetrations in weatherproof elements must be sealed to retain the waterproofing rating.
- (c) All Metro Station LV system supports must be designed and installed to accommodate the Loads supported and spare capacity as specified in 3.5.1 p).
- (d) Metro Station LV cable containment system must be ladder, conduit or enclosed troughing for all mains and submains.
- (e) All Metro Station LV services in public areas must be embedded or concealed in a manner that:
 - (i) ensures that adequate access is permitted for maintenance of the service;
 - (ii) does not diminish the aesthetic appeal of the installation;
 - (iii) does not undermine the integrity of any substrate it is embedded in; and
 - (iv) does not undermine the integrity of any surface it is mounted to.

- (f) Cutting and patching work for the Metro Station LV system is not acceptable.
- (g) The CSM Contractor must not install Metro Station LV system cable pits in platforms.
- (h) Metro Station LV system pits and conduits must:
 - (i) be water free before cables are installed and remain water free after installation;
 - (ii) have all conduits capped and inspected prior to the installation of services to ensure any water ingress has drained away; and
 - (iii) include appropriate measures to mitigate water ingress or to allow drainage of water from pits subsequent to the installation of services;
- (i) Metro Station cable pits must be designed to accommodate:
 - (i) the quantity of conduits to be installed in all directions; and
 - (ii) the quantity and size of cables that are to be placed in the conduit and pits.
- (j) All Metro Station conduits are to be fitted with bellmouth's and be de-burred
- (k) Draw wires must be installed in all spare Metro Station LV system conduits.
- (l) The CSM Contractor must:
 - (i) estimate maximum anticipated cable tensions prior to all cable pulls and not exceed the manufacturers cable pulling tension limit during installation; and
 - (ii) assess and determine the appropriate methods used to monitor the tension during the cable pull.
- (m) Cable pulling rollers and lubricating additives must not undermine the integrity of the Metro Station LV cable or cable containment system.
- (n) The Metro Station LV cable bending radii must not be less than the manufacturer's specifications:
 - (i) during storage;
 - (ii) prior to and during construction; and
 - (iii) during all stages of installation.
- (o) Metro Station cable installation for the electrical distribution system must not:
 - (i) interfere with other services;
 - (ii) be surface mounted in public areas; or
 - (iii) encroach into identified public access routes.
- (p) At Completion of each Portion, spare cable containment system(s) spatial capacity and thermal derating must be provided, including:
 - (i) the higher of one additional cable or 25% of additional design/route capacity, for areas that are inaccessible for future cable containment installation; and

- (ii) the higher of one additional cable or 20% of additional design/route capacity, for areas that are accessible for future cable containment installation.
- (q) All Metro Station LV cables and conduits within underground areas must have low smoke, zero halogen and low flame propagation properties tested to AS/NZS 1660 (Set) of standards.

3.4.2 High voltage system

- (a) Sydney Metro City & Southwest HV systems cables must be continuously supported over the entire cable length by a cable containment system.
- (b) Sydney Metro City & Southwest HV cable containment system must be ladder, conduit or enclosed troughing.
- (c) Sydney Metro City & Southwest HV cable routes must not be direct buried.
- (d) All Sydney Metro City & Southwest HV system cable routes must facilitate maintenance and replacement.
- (e) The Metro Station HV cable bending radii must not be less than 2.0m:
 - (i) during storage;
 - (ii) prior to and during construction; and
 - (iii) during all stages of installation.
- (f) For all Sydney Metro City & Southwest HV cable ladders or support mechanisms containing multiple HV circuits, mechanical protection must be provided between each HV circuit.
- (g) Conduits used for Sydney Metro City & Southwest HV system cables must be heavy duty unplasticised poly vinyl chloride (HD UPVC) to AS2053 or to a standard acceptable to the relevant approving authority.
- (h) All Sydney Metro City & Southwest HV system cables must be installed in accordance with manufacturer's recommendations for bending radius, pulling tension and environmental conditions, a minimum of 2m bending radii applies.
- (i) The Sydney Metro City & Southwest HV cable system installation must not:
 - (i) interfere with other services; and
 - (ii) encroach into the identified access routes.
- (j) The CSM Contractor must allow for additional Sydney Metro City & Southwest HV cables to be installed in the future by providing spare conduits and capacity in cable containment systems of:
 - (i) 100% for enclosed wiring systems; and
 - (ii) 30% for unenclosed wiring systems.
- (k) Sydney Metro City & Southwest HV cables and conduits within all underground stations and tunnels must be low smoke, zero halogen and low flame propagation properties tested to AS/NZS 1660 (Set) of standards.

3.5 Substation and substation services

3.5.1 General

- (a) The CSM Contractor must work with the Interface Contractor in accordance with the Interface Schedules to enable the Interface Contractor to design and construct the Metro Station substations.

3.5.2 Substation rooms and fire ratings

- (a) The CSM Contractor must provide Metro Station substation rooms in accordance with the Room Schedule and Room Data Sheets.
- (b) Indoor Metro Station equipment and enclosures must have a minimum Ingress Protection (IP) rating of IP42.
- (c) All Sydney Metro City & Southwest HV reticulation equipment must be contained within a dedicated fire compartment(s) that has a minimum fire resistance level of FRL 120/120/120 except doors which must have a minimum fire resistance level of FRL -/120/30; unless all parts of the equipment dedicated fire compartment(s) are more than 6m separated from any other fire compartment(s), including adjacent building(s) fire compartments, but excluding BCA Class 10 buildings where fire rating provisions are not otherwise specified.
- (d) Sydney Metro City & Southwest HV reticulation transformers must be contained within individual fire rated bays or rooms.
- (e) Sydney Metro City & Southwest HV transformers in underground substations must be of the indoor encapsulated-winding dry type, non-flammable insulation construction.
- (f) The CSM Contractor must make spatial provision for the Sydney Metro City & Southwest HV reticulation system to be enhanced and/or extended in accordance with the Interface Schedules.
- (g) The CSM Contractor must make space allowance to support augmentation requirements in accordance with the Interface Schedules and Room Schedules.
- (h) Sydney Metro City & Southwest HV reticulation equipment expansion, includes:
 - (i) HV switchgear expansion;
 - (ii) space for HV switchgear expansion; and
 - (iii) cable containment systems for HV Reticulation.
- (i) Sydney Metro City & Southwest HV reticulation system components, assemblies and equipment must be resilient, modular and expandable.

3.5.3 Auxiliary supply

- (a) Auxiliary supply requirements must be in accordance with section 2.5.2 of this SWTC Appendix B04a.

3.5.4 Substation communications

- (a) The CSM Contractor must interface with the Interface Contractor in accordance with the Interface Schedules to design and construct the Metro Station substation communications.

3.5.5 Lighting and staff access system

- (a) The CSM Contractor must provide lighting and a staff access system to all Metro Station substation rooms in accordance with section 2.5.5 SWTC Appendix B04a.

3.5.6 Ventilation

- (a) Metro Station HV substations must be designed to maintain the Metro Station equipment room air temperature below the maximum operating temperatures of the Metro Station substation equipment.
- (b) Metro Station HV power transformers must not be force cooled.

3.6 DC isolating link rooms and associated services

3.6.1 General

- (a) The CSM Contractor must interface with the Interface Contractor in accordance with the Interface Schedules to design and construct the DC isolating link rooms and associated services.

3.6.2 Substation rooms and fire ratings

- (a) The CSM Contractor must provide Metro Station DC isolating link rooms in accordance with the Room Schedule and Room Data.

3.7 DC energy storage equipment rooms and associated services

- (a) The CSM Contractor must provide Metro Station DC energy storage equipment rooms in accordance with the Room Schedule and Room Data Sheets.

4 Earthing and bonding, electrolysis protection and electromagnetic compatibility

4.1 General

- (a) The CSM Contractor must provide earthing systems for power systems of Central Station and the Metro Station, to be used for earthing of:
- (i) HV power system;
 - (ii) LV power system;
 - (iii) DC traction power system;
 - (iv) lightning protection;
 - (v) cable racking systems;
 - (vi) structural metallic earthing; and
 - (vii) communications systems.
- (b) The CSM Contractor must provide bonding systems that will be used to bond metallic infrastructure to rail for the power systems of Central Station and the Metro Station, and will:
- (i) provide equipotential bonding of metallic infrastructure supporting the 1500V OHW systems;
 - (ii) ensure safe touch potential of metallic infrastructure supporting the 1500V OHW systems;
 - (iii) manage voltage differences between PSD, rolling stock and the earth for safe passage entry and egress from rolling stock;
 - (iv) minimise the production of stray currents; and
 - (v) prevent the exchange of DC traction currents between Central Station and Metro Station DC traction power systems.

4.2 Earthing

4.2.1 System configuration

- (a) The CSM Contractor must provide a single earth system at Central Station.
- (b) The Central Station single earth system must be configured to:
- (i) provide a separate sub-system for the Metro Station;
 - (ii) provide a separate sub-system for Central Station;
 - (iii) provide a single bond point between the sub-systems; and
 - (iv) be isolated from external Multiple Earthed Neutral (MEN) power systems.

4.2.2 Central Station earthing boundary

- (a) The CSM Contractor must define the earthing boundary at Central Station to incorporate:
 - (i) an identified boundary around the Central Station within the area bounded by Lee St, Eddie Ave, Chalmers St and an appropriate point in Sydney Yard;
 - (ii) a boundary that represents a space in the ground where electrical isolation across the boundary is achievable; and
 - (iii) a boundary that may cut through civil structures where the structures can be electrically isolated from each other.
- (b) The CSM Contractor must manage the Project Works so that no metallic materials are installed that cross the earth boundary of the Project Works.

4.2.3 Metro Station earthing system

- (a) The CSM Contractor must provide an earthing system for the Metro Station that:
 - (i) is a combined HV/LV earth system;
 - (ii) bonds the cable screens of the HV feeders (cables coming from outside Central Station) to earth; and
 - (iii) includes redundant cables for earthing of power system equipment (HV, DC traction and LV MSB).
- (b) The CSM Contractor must ensure Metro Station structures provide:
 - (i) an earth grid and earth rods in the base slab;
 - (ii) 20 pressurised electrode pit chambers within the base slab of Metro Station Structure equally distributed;
 - (iii) electrode pit chamber which are designed and constructed to deliver the following performance requirements:
 - A. have a minimum design life of 100 years;
 - B. permit the future insertion of electrodes that have a minimum diameter of 15 mm and a maximum diameter of 30 mm;
 - C. achieve watertightness Grade A and are capable of resisting 600 kPa water pressure;
 - (iv) electrically continuous steel reinforcement with a resistance of less than 2Ω in accordance with AS2832 where:
 - A. testing of electrical continuity must be performed prior to pouring of concrete;
 - B. steel reinforcement must be made electrically separate at the earthing boundary; and
 - (v) electrically separate tunnel lining segments.

4.2.4 Central Station earthing system

- (a) The CSM Contractor must provide an earthing system that:
 - (iv) is a combined HV/LV earth system;

- (v) bonds the cable screens of the HV feeders (cables coming from outside Central Station) to earth; and
 - (vi) includes redundant cables for earthing of power system equipment (HV, DC traction and LV MSB).
- (b) The CSM Contractor must implement corrective action on the existing Central Station earth system affected by the Project Works to eliminate step and touch potential hazards.

4.2.5 Connection between Central Station and Metro Station earthing systems

- (a) The CSM Contractor must provide a connection between the Central Station and Metro Station earth systems so that:
- (i) the earthing at Central Station can be considered as one system;
 - (ii) there is a single connection point between the earthing sub-systems that is rated for all HV, LV and DC traction fault current that may flow through each of the sub-systems; and
 - (iii) the future operators have the ability to break the link between the two systems for the purpose of testing.
- (b) The CSM Contractor must provide a connection fitted with a DC current blocking device to prevent flow of stray currents between earthing sub-systems, but does not adversely affect the earth function.

4.3 DC Traction System Fault Path Bonding

4.3.1 Configuration

The CSM Contractor must provide bonding facilities to the DC traction system with separate sub-systems for Metro Station and Central Station and not transfer DC traction fault currents into the LV or HV power system.

4.3.2 Bonding of Metro Station and Central Station

- (a) The CSM Contractor must provide an equipotential bonded zone for all metallic structures supporting 1500V OHW.
- (b) The CSM contractor must provide an earthing and bounding system including condition monitoring with alarms to alert the electrical system operator that:
- (i) connects to the electrical system SCADA (Central Station) and PCS (Metro Station);
 - (ii) has user configurable alarm trigger levels;
 - (iii) alerts the operator if there is a failure of the system;
 - (iv) alerts the operator to the flow of stray current, and continues to provide this alarm while stray current is flowing;
 - (v) tells the operator the location of the fault;
 - (vi) collects status and condition information in accordance with NSW Electrolysis Committee; and
 - (vii) provides remote access via LAN/WAN to download data.

4.4 Electrolysis and Stray Current mitigation

4.4.1 Methods and practices

The CSM Contractor must provide cathodic protection systems associated with stray DC currents

4.4.2 Minimising Stray Currents

The CSM Contractor must:

- (a) identify any metallic infrastructure affected by the Project Works that cross the earthing boundary, and provide separation between the identified infrastructure and the earth;
- (b) only use/allow cables with conductive cores and/or conductive earth sheathes to pass across the earth boundary so long as they are inside non-conductive conduits for at least 2m on the earth side of the boundary;
- (c) allow rail track to cross the boundary; and
- (d) provide protective barriers over all exposed rail connections.

4.4.3 Providing Cathodic Protection

- (a) The CSM Contractor must implement cathodic protection measures for
 - (i) new structures which are part of the Project Works; and
 - (ii) existing structures which are impacted by the Project Works and future operation to make them code compliant.
- (b) The CSM Contractor must take base line stray current, and rail to structure voltage correlation measurements for all stray current drainage bonds in and around Central Station. Measurements must be taken before any construction works commence for the CSM Contract.
- (c) The CSM Contractor must take operational stray current, and rail to structure voltage correlation, measurements for all stray current drainage bonds used by Sydney Trains in and around Central Station. Measurements must be taken after the commencement of rail operations by Sydney Trains.

4.5 Electromagnetic compatibility

- (a) The CSM Contractor must:
 - (i) nominate three internationally recognised independent electromagnetic compatibility experts from which the Principal's Representative will select one of those three to be the independent electromagnetic compatibility expert for the Project Works;
 - (ii) engage the independent electromagnetic compatibility expert;
 - (iii) have the agreed independent electromagnetic compatibility expert review and verify the CSM Contractor's electromagnetic compatibility plan. The CSM Contractor must implement the recommendations contained in the electromagnetic compatibility plan as they relate to the Project Works; and
 - (iv) carry out field measurements for all operational modes and supply an independent verification certificate provided by the agreed independent electromagnetic compatibility expert.

- (b) The CSM Contractor must ensure that no failure of any electromagnetic suppression components fitted to Safety Critical Systems causes that equipment to fail and cause an unsafe condition on the Sydney Metro City & Southwest or Sydney Trains network, when it is subjected to interference that is within the bounds of EN50121.

4.6 Design Documentation Requirements

4.6.1 Design stage 1 Design Documentation

- (a) Design Documentation as it relates to earthing and bonding must include those documents and requirements defined in MR-T, Annexure C, section C4.2 Earthing and Bonding System Works, Design Stage 1.

4.6.2 Design Stage 2 Design Documentation

- (a) Design Documentation as it relates to earthing and bonding must include those documents and requirements defined in MR-T, Annexure C, section C4.2 Earthing and Bonding System Works, Design Stage 2.

4.7 Testing and Commissioning Requirements

- (a) In addition to the Management Requirements, the earthing and bonding, electrolysis and EMC systems must undergo the following specific testing and commissioning activities:
 - (i) test earth systems to prove compliance with relevant standards;
 - (ii) test earth systems to prove performance in accordance with the design requirements;
 - (iii) insulation testing of all Traction Power supply supports (including double insulation and associated test circuits);
 - (iv) test the bonding systems to ensure compliance and performance;
 - (v) measure and record rail-to-earth voltages for all of the Project Works and confirm the rails do not reach unsafe potential differences;
 - (vi) test cathodic protection to ensure it is providing protection over structures against electrolytic corrosion of the Project Works; and
 - (vii) test cathodic protection that is required for the Project at the Metro Station and ensure it is providing protection over structures against electrolytic corrosion at Construction Completion.

5 Lighting

5.1 Signage

- (a) The CSM Contractor must design and install the signage lighting for the Project Works such that:
- (i) the contrast ratio between the Project Works signage and adjacent light levels is a maximum of 6:1 and minimum of 3:1, whereby the signage is higher illuminance than that of adjacent vertical illumination levels;
 - (ii) back-lit or illuminated signage delivers even illumination across the lit surface;
 - (iii) the brightness of signage does not negatively affect the ambient light levels;
 - (iv) cool white light sources of between 3500K and 4500K in accordance with CIE-1931 is used;
 - (v) lighting for front illuminated signage is:
 - A. localised to ensure that, as far as practical, there is no light spill into adjacent areas; and
 - B. eliminates glare.
 - (vi) the materials used on the signage are selected to ensure that, as far as practical, reflection is avoided; and
 - (vii) meets the requirements of TfNSW Wayfinding and Signage guidelines.

5.2 Wayfinding

- (a) The CSM Contractor must design and install wayfinding lighting that accents specific wayfinding areas, with enhanced light levels that are at a minimum, 50% higher than the surrounding light levels including at:
- (i) new entries and exits;
 - (ii) ticket gates and the vicinity of ticketing equipment (including CLD (cash) and CLD (EFT));
 - (iii) platform edge PSD areas within the Metro Station; and
 - (iv) key customer decision points.

5.3 Glare and light spill

- (a) The CSM Contractor's design must address glare and light spill such that:
- (i) accessories on fittings are used to minimise glare;
 - (ii) appropriate beam angles on luminaires are used to ensure lighting is focussed where required, that spill light is minimised and direct views into a light source is minimised;

- (iii) high quality reflectors are used that have a maximum of 40% spill light outside of the peak intensity as defined by the fitting beam angle;
- (iv) where luminaires are lighting a horizontal surface, the CSM Contractor must mount the luminaires to ensure the angle of the luminaires does not exceed 45 degrees from the vertical;
- (v) where luminaires are lighting a vertical surface and the angle of adjustment justifies a greater than 45 degree position, the direct views to the light source is eliminated or obscured;
- (vi) light spill and light pollution externally is avoided in accordance with AS 4282;
- (vii) where up lighting is used for planting and feature lighting, the luminaires have glare control accessories with appropriate beam angles and directionality to ensure spill light is minimised; and
- (viii) flat horizontal glass luminaires for down lights in external environments are used and luminaires provide function illumination without being angled.

5.4 Reflection

- (a) Indirect glare from reflective surfaces must be avoided.
- (b) Where indirect lighting is to be used, the reflectance of the ceiling finishes must be:
 - (i) minimum 50% reflectance; and
 - (ii) diffuse.

5.5 Sustainability

- (a) The CSM Contractor must develop a lighting strategy that meets the sustainability requirements detailed in Appendix B07 Sustainability Requirements.
- (b) The CSM Contractor must provide light sources that have:
 - (i) efficacy of not less than 60 lumens / Watt; and
 - (ii) lamp life of not less than 10,000 hours.
- (c) LED light sources must have a minimum of 70% lumen maintenance after 50,000hrs for 90% of the light sources (L70 B10), unless otherwise specified.
- (d) Control gear, including LED drivers and transformers, must have an operation life of not less than 25,000 hrs.

5.6 Maintenance

- (a) The CSM Contractor must provide:
 - (i) a lighting system that enables each luminaire to be accessed for maintenance without the need for bespoke scaffolding constructions or suspension harnessing arrangements;
 - (ii) lamp modules within luminaires that are replaceable without the need to discard the whole luminaire;
 - (iii) where LED luminaires are selected they must enable the replacement of individual LED modules; and

- (iv) lighting circuits that are split to enable circuits to be switched off for maintenance whilst maintaining a minimum of 40% of lighting in any affected area.

5.7 Safety and security

- (a) Luminaires mounted in locations that require a maintenance climbing aid must include lanyards on removable components to facilitate lamp replacement and cleaning.
- (b) Vertical illumination in pedestrian and plaza areas must meet 'P' categories, as assessed in accordance with AS/NZS 1158, and be in accordance with local regulatory body guidelines.
- (c) Lighting and light levels must be adequate for CCTV and other security systems operations.
- (d) Light sources must have a colour rendition of no less than 80 in line with CIE-1960.
- (e) All public area luminaires must have a cover to ensure that lamp explosions do not scatter broken lamp glass.
- (f) All luminaires within public spaces with mounting heights at or below 2.4m above finished floor level must have a minimum IK Rating of 10.
- (g) All luminaires within public spaces with mounting heights above 2.4m above finished floor level must have a minimum IK Rating of 8.
- (h) Surface temperatures of luminaires at or below 2.4m from finished floor level must not exceed 50oC.
- (i) In-ground luminaires in trafficable areas must have slip resistant glass treatments.

5.8 Emergency lighting and exit signage

- (a) Emergency light fittings in public areas and office areas must be incorporated in to the area general use light fittings.
- (b) Emergency light fittings must be supported by a UPS via a fire-rated cabling system.
- (c) All emergency light fittings in the presence detection controlled areas must remain on.
- (d) The CSM Contractor must provide all emergency lights with a monitoring and testing system that complies with AS/NZS2293.
- (e) The CSM Contractor must provide an emergency monitoring and testing system that interfaces with the Metro Station BMS.

5.9 Lighting control, circuiting and monitoring

- (a) Lighting must be arranged so the failure of any one circuit does not affect more than 60% of all lights in the area affected by the failure of a distribution board from which a final circuit emanates.
- (b) All lighting must be remotely monitored and controlled by the Metro Station BMS.
- (c) All public area lighting must be installed in zones that can be controlled, monitored and isolated as a group.

- (d) Dual technology presence detection must be used in BOH and public toilets. Where full height walls are used to separate cubicles, each cubicle must have its own detector.
- (e) External lighting must be controlled by daylight sensors and astrological time clocks, either of which must operate the lighting.
- (f) Timed lighting control must be linked to an astronomical time clock.
- (g) Luminaires specified to be dimmable with DMX / DSI / 0-10v / DALI protocols must achieve smooth and flicker free operation through the entire range, which may be from full brightness (100%) through to 1%.
- (h) Natural daylight harvesting must react in a smooth dimmable way from 1% to 100% to balance the required artificial illumination levels with the ingress of natural daylight in public access areas and office areas.
- (i) The daylight monitoring and control of lighting must have:
 - (i) a light level threshold set to twice the area lighting design level; and
 - (ii) a time out period for a minimum of 10 minutes.
- (j) Only immediate start luminaires must be used on sensor controlled circuits in public access areas and BOH areas.
- (k) All lighting to public art and all surrounding lighting which impacts the public art zone must be dimmable.

5.10 Lighting equipment

- (a) Luminaires located in:
 - (i) interior public areas must have a minimum IP rating of IP44;
 - (ii) exterior areas must have a minimum IP rating of IP65;
 - (iii) on platform levels, must have a minimum IP rating of IP44; and
 - (iv) interior non-public areas must have a minimum IP rating of IP20.
- (b) Light sources, excluding signage, must have a colour range of between 2700K and 4500K in accordance with CIE-1931.
- (c) Light sources must have chromaticity coordinates which fall within maximum 3 SDCM (standard deviation colour matching), equivalent to a 3-step MacAdam ellipse.
- (d) LED light sources must have a minimum of 70% lumen maintenance after 50,000hrs for 90% of the light sources (L70 B10), unless otherwise specified.
- (e) Lighting materials must comply with AS/NZS60598.1.
- (f) Light output ratio combined with the reflector and optics must deliver a minimum of 60% light output ratio, in accordance with AS/NZS1680.
- (g) Light fittings must provide 60% of the lamp lumen output of the fitting in the peak intensity, as defined by the fitting beam angle.
- (h) The CSM Contractor must select from the following range of light sources:
 - (i) high efficient LED or equivalent;

- (ii) circular and linear T5 fluorescent; and
- (iii) metal halide.
- (i) Luminaires must only be mounted in accordance with luminaires and lamp manufacturers' recommendations.
- (j) All fittings including control gear and lamps must be appropriately temperature rated for mounting in their intended location.
- (k) All transformer / ballast / control gear required must be purchased from the specified lamp manufacturer or be confirmed as suitable by the lamp manufacturer.
- (l) All lighting control equipment must be electronic.
- (m) All fluorescent and LED lighting control equipment must be high frequency.
- (n) For linear LED product, total length of linear product fed from a single feed must not exceed manufacturer recommendations.
- (o) All luminaires in the surrounding plazas and public domain must meet the requirements and guidelines of the local regulatory body and energy provider.

5.11 Lighting performance

- (a) The light level must be calculated in accordance with the IESNA handbook.
- (b) The CSM Contractor must provide lighting performance in accordance with AS1680 and the minimum lighting levels in Table 1, as a minimum.

Table 1 Minimum lighting levels

Area / Zone / Element	Minimum average horizontal illuminance (lux)	Minimum vertical illuminance (lux)
Plant rooms and BOH	160	N/A
Offices	Refer to AS1680 for levels specific to each office type	
Station toilets and customer amenities	200	20
Public counter tops	250	150
East Concourse	150	20
North South Concourse	150	20
Ramps & stairs (underground areas)	150	N/A
Gatelines	240	20
Metro Station platforms	160	20
Metro Station platform edge	240 <i>note 1.</i>	150 <i>note 1.</i>
Eastern Entrance - daytime only	240 <i>note 2.</i>	N/A
Eastern Entrance – night time only	42	N/A
North Concourse	150	20

Area / Zone / Element	Minimum average horizontal illuminance (lux)	Minimum vertical illuminance (lux)
ESR Concourse	150	20
Devonshire Street Tunnel	150	20
Ramps and stairs (elevated station areas)	42	14
Central Station overground platforms	42 (to the extent of covered area)	30
Transport interchange (open entrance walkway)	42	12
Accessible path (station open entry to car park)	42	8
Surrounding plazas and public domains	Refer to local regulatory body for specific guidelines and requirements	

Table Notes

Note 1: Where the platform has PSD, recommend minimum illuminance is the same as the general platform area.

Note 2: Daytime elevated light levels to accommodate human eye light adaption from exterior daylight.

- (c) Light performance level calculation must use maintenance factors listed below as a maximum:
 - (i) stations – interior public zones 0.7
 - (ii) stations – exterior public zones 0.6
 - (iii) tunnels 0.6
 - (iv) exterior public zones 0.7
 - (v) maintenance buildings and plant rooms 0.7
 - (vi) administration and BOH spaces 0.8
- (d) Deviation from the lighting performance requirements in Table 1 may be permissible where the CSM Contractor demonstrates that a reduction to these values is appropriate and does not negatively impact safety or task performance.
- (e) The CSM Contractor must ensure that lighting performance complies with the CSM Contractor’s FLS strategy.

5.12 Strobing

- (a) The CSM Contractor must ensure the installed lighting does not cause a stroboscopic effect on any persons.

5.13 Design documentation

- (a) In addition to the Design Documentation requirements described in the Management Requirements, the Design Stage 1 Design Documentation must include:
- (i) visualisations of overall intent, to cover each area and zone;
 - (ii) architectural integration details;
 - (iii) indicative luminaire types;
 - (iv) control strategy; and
 - (v) budget estimate.
- (b) In addition to the Design Documentation requirements described in the Management Requirements, the CSM Contractors Design Stage 2 Design Documentation must include:
- (i) low level lighting plans showing luminaire types, mounting locations of luminaires on floor / walls and indicative set out dimensions;
 - (ii) reflected ceiling plan showing locations and types of luminaires and indicative set out dimensions;
 - (iii) luminaire specifications;
 - (iv) luminaire electrical loading details; and
 - (v) preliminary light level calculations illustrating compliance with key design principles and requirements.
- (c) In addition to the Design Documentation requirements described in the Management Requirements, the Design Stage 3 Design Documentation must include:
- (i) low level lighting plans showing luminaire types, mounting locations of luminaires on floor / walls, indicative set out dimensions and control groupings;
 - (ii) reflected ceiling plan showing locations and types of luminaires, indicative set out dimensions and control groupings;
 - (iii) sections and elevations illustrating mounting locations, critical dimensions and positions of integration details;
 - (iv) integration details within architectural details, with critical dimensions and surface finishes;
 - (v) control strategy, including specification of control system, sensors, time clocks etc. control groups and operation of those groups during various times of day;
 - (vi) luminaire specification;
 - (vii) control schedule outlining, per channel:
 - A. luminaire type;
 - B. luminaire quantity;
 - C. unit load;

- D. control type; and
- E. total load.
- (viii) final illuminance and (where appropriate) luminance calculations, which illustrate horizontal, work surface and vertical illuminance where required;
- (ix) BCA compliance statement, outlining allocation of W/m² per space, area and room index of each space, any adjustment factors that have been used and any elements that have been, justifiably excluded from the calculation results; and
- (x) green star and National Australian Built Environment Rating System (NABERS) energy rating compliance statement outlining targeted points and achievements.

- Sydney Metro City & Southwest

- Central Station Main Works**

- Schedule C1

- - Scope of Works and Technical Criteria
 - Appendix B04b
 - Mechanical Services

PROJECT	Central Station Main Works	DATE	27 February 2018
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1 Overview

- (a) This Appendix describes the performance and technical requirements of the mechanical services for the Project Works which includes:
 - (i) Central Station Works;
 - (ii) Central Walk Works; and
 - (iii) Metro Station Works.
- (b) The Central Station Works and Central Walk Works performance and technical requirements are covered in section 2 of this SWTC Appendix and include:
 - (i) environmental control systems and ventilation;
 - (ii) hydraulics, water and sewerage;
 - (iii) vertical transportation;
 - (iv) fire protection and detection systems; and
 - (v) building management system.
- (c) The Metro Station performance and technical requirements are covered in section 3 of this SWTC Appendix and include:
 - (i) environmental control systems and Metro Station ventilation;
 - (ii) tunnel and trackway ventilation allowances;
 - (iii) hydraulics, water and sewerage;
 - (iv) vertical transportation;
 - (v) fire protection and detection systems;
 - (vi) platform screen doors; and
 - (vii) building management system.
- (d) The scope, performance and technical requirements of the fire hydrant systems are described in section 4 of this SWTC Appendix B04b.
- (e) The CSM Contractor's Design Documentation requirements for Mechanical Services are described in section 5 of this SWTC Appendix B04b.

2 Central Station mechanical services

2.1 Environmental control systems and ventilation

2.1.1 General

- (a) The CSM Contractor must provide an environmental control system (ECS) for the Central Station Works and Central Walk Works including:
- (i) heating, ventilation and air-conditioning (HVAC) systems;
 - (ii) equipment room cooling systems;
 - (iii) back-up cooling systems for Critical Equipment Rooms;
 - (iv) economy cycles and heat recovery systems to suit the areas being served and provide energy efficient operation;
 - (v) ventilation systems for concourse public areas;
 - (vi) pressurisation systems for any enclosed emergency stairs and associated, corridors, and lobbies, including relief air paths;
 - (vii) pressure relief and purge systems for rooms with gaseous fire suppression;
 - (viii) associated equipment and system component supports, intakes, discharges, risers, civil and structural works, and acoustic treatments;
 - (ix) power supply, control, and monitoring systems and interfaces;
 - (x) air conditioning cooling water systems, treatment, and condensate drainage systems; and
 - (xi) respective fire separation, fire stopping, fire proofing, and fire system interfaces.
- (b) The CSM Contractor must comply with the Interface Schedule (see section 13.01, Appendix E2, Environmental Control Systems).
- (c) The CSM Contractor must provide the Central Station Works and Central Walk Works ECS to comply with the performance requirements of this Appendix B04b, ASA Standards, the Contract, the National Code of Construction (NCC), Building Code of Australia (BCA), applicable Australian Standards and Codes, local NSW codes of practice, best practice industry guidelines, and the CSM Contractors Fire and Life Safety (FLS) strategy.
- (d) The CSM Contractor must provide a complete and integrated ECS for Central Station Works and Central Walk Works with all necessary components and systems.
- (e) The Central Station Works and Central Walk Works ECS must be independent of the Metro Station Works ECS systems.
- (f) The Central Station Works and Central Walk Works ECS must be integrated in terms of equipment, control and monitoring such that system performance conflicts are avoided.
- (g) Natural ventilation is to be prioritised over mechanically forced ventilation where reasonably practical and in accordance with section 2.1.1 (c).

- (h) In the implementation of the ECS the CSM Contractor must ensure that the design, construction testing and integration will enable the maintenance of the continuous operation of train services at all times.
- (i) The ECS must be capacity rated for Normal Operations, Degraded Operations and Emergency Operations.
- (j) The ECS must maintain the availability of Emergency Operations systems and services.
- (k) The ECS must:
 - (i) ventilate, heat, cool, or air-condition as required, Occupied Spaces for a safe and comfortable thermal environment;
 - (ii) ventilate and cool BOH, equipment spaces, toilets, wet areas, lift shafts, and hazardous areas to:
 - A. maintain suitable operating conditions for safe and normal operation of equipment in accordance with manufacturers requirements;
 - B. remove heat from any embodied operating equipment and limit temperature rise within acceptable ranges for safe and normal operation of equipment, as intended by design;
 - C. provide basic amenity for Enclosed Spaces where expected occupancy is less than 30 minutes duration in any situation;
 - D. positively pressurise against dust ingress;
 - E. mitigate condensation and mould growth;
 - F. capture, contain and remove obnoxious and hazardous substances, contaminants, gases, and vapours;
 - G. prevent development of potentially hazardous or explosive environments;
 - H. maintain any respective hazardous area classifications;
 - I. relieve pressure build up in rooms with gaseous fire suppression to protect integrity of structure;
 - J. purge rooms with gaseous fire suppression to clear room for access or to resume normal operations, and to avoid development of a hazardous environment in adjacent spaces; and
 - K. prevent fire and smoke spread.
 - (iii) pressurise any enclosed emergency egress stairs and associated lobbies and corridors to prevent the ingress of smoke;
 - (iv) support continuous operation of Critical Equipment; and
 - (v) maintain availability of systems and services supporting responses to an emergency event.
- (l) Rooms and Enclosed Spaces served by the ECS must employ passive measures to reduce energy use and the ECS capacity, including; thermal insulation, shading of

- external walls, roofs, and windows, solar treatment of glazing, and room location and orientation.
- (m) Passive thermal performance measures must be applied to cooled spaces to exceed energy reductions achieved by the performance requirements as set in Section J of the BCA.
 - (n) Canopies and shade structures that form part of the Central Station Works and Central Walk Works must be capable of restricting solar radiation to achieve the design temperatures nominated in this Appendix B04b and the energy performance requirements nominated in Appendix B03 Architectural Requirements – Spatial, Functional and Finishes.
 - (o) The ECS must operate efficiently both under full load and part load conditions by use of variable speed drives and high efficiency motors.
 - (p) The ECS must be installed with a minimum of 20% spare capacity including heating or cooling and ventilation capacity, against peak operations and the respective design conditions, where peak operations are the peak hot summer day, the peak winter day, and the peak ventilation demand for each system.
 - (q) The ECS must be demand-controlled where the purpose is to control temperature, maintain a minimum air quality, or where it is serving a normally occupied area.
 - (r) Demand control must be on a respective zone basis.
 - (s) Toilet ventilation must be configured to operate on demand, i.e. whenever the toilet is occupied.
 - (t) The ECS, including ventilation and refrigeration equipment, ductwork and pipework insulation must exceed the performance requirements within Section J of the BCA.
 - (u) The ECS must be able to operate at full system design capacity in ambient condition, in accordance with ASA Standard ESB004.
 - (v) Belt-driven fans and pumps must not be used.
 - (w) Electric duct heaters must not be used.
 - (x) Where no Australian Standard exists, the ECS must be in accordance with the Australian Institute of Refrigeration Air-conditioning and Heating (AIRAH) and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards and guidelines.
 - (y) Ductwork must be designed to minimise airflow resistance and system effect factors and be constructed in accordance with AS4254 and Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) standards and fan and air handling unit manufacturers' recommendations for good practice and low whole life-cycle cost.
 - (z) All mitred bends in ductwork must use turning vanes.
 - (aa) There must be no abrupt transitions in ductwork and pipework. Minimum transitions must be 1:4 ratios.
 - (bb) High performance, low resistance noise attenuators must be used. Noise attenuators must be lined to suit their environmental conditions.
 - (cc) ECS water services, including gravity or pressure water pipes, cooling and heating services, and condensate drainage, must be located external to Critical Equipment

Rooms, including communications equipment, signalling equipment, and motor control cabinets or drives, servers, switchboards, switch gear and transformers.

- (dd) Water pipes or drainage must not be routed directly above any equipment or devices susceptible to water damage or the effects of moisture.
- (ee) Condensate drip trays must be provided under cooling coils, fan coil units, evaporator units, and where condensate may form, with trap and gravity drainage to the closest available tundish. Drip trays and drains must be insulated.
- (ff) Where a room or Enclosed Space can be defined as more than one type or area by its contents or functions, then the most onerous design criteria and extent of ECS provisions set by its individual contents or functions must be applied to the whole room or space.

2.1.2 Environmental design conditions

- (a) The ECS must be designed to ambient design conditions appropriate for its given application, climate change considerations, ECS peak design condition (design hour), and most relevant to the respective geographic locations in which it operates.
- (b) Ambient design temperatures and wind characteristics must be based on recorded data from the Australian Bureau of Meteorology.
- (c) For summer ECS comfort applications, the summer design hour ambient conditions must:
 - (i) be based on the 90th percentile summer dry bulb temperature from temperature observations for the last 30 years; and
 - (ii) not be exceeded on more than 10 days of the 92 summer days of the year.
- (d) For winter ECS comfort applications, the winter design hour ambient conditions must be:
 - (i) based on the 10th percentile winter dry bulb temperature from temperature observations for the last 30 years; and
 - (ii) selected for the system operating hours or hours in which the serviced spaces are typically utilised.
- (e) For ECS Critical Equipment Rooms, the summer design hour ambient conditions must be:
 - (i) based on the summer dry bulb temperature not exceeded on more than 0.25% of plant operating hours per year; or
 - (ii) the 98th percentile dry bulb temperature from data of the hottest month from temperature observations for the last 30 years, whichever is more onerous.
- (f) The ambient design condition must take into account climate change temperature increases to the ambient temperature by applying the change in environmental conditions due to climate change predicted by the representative concentration pathway (RCP) 8.5 for 2030 and 2050 scenarios. The HVAC system capacities shall be sized to accommodate the system load +20% spare, or the system load and climate change growth, whichever is larger. The 20% spare capacity and climate change growth allowance are to be considered in parallel not concurrently.
- (g) Relative humidity must be that which corresponds to the respective design dry bulb temperature in each case.

- (h) Background noise levels must be based on baseline measurement reports, future land use assessments and requirements of Planning Approvals.
- (i) Wind characteristics must account for local wind effects, including prevailing wind direction, frequency, and magnitude, and minimising the likelihood of wind tunnel effects to a maximum air movement speed of 1m/s through concourse spaces.
- (j) The CSM Contractors design and installation must consider the micro-climate and prevailing winds.
- (k) Remotely recorded wind data must be corrected for use at the specific geographic location based on the approach detailed in American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 2009 Fundamentals Handbook chapter 24.
- (l) Site measurements or local records must be used to support any correction factors.

2.1.3 Internal design temperatures

- (a) The ECS must be provided to meet the internal design temperatures, as per Table 1 below, against the respective environmental design conditions determined in section 2.1.2.

Table 1 Internal design temperatures

Area	Internal design temperature (dry-bulb)
Covered public open areas	Nominally ambient to a maximum 5°C above ambient temperature.
Concourse and circulation areas (not platform areas)	Nominally ambient to provide a thermal transition from outside station to platform. To a maximum 5°C above ambient temperature
Equipment rooms (temperature sensitive electronics)	24°C±1.5°C
Critical Equipment Rooms	24°C±1.5°C 40-65% RH
Garbage rooms	Nominally ambient + 5°C (maximum) by mechanical ventilation if no food waste may be present. Up to 22°C +1°C where food waste may be present.
Occupied spaces - non-transient ECS comfort applications	23°C ±1°C (summer) 21°C ±1°C (winter)
Workshops	Nominally ambient + 5°C (maximum), however in accordance with Sydney Trains strategy and agreements for respective work activities.
Lift shafts	Ambient + 5°C Limited to 40°C (maximum)

Area	Internal design temperature (dry-bulb)
Electrical rooms	Ambient + 5°C (maximum)
Plant rooms	Ambient + 5°C (maximum)
ESR ghost platforms – areas other than plant rooms	Nominally ambient to a maximum 5°C above ambient temperature.
Electrical substations	≤50°C

- (b) The Eastern Entrance, ESR Concourse, East Concourse and the North South Concourse, excluding the Northern Entrance, must have a high degree of thermal comfort for occupants for 90% of the space area over 90% of the operational hours. The CSM Contractor must demonstrate in its Design Documentation that internal temperatures within such spaces are within the 80% acceptability limits of ASHRAE Standard 55 for the nominated period of time. Computer simulation modelling of the space design carried out in accordance with the requirements of Green Star Thermal Comfort credit applicable to naturally ventilated spaces must be utilised to evidence achievement of the requirement.
- (c) The North South Concourse and East Concourse spaces must be ventilated to provide a thermal transition zone from outside ambient conditions.
- (d) The North South Concourse and East Concourse spaces must be naturally ventilated when possible and augmented with mechanical ventilation as required for temperature control, air quality requirements and smoke control.
- (e) The CSM Contractor’s design for ECS controls will target a relative humidity in Occupied Spaces between 30-60%.
- (f) Condensation must not occur at any time on the internal surfaces of served spaces or on equipment in those spaces.
- (g) The cooling systems must be designed to prevent condensation on grilles and air terminals.
- (h) Maximum internal design temperatures of rooms and spaces must meet the equipment supplier’s requirements for any respective embodied equipment.
- (i) Maximum internal design temperatures of lift shafts must meet the supplier’s or manufacturer’s requirements.

2.1.4 Ventilation

- (a) The CSM Contractors ventilation systems must be designed and able to be operated in accordance with ASA Standards, AS/NZS 1668.1 ‘The use of ventilation and air-conditioning in buildings – Fire and smoke control in buildings’, AS/NZS 1668.2 ‘The use of ventilation and air-conditioning in buildings – Mechanical ventilation in buildings’ and the CSM Contractor’s FLS strategy.
- (b) Ventilation systems provided for temperature control, must meet the supplier’s maximum design temperatures for the respective equipment.
- (c) Occupied Spaces must have a minimum fresh air rate of 10l/s per person.
- (d) The mechanical ventilation supply (fresh air) and exhaust rates for normally unoccupied spaces must achieve the design rates in Table 2.

Table 2 Supply and exhaust air flow rates for unoccupied spaces

Room	Required Exhaust	Required Supply
Office area (basic rate, unoccupied)	Passive relief to common corridor	2 l/s/m ²
Equipment rooms	4.5 l/s/m ²	5 l/s/m ²
Locker rooms	5 l/s/m ²	Passive make-up
Toilets (WCs)	10 l/s/m ² or 25 l/s/sanitary fixture	Passive make-up
Archive/Store	Passive relief to common corridor	5 l/s/m ²
Garbage and cleaners rooms	10 l/s/m ² - if ventilated 5 l/s/m ² – if air-conditioned	Passive make-up
Electrical rooms	Passive relief or 4.5 l/s/m ²	5 l/s/m ² or as required for room pressurisation and temperature limitation.
Corridor/lobby	-	1 l/s/m ²
UPS/Battery rooms	To AS 2676.1	To AS 2676.1
Sumps	5 l/s/m ²	4.5 l/s/m ² or passive make-up
Chemical stores	10 l/s/m ²	Passive make-up

- (e) Rooms served by gaseous fire suppression must have passive pressure relief, to atmosphere where possible, and a purge ventilation system, principally extraction, to clear the room of suppression agent at a minimum rate of 6 air changes per hour.
- (f) Gaseous fire suppression extraction systems must be ducted to atmosphere, and supported with suitable make up air to the room.
- (g) Gaseous fire suppression extraction systems must feature high and low level exhaust points in each respective room according to the gas density to ensure all discharged extinguishing agents and smoke is captured and removed.
- (h) Discharge from pressure relief and purging systems must not be allowed to enter any space in concentrations or velocities that may cause harm to occupants.
- (i) Rooms with high density heat loads and electrical rooms which contain equipment that can operate at temperatures above ambient and is not sensitive to dust must be naturally ventilated where such rooms are above ground.
- (j) Natural ventilation must be augmented with mechanical ventilation as required for temperature control, air quality requirements, and smoke control.
- (k) Ventilated rooms must not be supplied with air drawn from any underground space, including underground concourses.

2.1.5 Occupancy levels and heat loads

- (a) The CSM Contractor must design the ECS for the specific occupancies and heat loads to the ultimate design year capacities (UDYC), where UDYC is the requirement for capacity to be safeguarded to allow for long term patronage growth as per the

Degraded Operation scenario pedestrian modelling for the Ultimate Design Year forecast defined in Appendix B16.

- (b) Design occupancies must be based on specific occupancies for the design in accordance with section 2.1.5 (a) or on the values (people/m²) provided in Appendix A of AS1668.2.

2.1.6 Intakes and discharges

- (a) The CSM Contractor must ensure that all ECS exhaust and discharge points, except for cooling tower discharges, must be located greater than 12m from any surrounding air intakes including:
 - (i) Central Station entrances
 - (ii) openings from surface platforms to the concourse level including voids, open stairs and open escalators;
 - (iii) ECS fresh air intakes for cooling or ventilation;
 - (iv) stair pressurisation fresh air intakes;
 - (v) Sydney Metro City and Southwest tunnel draught relief shaft outlets/intakes; and
 - (vi) Sydney Metro City and Southwest tunnel ventilation fan intakes.
- (b) If the separation distances defined in section 2.1.6 (a) cannot be achieved, the CSM Contractor must demonstrate in the Stage 1 design documentation that any obnoxious discharge, including smoke, which may be drawn back into air intakes, has been adequately minimised and obtain agreement from the Principal as part of Design Stage 1.
- (c) The CSM Contractor must ensure that cooling tower discharges must be sited above the horizontal plane of and greater than 12 metres from any surrounding air intakes, including:
 - (i) Central Station entrances;
 - (ii) openings from surface platforms to the concourse level including voids, open stairs and open escalators;
 - (iii) ECS fresh air intakes for cooling or ventilation;
 - (iv) stair pressurisation fresh air intakes;
 - (v) Sydney Metro City and Southwest tunnel draught relief shaft outlets/intakes; and
 - (vi) Sydney Metro City and Southwest tunnel ventilation fan intakes.
- (d) The CSM Contractor must ensure that outdoor air intakes must be located and arranged to avoid drawing air in from sources of contamination and pollution above that present in the general ambient air quality for the locality.
- (e) The CSM Contractor must ensure that outdoor air intakes must not be located in the predominant downwind direction from exhaust points and cooling tower discharges.

2.1.7 Air filtration

- (a) Mechanical supply air and cooling systems must be filtered to adequately clean air delivered to occupied and serviced spaces.

- (b) Filters must be rated in accordance with and selected with consideration of energy rating set out in EN779.
- (c) Filters must be selected and provided on the basis of a whole system life cycle cost assessment.

2.1.8 Vibration criteria

- (a) The ECS must be designed and provided with the necessary vibration isolation to keep vibration to a practical minimum and achieve the criteria defined in AS2670 series, and with reference to ASHRAE:2007 Application Handbook chapter 47.
- (b) Static and dynamic balancing of all rotating machinery must be undertaken to comply with the requirements of AS1359 Rotating electrical machines parts 50 and 51, and AS2625 Mechanical Vibration.

2.1.9 Fire rating and fire systems

- (a) The ECS must be designed and provided to meet the fire rating and separation requirements set by the BCA and the CSM Contractor's FLS strategy.
- (b) All fans, motors, dampers, ductwork, and related components, required to provide a smoke management function (including exhaust, pressurisation, ventilation, make-up air and pressure relief) must be capable of operating in an environment of 300°C for a minimum of 2 hours.
- (c) Ventilation systems must include, at minimum, smoke sensors in fresh air and return air intakes or mixing plenums.
- (d) Smoke sensors must be selected and positioned to minimise false alarms, notably from dust.
- (e) Two sensors must be used to provide positive confirmation of smoke entering the ventilation system.
- (f) Ventilation systems serving multiple rooms or zones must incorporate dampers and controls to isolate any fire affected compartment and continue ventilation of non-affected areas.
- (g) Fire dampers must be provided to maintain the fire resistance level of fire rated partitions.
- (h) Emergency ventilation panels for local control of station smoke management systems by the fire brigade shall be provided in the station fire control room (FCR). This control shall be 'modal' only and will not enable the control of individual elements.
- (i) All cabling must be Low Smoke Zero Halogen.
- (j) Sealants and adhesives used for fire sealing of penetrations or as part of other fire safety systems must have a maximum total volatile organic compound content of 250 g/L of ready to use product.

2.1.10 Redundancy

- (a) For all critical applications or serving lift shafts, the ECS must apply a minimum 'n+1' duty/standby provisions to all powered active equipment, including providing redundant fans, pumps, and compressors of equivalent duty.
- (b) Where fire isolated stairs are provided, the CSM Contractor must provide an emergency staircase pressurisation system for either:

- (vii) a 'n+1' fan assembly for duty/standby provision; or
- (viii) ensure that with a duty only system, the system is available when needed through routine operation and testing.
- (c) Central Station Works and Central Walk toilets are to be fitted with an exhaust system comprising dual fans so as to provide 'n+1' standby Redundancy in accordance with ASA Standard ESB004.
- (d) Duty/standby equipment must be programmed to swap duty cycle at defined intervals or start occasionally if normally dormant to ensure equal run times and check for compliant operation of the system.
- (e) To avoid providing backup power to cooling and ventilation systems, the respective rooms which require continuing operation during a complete power failure must have equipment and systems that are rated to operate for the respective UPS duration without cooling or ventilation.
- (f) All ECS components must automatically restart at the previous set point following restoration of power and clearing of any fire alarms.
- (g) Standby equipment must automatically activate on detection of failure of the respective duty device.
- (h) The ECS must incorporate fail safe modes, including as a minimum:
 - (i) load shedding non-critical service to support critical operations in fault mode operation;
 - (ii) motorised dampers which spring return to close, power to open, so that in complete failure, fire separation and system and equipment isolation is maintained; and
 - (iii) interlocked or passively reactive fan and damper operation.
- (i) The design and installation must limit exposure of the passive pipework and ductwork to damage which could cause failure of the whole cooling system.
- (j) Inherent Redundancy must be provided for cooling system pipework to remote terminal units and field devices such that in the event of failure of the pipework an alternative route may be provided for the cooling medium whilst rectification is undertaken.
- (k) Back-up cooling system components, including water cooled condensers, must be located with the primary duty cooling system components, including water cooled chillers, in a common plant room.
- (l) A mechanically protected pipework route or redundant pipework, connected by normally closed isolation valves, must be provided where co-location of the back-up cooling system components and primary duty cooling system components are not possible.

2.1.11 Availability

- (a) The CSM Contractor must ensure system availability is maintained during periods of highly ambient conditions.
- (b) The CSM Contractor must ensure the heat rejection of the ECS system is suitable to maintain system critical operations at all times.

2.1.12 Systems and components

2.1.12.1 Heating, cooling and air-conditioning and refrigerant systems

- (a) The CSM Contractor must apply an air cooled refrigerant based system to meet with the availability requirements of Central Station Works and Central Walk Works.
- (b) The CSM Contractor must ensure that refrigerant systems within temporary site facilities and permanent infrastructure have zero ozone depletion potential (ODP) and zero or low 100 year global warming potential (GWP).
- (c) The CSM Contractor must ensure refrigerants used by the station ECS systems have a combined total system direct environmental impact (TSDEI) less than 35, and a leak detection system and automatic refrigerant recovery system is in place. Compliance must be demonstrated in accordance with the Green Star Design and As Built Refrigerants Impacts Calculator.
- (d) The CSM Contractor must maximise the energy efficiency of ECS power consumption and operational control. ECS and power consumption must be designed to support achievement of the minimum percentage improvement in energy efficiency over Section J of the National Construction Code, Building Code of Australia (NCC BCA) as defined in Appendix B7 Sustainability Requirements.
- (e) Chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC) refrigerants must not be used.
- (f) A refrigerant leak detection system must be provided in each chiller room.
- (g) A refrigerant leak detection system must be provided where there is a significant consolidation of condensers.
- (h) Rooms containing condensers or chillers must be ventilated to mitigate refrigerant build up.
- (i) Air cooled condensers must feature automatic defrosting functions.
- (j) Split, multi-split, and variable refrigerant volume or flow direct expansion air conditioning systems must have inverter driven compressors.
- (k) Use of individual direct expansion split system units must be avoided except where servicing remote and isolated buildings, where connection to centralised cooling systems are not feasible.
- (l) Window mounted package units must not be used.
- (m) Primary cooling must be provided by centralised heat rejection systems so to increase the overall efficiency of the ECS, except where remote and discrete equipment rooms or offices require cooling.
- (n) Cooling and air-conditioning systems must incorporate outdoor air economy cycles to utilise fresh outside air for cooling where ambient conditions permit.

2.1.12.2 Occupied Spaces (non-transient)

- (a) Ventilation systems serving Occupied Spaces must be separate to ventilation systems serving public space, and ventilation systems serving equipment, electrical and plant rooms.
- (b) Any back-up control room must have back-up cooling provision.
- (c) Any back-up control room must each have standalone back-up ventilation provisions.

- (d) Occupied Spaces must include, as a minimum; offices, staff rooms, operations rooms, meeting rooms, control rooms, meal rooms, lockers, change rooms, and backup control rooms.

2.1.12.3 Equipment, plant, and electrical rooms

- (a) Critical ventilation applications must include battery rooms as defined by AS2676, hazard material stores, chemical stores, garbage rooms, fire pump rooms, and force ventilated sumps or pits.
- (b) Rooms with sensitive electronic equipment must be mechanically ventilated with filtered air supply to maintain consistent positive pressure and mitigate dust ingress.
- (c) Rooms containing potentially hazardous or obnoxious substances, including wet areas or stores, sewage ejector rooms, sumps, and chemical stores, must be mechanically ventilated and maintained under negative pressure to contain odours, vapours and contaminants.
- (d) Rooms containing potentially hazardous or obnoxious substances must have dedicated exhaust systems that are completely ducted to their discharge point and do not mix with any other airstreams.
- (e) Ventilation systems serving plant rooms, electrical rooms, and equipment rooms must be separate to ventilation systems serving Occupied Spaces, and to ventilation systems serving public space.
- (f) The fire pump room must be naturally ventilated.
- (g) Rooms containing combustion engines must discharge exhaust directly to the outside, through a thermally lagged flue.
- (h) Plant rooms containing water-cooled ECS equipment must have a graded floor to a central drainage pit which freely drains from the room, via a trap to a drainage system.
- (i) ECS components provided for Critical Equipment must be capable of 24 hour, continuous operation.
- (j) ECS systems to Critical Equipment Rooms must be designed so that they can continue to operate during a fire alarm without contributing to smoke spread.

2.1.12.4 Cooling requirements

- (a) Cooling systems must be capable of delivering the outdoor air ventilation rate at nominally 20°C dry-bulb issuing from the air terminals, as measured at the face of the grill, register or diffuser, against the environmental design conditions as determined by sections 2.1.2 and 2.1.3.
- (b) Cooling must not be provided by direct evaporative cooling or misting systems.
- (c) The cooling systems must operate on demand and with ambient condition (enthalpy) control to limit energy use and capitalise on free cooling by fresh air when external conditions permit.
- (d) Cooling ventilation must operate on temperature demand however must not supply less than the minimum fresh air requirements of AS1668.2 at any time.

2.1.12.5 Public area ventilation

- (a) Ventilation to public areas must provide sufficient general air movement to avoid air stagnation at any location within the space.

- (b) Supply air systems, ductwork and diffusers must cover at least 85% in total of the public access areas of the total concourse space.
- (c) Supply air systems, ductwork and diffusers must be evenly spaced along the concourse.
- (d) The CSM Contractor must develop a thermal and aerodynamic model for the Eastern Entrance, the ESR Concourse, the Eastern Concourse and the North South Concourse excluding the Northern Entrance to visually identify the cooling coverage and distribution that will be achieved, to demonstrate conformance.
- (e) The thermal and aerodynamic model must:
 - (i) be a computational fluid dynamics model;
 - (ii) incorporate all applicable final design heat loads and reflect conditions to ultimate design year design capacities;
 - (iii) be representative of ECS peak operating conditions;
 - (iv) be able to resolve turbulence effects to accurately model the diffusion of air issuing from the air terminals;
 - (v) have sufficient grid resolution, with a maximum 1.0 metre spacing, such that it is possible to accurately represent the local thermal condition experienced by individual occupants at any location in the occupiable public area;
 - (vi) be able to demonstrate a grid converged solution; and
 - (vii) be supported by appropriate validation.
- (f) Public area ventilation must provide the capability to employ night-flushing to pre-cool spaces.
- (g) Mechanical smoke exhaust requirements are to be determined by the CSM Contractor's FLS strategy.
- (h) All mechanical smoke ventilation and pressurisations systems shall be able to operate simultaneously without any reduction in the design capacity requirements.
- (i) ECS systems in public access areas that are not required for smoke management must shut down on fire alarm.

2.1.12.6 Emergency stair pressurisation systems

- (a) All enclosed egress stairs, and associated transfers, corridors and lobbies must be provided with pressurisation systems as required by applicable codes and standards and the CSM Contractor's FLS strategy.
- (b) The CSM Contractor's design of pressurisation systems must take into account the number of doors which need to open simultaneously during an egress operation and provide at least 1m/s airflow velocity through each opening.
- (c) Pressurisation systems must incorporate ducting and distribution for pressure equalisation of respective openings.
- (d) A fire fan control panel must be provided adjacent to the fire indication panel in the existing FCR (located adjacent to Eddy's Ave) to allow the override control for stair pressurisation systems.
- (e) Pressure relief must be used to prevent over pressurisation of the egress space.
- (f) Pressure relief must be passive, not dynamic or energised.

2.1.12.7 Lift shaft and lift car ventilation

- (a) Lift shafts must be mechanically ventilated with filtered supply air to limit temperature rise and mitigate dust ingress.
- (b) Lift shafts must have louvres at the top of the shaft to allow air to exhaust and promote natural ventilation.
- (c) Solar load on glazed lift shafts is to be minimised.
- (d) Lift cars must be air-conditioned as required by section 2.3 of this Appendix B04b.

2.1.12.8 Hazardous area ventilation

- (a) Enclosed hazardous areas must be ventilated to prevent the development of potentially hazardous or explosive atmospheres.
- (b) Classifications of potentially hazardous or explosive atmospheres must be determined according to AS/NZS 60079.10.1.
- (c) Extraction ventilation serving hazardous areas must be continuously ducted to the external discharge point and not mix with any other airstreams.
- (d) Extraction ventilation systems must operate with the majority of the duct-run under negative pressure, the fan must be as close as practical to the point of discharge.
- (e) Explosion proof fans and components must be provided according to the characteristic of the medium being captured and removed.
- (f) Hazardous area ventilation systems must restrict potential sources of ignition, including exclusion of any energised equipment from any potentially explosive zone.

2.1.13 Controls and monitoring

- (a) The CSM Contractor must provide the associated controls, including software, for the ECS.
- (b) In the event that existing Sydney trains assets are modified due to the CSM Contractor Activities, the CSM Contractor must:
 - (i) operate the Sydney Trains station air conditioning and mechanical ventilation systems automatically under the control of a direct digital control systems (DDCS), and be monitored and controlled by the station management control systems (SMCS) workstation located in the communication room, in accordance with ASA Standard ESB004 4.3.1.10; and
 - (ii) locate the mechanical services switchboard for Sydney Trains within the switch room and segregated into essential and non-essential power supplies. It must interface with Sydney Trains station management control system (where applicable) to provide centralized monitoring and control of all station ventilation and air conditioning systems.
- (c) The ECS must connect to the new Central Station BMS, as defined in section 2.5 of this Appendix B04b, which provides overall monitoring and control of the ECS, and interface with sub-systems, other building management systems and the fire system.
- (d) Each ECS sub-system must operate on demand on a room or zone basis in response to the metric it is designed to control.
- (e) The ECS must be capable to operate automatically without manual intervention, including automatic restart at the previous set point on restoration of power or clearing of any fire alarms.

- (f) Decentralised mechanical control panels must be provided in mechanical plant rooms close to the equipment they serve.
- (g) Local control must be provided in each mechanical plant room for emergency and maintenance operation.
- (h) The ECS and sub systems must be able to detect faults within the system elements including; no or low airflow or water flow, sudden pressure loss, flooding, short circuits, motor fail to start, and power supply failure as applicable.
- (i) Equipment rooms provided with cooling or air-conditioning must have independent temperature sensors, which:
 - (i) monitor the temperature in the space and report to the new Central Station BMS; and
 - (ii) raise a high temperature alarm to the new Central Station BMS when the room temperature exceeds 28°C dry-bulb.
- (j) Rooms provided with ventilation for temperature control must have independent temperature sensors, which:
 - (i) monitor the temperature in the space and report to the new Central Station BMS; and
 - (ii) raise a high temperature alarm when the space exceeds more than 8°C above ambient.
- (k) Lift shafts must have independent temperature sensors at the top of the shaft, which:
 - (i) monitor the temperature in the space and report to the new Central Station BMS; and
 - (ii) raise a high temperature alarm to the new Central Station BMS when the lift shaft temperature exceeds 40°C dry-bulb.
- (l) When the lift shaft temperature exceeds 40°C dry-bulb at the top of the shaft, the lift is to complete its journey and be taken out of service, until the lift shaft temperature drops below 40°C dry-bulb at the top of the shaft.
- (m) Localised purge ventilation system control must be provided by a keyed switch outside the rooms with gaseous fire suppression.
- (n) ECS control systems must be of the digital programmable type, with a facility for data output and interrogation via a digital communications network.
- (o) As a minimum, the new Central Station BMS must monitor the following characteristics of the ECS:
 - (i) operation mode of systems: normal, manual, fault;
 - (ii) operation status of dynamic equipment: on, off, standby, fail to start;
 - (iii) operating time of dynamic equipment: log of running hours;
 - (iv) position of motorised dampers and valves: actuator status, and blade or valve position;
 - (v) temperature of respective rooms or spaces, where ECS is provided for temperature control;
 - (vi) air quality of respective rooms or spaces, where ECS is provided to control accumulation of contaminants, specifically in a potentially Hazardous Area;

- (vii) fan and pump vibration and operating temperature, for motors greater than 5kW;
 - (viii) filter resistance: clean, dirty based on the design allowance; and
 - (ix) fault signals, operating status, and performance metrics from packaged elements which include their own local controls.
- (p) Positive confirmation of dynamic equipment operation must be provided by flow or pressure switches, valves, or limit switches, as appropriate to the device.
- (q) As a minimum, the new Central Station BMS must log all alarms from the ECS where:
- (i) dynamic equipment fails to start;
 - (ii) positive confirmation of dynamic equipment operation is not received;
 - (iii) room conditions, including temperature and accumulated contaminants, exceed design allowances;
 - (iv) high level temperature alarm set points are exceeded;
 - (v) faults are received from local device controllers or instrumentation;
 - (vi) filter resistance exceeds design allowance;
 - (vii) water quality does not meet design allowances; and
 - (viii) pre-set water alarm levels are exceeded.
- (r) Alarms that indicate complete failure of an ECS system serving Critical Equipment Room must be reported up to the Central Station SMCS and brought to the attention of Sydney Trains, including:
- (i) failure to start standby devices;
 - (ii) failure to confirm positive operation of respective systems;
 - (iii) high level temperature alarms; and
 - (iv) accumulation of contaminants in potentially hazardous areas reaching pre-defined limits, including; 10% lower explosive limits, and depletion of oxygen.

2.2 Hydraulics (water and sewer)

2.2.1 General requirements

- (a) The CSM Contractor must provide hydraulic services to Central Station Works and Central Walk Works in accordance with the performance requirements of this Appendix, the Building Code of Australia (BCA), ASA Standards, applicable Codes and Standards, best practice industry guidelines and the CSM Contractor's FLS strategy.
- (b) The Central Station Works and Central Walk Works hydraulic services must, as a minimum:
- (i) protect the health and safety of the public, staff, operators and service providers;
 - (ii) support the continuous operation of train services;

- (iii) provide potable cold water, and heated water as required, to potable water fixtures and fittings;
 - (iv) provide non-potable rainwater, and recycled non-potable water where available, to non-potable water outlets or users;
 - (v) provide waste water capture, conveyance, treatment where required and drainage;
 - (vi) employ sustainable design initiatives;
 - (vii) provide roof and canopy drainage and downpipes;
 - (viii) provide stormwater drainage extending from the downpipes to the civil drainage infrastructure;
 - (ix) provide drainage of escalators pits and lift pits into the sewer infrastructure including oil and grease traps; and
 - (x) provide surface/subsurface water drainage pumps, sumps and rising main as required.
- (c) The hydraulic services must be standalone systems.
 - (d) The CSM Contractor must provide complete and integrated hydraulic service systems with all necessary components and approvals.
 - (e) The hydraulic services detailed in this section 2.2 do not cover the fire protection water services, which are specified in section 2.4 and section 4 of this Appendix B04b.
 - (f) The hydraulic services detailed in this Appendix B04b do not deal with overland flows or stormwater drainage, or drainage from the precinct or track. These flows are managed by the civil drainage system, specified in Appendix B01 of this SWTC.
 - (g) This Appendix does not specify landscape irrigation beyond provision of water supply for irrigation purpose. Landscape irrigation is specified in Appendix B03 of this SWTC.
 - (h) Hydraulic services pipework, unless it specifically services the room, must be located external to rooms containing electrical equipment susceptible to water damage including communications equipment, signalling equipment, motor control cabinets or drives, servers, switchboards, switch gear and transformers.
 - (i) Water pipes or drainage must not be routed directly above any equipment or devices susceptible to water damage.
 - (j) Water pipes must be lagged as required to prevent condensation.
 - (k) Screwed, flanged or mechanical joints must not be made in pipes concealed behind wall linings or inaccessible spaces.
 - (l) Pipework must be laid out to minimise crossovers and offsets.
 - (m) All pipes, valves, and fittings must be arranged to ensure neat and orderly appearance with true alignment and grade to make these elements conveniently accessible and readily replaceable.
 - (n) Pipes running in the same direction must be parallel.
 - (o) Pipes runs must be arranged to avoid air locks and dead ends.
 - (p) Precautions must be taken to prevent water hammer.

- (q) Hydraulic services and pipework must be arranged and sized to minimise resistance and obstruction to flow.
- (r) Offsets in piping must use 45° bends wherever possible.
- (s) Flanges, unions and other approved mechanical couplings must incorporate replaceable gaskets or 'O' rings for sealing to ensure that re-sealing is achievable after servicing.
- (t) Metal-to-metal seals must not be used.
- (u) Flanged joints must be made with gaskets suitable for the service or as recommended by equipment manufacturers.
- (v) Permanently installed automatic air release vents must only be fitted in plant rooms and service areas.
- (w) Access for cleaning must be provided so that all sections of the installation can be rodded or otherwise cleaned without cutting into the pipe or damaging wall or ceiling linings, or other building elements.
- (x) The CSM Contractor must engage a Sydney Water service coordinator for the submittal of a Section 73 application.
- (y) The CSM Contractor must submit calculations, drawings and pay all associated fees for Section 73 applications and adhere to/ install all the requirements listed in Sydney Water's Notice of Requirements (NOR).

2.2.2 Water services system

2.2.2.1 General requirements

- (a) Water supply systems must be provided with a minimum discharge pressure of 25 metres head at the most disadvantaged outlet.
- (b) Water supply systems must be provided with a maximum pipe velocity of 1.6m/s, or a maximum pipe velocity of 1.2m/s for pipework installed in hot water circulating systems
- (c) Water supply system infrastructure, including authority connections, meters, valves, pipework, pumps, and associated components, must be provided with a minimum spare flow capacity of 20% at the time of Completion, above the probable simultaneous flow rate, calculated in accordance with AS/NZS 3500.1.
- (d) Stop valves must be installed to isolate outlet groups, including:
 - (i) bathroom and amenities groups;
 - (ii) individual serviced plant rooms;
 - (iii) inlets to individual water heating units; and
 - (iv) any other discrete equipment requiring water supply.
- (e) Fixture outlets for new/temporary fixtures must meet the minimum water efficiency ratings described in **Table 4**.

Table 4 Minimum water efficiency ratings

Fixture Type	Minimum WELS Star Rating	Maximum Flow Rate (l/min)	Other Required Features
Basins – customer use	6	4.5	Vandal proof Timed flow push button
Basin – non public	6	4.5	Timed flow push button
Basins – disabled amenities	6	4.5	DDA compliant
Sink	4	7.5	Not Applicable
Shower	3	9.0	Not Applicable
Urinal – customer use	Not Applicable	Not Applicable	Vandal proof Low flush type: less than 1.0 litre per flush
Urinal – non public	Not Applicable	Not Applicable	Low flush type: less than 1.0 litre per flush
Water Closet – customer use	4	Not Applicable	Vandal proof Dual flush (3litre half flush/ 4.5 litre full flush)
Water Closet – non public	4	Not Applicable	Dual flush (3litre half flush/ 4.5 litre full flush)

2.2.2.2 Water supply

- (a) Flexible, non-metallic connections for the incoming water supply must be provided to accommodate differential settlement where the potential exists.
- (b) All metal pipe work must be electrically isolated by means of an insulation pipe section at the boundary of the Site to prevent earth leakage and egress of any Stray Currents.
- (c) The CSM Contractor must provide water supply connections with backflow control, any isolation, separation provisions, supply points and length of connections to meet the requirements of Sydney Water Corporation.

2.2.2.3 Potable domestic cold water

- (a) The CSM Contractor must provide a new water service extending from the new water supply connection/ meter and extend to serve all the water consuming fixtures, tap fitting and the fire hose reel system.
- (b) The CSM Contractor must interconnect the potable domestic cold water to create a ring main.
- (c) Sectional isolation valves must be provided to each ring main at a maximum of two branch pipe intervals.
- (d) Isolation valves installed in-line on the system where connected to fire hose reels must be fitted with lockable isolation valves and the required statutory signage adjacent to the isolation valve.

2.2.2.4 Potable domestic heated water

- (a) Potable domestic heated water must be provided to, as a minimum:
 - (i) basins in disabled amenities;
 - (ii) non-customer basins;
 - (iii) sinks; and
 - (iv) showers.
- (b) Water must not be heated by gas fired systems.
- (c) Thermostatic mixing valves must be provided to limit the water temperature at sanitary fixtures used primarily for personal hygiene purposes and where heated water service is provided.
- (d) Heated water must be available at all times.
- (e) Dead legs in hot water pipework must be kept to a maximum of 10 meters from hot water system/ring main to the fixture outlet.

2.2.2.5 Rainwater service

- (a) The rainwater service must primarily source water from the existing Central Station rainwater capture system.
- (b) A failsafe back-up water supply must be provided to the rainwater service from the potable domestic cold water service.
- (c) Rainwater service must be provided to supply captured rainwater for, as a minimum:
 - (i) toilet flushing;
 - (ii) cleaning and wash down;
 - (iii) make-up water supply to mechanical cooling systems; and
 - (iv) landscape irrigation.
- (d) The captured rainwater must be pumped using a dual pumpset configuration. The pumpset must consist of in-line pumps complete with foot valve arrangement and a pressure vessel installed on the pumpset's outlet manifold.
- (e) The rainwater re-use pumpset must be provided with a spare flow capacity of a minimum of 20% at Completion, above the calculated.

2.2.3 Drainage system

2.2.3.1 General requirements

- (a) Drainage pump and sump installations must meet the following minimum criteria:
 - (i) inclusion of dual identical sump pumps, for duty and standby provision;
 - (ii) pumps alternate as duty and standby on a 24 hour basis;
 - (iii) equipment protection level suitable for the applicable hazardous area classification;
 - (iv) duty pump to be sized to start a maximum of 3 times per hour.

- (v) to ensure the maximum of 3 starts, the duty pump shall be capable of removing the inflow collected in a period of 20 minutes within a maximum of 5 minutes and a minimum of 1 minute;
 - (vi) pump housing constructed of ductile cast iron;
 - (vii) impeller constructed of ductile cast iron;
 - (viii) motor constructed of cast iron;
 - (ix) vortex impeller or macerator type;
 - (x) hard piping with stainless steel guide rail system;
 - (xi) stainless steel clamps on rising main;
 - (xii) stainless steel step irons or access ladders provided, where the internal sump depth is greater than 1 metre;
 - (xiii) stainless steel heavy duty lifting chains connecting to a stainless steel bracket below a heavy duty gas tight cover in accessible position;
 - (xiv) hose and electrical cables of sufficient length to allow removal of pumps without entering the sump;
 - (xv) valves located outside of sump;
 - (xvi) located within a plant room and not accessed by public spaces;
 - (xvii) pump control panels must be located within a plant room and not accessed by public spaces;
 - (xviii) sump base benched to fall at a minimum of 1% to the sump well; and
 - (xix) be sized to contain emergency storage of 8 hours inflow, assuming no outflow.
- (b) Any sewer pump-out system must not exceed the pumping flowrates outlined in Sydney Water's guidelines.
- (c) The CSM Contractor must determine and apply the classifications of potentially hazardous or explosive atmospheres in accordance with Australian Standards, including AS/NZS 60079.10.1-2009.
- (d) Explosion or flame-proof pumps and components must be provided according to the CSM Contractor's classification and risk assessment of the space in which they operate and the characteristic of the medium being conveyed.
- (e) Drainage systems must restrict potential sources of ignition, including by exclusion of any energised equipment from any potentially explosive zone.
- (f) Drainage pump stations must be internally coated with a polyurea component spray applied polyurethane or polyurea water proofing system, complete with primer and 3mm basecoat, to AS3735.

2.2.3.2 Sewage drainage system

- (a) Sewer drainage system infrastructure must be provided with a minimum spare flow capacity of 20% at time of Completion, above the fixture unit ratings, calculated in accordance with AS/NZS3500.2.
- (b) All sewage drainage must be connected to the Sydney Water sewage network, where available.

- (c) Gravity sewage drainage systems must be used where levels permit. New additional authority sewage drainage connection points are to be installed prior to the use/ installation of a sewage pump-out system being adopted.
- (d) Where a gravitational feed to the main is not possible, a sewage pump-out system may be incorporated into the design and installation to pump effluent to a section of the gravity sewage drainage system.
- (e) The CSM Contractor must provide a sewage drainage system extending from either the gravity sewage or pump-out systems to receive the discharge from the sanitary fixtures and fittings.
- (f) The sanitary drainage systems must be complete with boundary traps/ or inspection shafts, overflow relief gully, drainage pipe installation and vents.

2.2.3.3 Rainwater capture, roof drainage and platform drainage system

- (a) The CSM Contractor must provide stormwater drainage from new canopies to the existing stormwater harvesting tank.
- (b) Where rainwater is not collected by the existing Central Station rainwater harvesting tanks, rainwater must be directed by guttering, pipes and drains to the applicable stormwater drainage system, in accordance with local codes, the BCA and Australian Standards and discharged to the nearest suitable civil stormwater pit.
- (c) The rainwater capture, roof drainage and platform drainage system must be compatible and comply with the requirements of the Hydrology and Drainage Section of Appendix B01.
- (d) Surface water collected from existing platforms, new platforms, all concourses and all tracks must not be directed to existing harvesting rainwater system.

2.2.4 Interfacing, control and monitoring

- (a) The CSM Contractor must provide the associated controls, including software, for the hydraulics services.
- (b) The hydraulics services controls must connect to the new Central Station BMS.
- (c) Each hydraulic system must normally operate under local control and on demand.
- (d) Each hydraulic system must be capable of operating automatically without manual intervention, including automatic restart on restoration of power, and clearing of any fire alarms.
- (e) Standby equipment must automatically activate on detection of failure of the duty device.
- (f) Local mechanical control panels must be provided in mechanical plant rooms close to the equipment they serve.
- (g) The local control must be provided in each mechanical plant room for emergency and maintenance operation.
- (h) The hydraulics services systems and sub-systems must be able to detect faults within the system elements including, no or low water flow, sudden pressure loss, flooding, short circuits, motor fail to start and power supply failure as applicable for each component of active equipment.
- (i) As a minimum, the new Central Station BMS must monitor the following characteristics of the hydraulics services:

- (i) operation mode of systems: normal (automatic), manual, fault;
 - (ii) operation status of dynamic equipment: on, off, standby, fail to start;
 - (iii) operating time of dynamic equipment: log of running hours;
 - (iv) position of motorised valves: actuator status, and valve position;
 - (v) water levels in sumps and tanks: level alarms, and analogue level;
 - (vi) water quality of the rainwater service: analogue scale and limits;
 - (vii) leak detection in plant rooms as appropriate; and
 - (viii) fault signals, operating status, and performance metrics from packaged elements which include their own local controls.
- (j) Positive confirmation of dynamic equipment operation must be provided by flow or pressure switches, or limit switches, as appropriate to the device.
- (k) As a minimum, the new Central Station BMS must log all alarms from the hydraulics services systems where:
- (i) dynamic equipment fails to start;
 - (ii) positive confirmation of dynamic equipment operation is not received;
 - (iii) high level temperature alarm set points are exceeded;
 - (iv) faults are received from local device controllers or instrumentation;
 - (v) water quality does not meet design allowances; and
 - (vi) pre-set water alarm levels are exceeded, including high level, and low level in tanks and sumps as appropriate.
- (l) Alarms that indicate complete failure of an operations-critical or safety service system must be reported up to the Sydney Trains SMCS, including:
- (i) failure to start standby devices;
 - (ii) failure to confirm positive operation of respective systems; and
 - (iii) high level alarms of sumps.
- (m) Water sub-meters must be provided to the following areas, as a minimum:
- (i) site potable domestic cold water supply;
 - (ii) rainwater service site usage;
 - (iii) make-up water supply to mechanical cooling systems;
 - (iv) supplies to commercial opportunity services; and
 - (v) back-up supply to site rainwater service.
- (n) Water sub-meters must duplicate the local water supply authority meter and be provided with an analogue output.
- (o) For external water supplies, water sub-meters must be provided directly upstream of the Sydney Water Corporation water meter.
- (p) Water sub-meters must connect to the new Central Station BMS to log water usage from each meter.

- (q) All cabling must be Low Smoke Zero Halogen.
- (r) Sealants used for fire sealing of penetrations must have a maximum total volatile organic compound content of 250 g/L of ready to use product.

2.3 Vertical Transport

- (a) The CSM Contractor must provide all VT including lift shafts and other associated infrastructure for the Central Station Works and Central Walk Works.
- (b) The Central Station Works and Central Walk Works vertical transport (VT) must meet the following requirements:
 - (i) egress requirements of the CSM Contractor's FLS strategy; and
 - (ii) all safety assessments and approvals in accordance with the requirements of the applicable Codes and Standards.
- (c) The CSM Contractor must comply with the Interface Schedule – Appendix E2, section 15.01 Vertical Transport System.

2.3.1 Lifts

- (a) All lifts must incorporate facilities for disabled and mobility impaired customers. As a minimum all lifts are to be compliant with AS1735.12.
- (b) The CSM Contractor must allow for lifts where necessary to achieve DDA accessible compliance and in accordance with this Appendix B04b.
- (c) Lifts must meet ASA and legislative requirements and must be in accordance with the specifications in Appendix C of the SWTC.
- (d) Lifts that serve customers or other members of the public must have the lift car wall, door and shaft construction as transparent as far as is practicable, with minimal obstruction to view from structural and other elements as a minimum in accordance with Appendix B03 of the SWTC.
- (e) Lifts must allow for mobile hoists as required by Sydney Trains for maintenance activities.
- (f) The fire mode operating protocol for lifts is to be determined by the CSM Contractor's FLS strategy.

2.3.1.1 Interfacing systems

- (a) Provisions must be made for closed circuit television (CCTV) coverage and communications systems in accordance with Appendix B02 of this SWTC.
- (b) Fire, heat and smoke detection and fire suppression must be provided in lift shafts with links to the fire system in accordance with section 2.4 of this Appendix B04b.
- (c) All lifts must be run off safety service power supply.

2.3.1.2 Control features

- (a) All lifts must be provided with fire service operation. A continuous audible signal in the car must sound and a visual signal must be displayed in the car identifying a "Fire Service Operation" status.
- (b) Out-of-service key switches must be provided in one of the landing call panels. When the switch is activated:

- (i) all landing calls must be cancelled; and
 - (ii) the out of service indicator must illuminate on each landing.
- (c) All lifts must have full fire brigade control functions.

2.3.2 Escalators

- (a) All new escalators must meet ASA and legislative requirements and be in accordance with the specifications in Appendix C of the SWTC.
- (b) Escalators must be capable of being utilised as a means of egress as follows:
- (i) the escalator operating mode must be determined from information from the fire detection system which will determine the location of a fire, subject to confirmation from the Rail Management Centre (RMC);
 - (ii) escalators operating in the direction of egress must keep operating in that direction;
 - (iii) escalators operating in the opposite direction of egress must be brought to a slow/soft stop, either locally or remotely; and
 - (iv) when initiating a soft stop an audible signal or warning message must sound for at least 15 seconds to deter passengers from entering the escalator, prior to it coming to a stop.
- (c) The option to reverse and restart escalators in the direction of egress is to be determined by the CSM Contractor's FLS strategy.

2.4 Fire protection and detection systems

2.4.1 General requirements

- (a) The CSM Contractor must provide a fire protection and detection systems for Central Station in accordance with relevant Building Code of Australia (BCA) requirements, relevant Australian Standards, applicable ASA Standards, legislative obligations and the CSM Contractor's FLS strategy.
- (b) The CSM Contractor must comply with the Interface Schedule – Appendix E2, section 16 Fire Services Systems).
- (c) All cabling is to be Low Smoke Zero Halogen.

2.4.2 Fire sprinkler system

2.4.2.1 General requirements

- (a) The CSM Contractor must comply with ASA Standards and legislative requirements.
- (b) Sprinkler protection must be provided to the following areas as a minimum:
- (i) North South Concourse and North South Concourse Sydney Trains BOH (noting the existing ceiling panels are to be re-used on the Northern Concourse);
 - (ii) North Concourse and North Concourse BOH (noting the existing ceiling panels are to be re-used on the Northern Concourse);
 - (iii) Intercity Concourse and Intercity BOH;
 - (iv) Elizabeth Street Entrance and Elizabeth Street Entrance BOH;

- (v) Eastern Stairs Entrance and Eastern Stairs Entrance BOH;
- (vi) Eastern Entrance including BOH;
- (vii) ESR Concourse and ESR Concourse BOH including sub-levels;
- (viii) South Concourse and South Concourse BOH;
- (ix) Chalmers Street Entrance;
- (x) the eastern Olympic Tunnel and western Olympic Tunnel;
- (xi) Southern Suburban Interchange Tunnel;
- (xii) Southern Suburban Baggage Tunnel;
- (xiii) all lift shafts connected to the Suburban Platforms, including platforms 24/25;
- (xiv) escalator trusses in Chalmers Street Entrance;
- (xv) lift shafts in South Concourse BOH;
- (xvi) Southern Intercity Interchange Tunnel;
- (xvii) any accessible enclosed services route;
- (xviii) the ESR 'Ghost' Platform level;
- (xix) the platform 24/25 level BOH;
- (xx) ESR platforms open stair and escalator runs;
- (xxi) with the exception of:
 - A. trackways;
 - B. public access areas of platforms;
 - C. Devonshire Street Tunnel
 - D. BOH rooms provided with gaseous suppression;
 - E. inside fire isolated egress stairs; and
 - F. substations and HV plant rooms.
- (c) The fire sprinkler and station hydrant systems at Central Station must not be combined into a single system.
- (d) During construction, sprinkler, fire hose reel and gaseous suppression systems in operating parts of Central Station must remain active at all times to those areas occupied by the general public or Sydney Trains staff. Any isolations of the existing system are to occur outside operating hours or during possessions and risk mitigation measures are to be agreed with the Principal's Representative and Sydney Trains prior to the isolation.

2.4.2.2 Water supply

- (a) The Central Station sprinkler systems must be fed, as a minimum, by a Grade 2 water supply as defined by AS2118.1:1999.
- (b) If an existing water supply location cannot provide the required system or supply pressure, a fire pump or water tank system, inclusive of diesel and electric driven fire pumps, and sprinkler jockey or pressure maintenance pump must be provided in accordance with AS2118, including:

- (i) provisions to sense changes in system pressure to start the jockey or pressure maintenance pump automatically; and
 - (ii) a water test line from the fire pump must be discharged back into the existing rainwater harvesting tank.
- (c) Separate booster assemblies for both the Central Station sprinkler and Central Station hydrant systems must be provided in accordance with the type of system, hydraulic requirements, the requirements of Fire and Rescue NSW (FRNSW), and relevant local council requirements.
- (d) The location of the booster assembly must be agreed with the Principal's Representative, Sydney Trains, FRNSW, Sydney Light Rail and must as a minimum:
- (i) provide vehicle hard stand area for two general fire appliances within 8m of the booster inlet valves;
 - (ii) allow fire brigade appliances attending from the nearest fire station to directly pull up without the need to travel the wrong way down one-way streets or carry out U-turns;
 - (iii) allow for a 11.3m turning circle of the fire appliance such that when arriving and leaving, the fire appliance must be able to drive out in a forward direction without needing to reverse or carry out 3-point turns;
 - (iv) not be located in driveways or carpark entrances; and
 - (v) minimise the impact, so far as is reasonably practicable (SFAIRP) of parked fire appliances impacting vehicle traffic and light rail operations.
- (e) The existing sprinkler booster assembly located off Eddy Ave is to be retained, however if the CSM Contractor proposes an alternate location for the new booster assemblies, this existing sprinkler booster assembly is to be relocated so that all booster assemblies are co-located.
- (f) The existing sprinkler booster assembly located at the base of the stairs to exit 5 in the Eastern Stairs Entrance is to be de-commissioned and removed.
- (g) Each separate system is to be provided with its own booster inlet, labelled with a single boost pressure required to achieve the performance requirements at all points of the system.
- (h) Any upgrades required, within or external to Central Station, to achieve the necessary water supplies are the responsibility of the CSM Contractor.
- (i) Water supply from recycled water mains is to be used in firefighting where available. The CSM Contractor must obtain Approvals from Sydney Water Corporation and FRNSW for its use.
- (j) Fire protection systems must include technology to detect and identify leaks.
- (k) The CSM Contractor must ensure that 80% of potable water associated with fire protection system testing is reused through recirculation systems and temporary storage.

2.4.2.3 Sprinkler system design

- (a) The sprinkler system must be wet pipe, designated according to the room hazard type it is protecting. The CSM Contractor's FLS strategy may permit some electrical rooms to be protected with a pre-action sprinkler system.

- (b) Lift shafts and escalator pits, trusses and associated machine rooms must be protected by sprinkler systems.
- (c) Fire protection systems must include isolation valves to enable sprinkler testing on a zone by zone basis.
- (d) In areas that require sprinkler protection, the minimum hazard classifications as defined in AS2118.1 are:
 - (i) Concourses and entries: OH1;
 - (ii) Plant rooms and general BOH: OH2; and
 - (iii) Retail and storage: OH3.
- (e) There are currently two separate sprinkler systems at Central Station serving some areas within the Project Works described in sections 2.4.2.1 b) and c). The CSM Contractor must make the necessary modifications to combine these two systems such that they are fed from a single sprinkler booster assembly located in Eddy Ave, subject to 2.4.2.2 d).
- (f) The sprinkler system must be monitored by the existing Central Station FIP.

2.4.3 Fire hydrant system

- (a) The Central Station Works and Central Walk Works fire hydrant system requirements are described in section 4 of this Appendix B04b.

2.4.4 Fire and smoke detection and alarm system

- (a) The CSM Contractor must provide a fire and smoke detection system and sound system and intercom system for emergency purposes (SSISEP) to the following areas as a minimum:
 - (i) North South Concourse and North South Concourse Sydney Trains BOH;
 - (ii) Intercity Concourse and Intercity Concourse BOH;
 - (iii) Eastern Entrance including BOH;
 - (iv) ESR Concourse and ESR Concourse BOH including sub-levels;
 - (v) South Concourse and South Concourse BOH;
 - (vi) the Olympic Tunnel (East and West);
 - (vii) Southern Suburban Interchange Tunnel;
 - (viii) Southern Suburban Baggage Tunnel;
 - (ix) any accessible enclosed services route;
 - (x) the existing building at the north end of platform 16/17;
 - (xi) North Concourse and North Concourse BOH;
 - (xii) Elizabeth Street Entry and Elizabeth Street Entrance BOH;
 - (xiii) Eastern Stairs Entrance and Eastern Stairs Entrance BOH;
 - (xiv) Chalmers Street Entrance;
 - (xv) all lift shafts connected to the Suburban Platforms, including to platform 24/25;

- (xvi) lift shafts in South Concourse BOH;
- (xvii) Southern Intercity Interchange Tunnel;
- (xviii) ESR 'Ghost' Platform level including all rooms, intake ducts, services risers and access shafts;
- (xix) platform 24/25 including BOH rooms, open stair, and escalator runs but excluding trackways;
- (xx) detection required to activate the operation of any smoke doors, fire doors, fire shutters or drop-down fire/smoke curtain as defined in the CSM Contractor's FLS Strategy; and
- (xxi) with the exception of:
 - A. trackways;
 - B. Devonshire Street Tunnel; and
 - C. inside fire isolated egress stairs.
- (b) The fire and smoke detection system and sound system and intercom system for emergency purposes (SSISEP) to areas defined in section 2.4.4 a) is to include:
 - (i) detection required to activate the operation of any smoke doors, fire doors, fire shutters or drop-down fire/smoke curtains.
 - (ii) manual call points to BOH. Manual call points are not required in public access areas, subject to an alternative solution in the CSM Contractor's FLS strategy.
 - (iii) multipoint aspirating smoke detection system (MASDS) for early fire detection in Critical Equipment Rooms or where room flooding gaseous fire suppression systems are used. The MASDS must:
 - A. be addressed as a separate alarm zone to the fire indicator panel (FIP);
 - B. provide an air sampling pipe network to transport air to the detection unit;
 - C. interface with the Central Station fire detection and alarm system;
 - D. house the detector, filter and aspirating fan in a mounting box arranged in such a way that air is drawn from the fire risk area through the filter and detector by the aspirator;
 - E. provide a detection unit of the integrating LASER-based type or the high intensity Xenon flash tube type, and having an obscuration range of 0.005 - 20%/meter;
 - F. incorporate in the detector controller facilities with the ability to transmit detector fault and air flow fault conditions;
 - G. provide an assembly containing sufficient relays to annunciate all required alarm and fault conditions;
 - H. have a response time for the least favourable sampling point in the system not exceeding 90 seconds;

- I. balance the system so that the volume of air drawn from the last sampling point shall not be less than 60% of the volume from the first sampling point;
 - J. include all necessary software and associated programming; and
 - K. be powered from regulated 24 V DC supply. The battery charger and battery must comply with the requirements of AS 4428.5;
- (iv) for any MASDS system the CSM Contractor must provide computer-generated calculations showing response times, suction pressures and balance details of each sampling point for each pipe system;
- (v) modification to the existing Central Station FIP located in the Eddy Ave FCR that must:
- A. receive additional fire alarm signals from all areas listed in 2.4.4 a);
 - B. receive alarm signals from the operation of any new or modified active fire safety systems in areas as defined in sections 2.4.2.1 b), 2.4.5, 2.4.6 and 4.1 j);
 - C. have modified existing loop cards and devices (i.e. detectors, input/output modules), as required;
 - D. have new input/output modules, control modules and monitoring modules as required to support the functionality of the detection and alarm system; and
 - E. have a minimum of 25% spare capacity of the total addresses installed on each new or modified loop at Completion.
- (vi) mimic FIP's which provide alarm information for all areas at Central Station, must be located at the new Eastern Entrance building in a weatherproof location or enclosure, on the unpaid side of the Gateline in a readily accessible location agreed with FRNSW and the Sydney Trains Rail Emergency Response Unit (RERU).
- (vii) An SSISEP compliant with AS1670.4:2015 to all new and modified areas that must:
- A. interface with the existing Central Station FIP, PA system, data communications network, and SMCS;
 - B. integrate with the existing SSISEP system, either through an additional interfaced SSISEP panel or by adding SSISEP zones to the existing panel, subject to agreement from operators and FRNSW;
 - C. include SSISEP zones that are defined in the CSM Contractor's FLS strategy and agreed with operators and FRNSW;
 - D. include a warden intercom point (WIP) phone and a manual call point in the Station Managers Office and RMC;
 - E. cascade sequence and cascade timing of SSISEP zones as defined in the CSM Contractor's FLS strategy and agreed with operators and FRNSW;

- F. provide emergency audio message broadcasting coordinated with the PA system using options of pre-recorded messages and live announcements;
 - G. include a PA system that is able to be overridden by an emergency warning function from the fire alarm system to enable any emergency warning signals or announcements to have priority;
 - H. include alarm systems that provide a means of alarm notification to the visually impaired and hearing impaired SFAIRP;
 - I. be able to override PIDS and display emergency warning and evacuation instruction messages as defined in the CSM Contractor's FLS strategy and agreed with operators and FRNSW; and
 - J. have 25% spare capacity of the total devices installed at Completion.
- (viii) Sydney Trains emergency ventilation panel that must:
- A. provide modal control of the any mechanical smoke ventilation in new or modified Central Station Works and Central Walk Works areas including the concourses;
 - B. be located in the same room and in close proximity to the existing Central Station FIP; and
 - C. include a minimum 10% spare capacity (including both hardware and software) of the total devices installed at Completion.
- (ix) power supplies, batteries and battery chargers to support the detection and alarm system; and
- (x) all necessary software and associated programming.
- (c) The type of fire detection system chosen by the CSM Contractor must balance the requirements of:
- (i) alarm sensitivity to support the activation times assumed in the CSM Contractor's FLS strategy;
 - (ii) minimising the risk of unwanted false alarms; and
 - (iii) minimising the safety risk, SFAIRP, in the maintenance of the detection system.
- (d) Detection and alarm zones must be coordinated SFAIRP with the respective sprinkler system zones and smoke management control and fire separated zones.
- (e) All panel control and monitoring equipment must enable quick detection and location of line faults and component failure.
- (f) The system must be fault-tolerant in that failure of a single component must not affect the operation of more than one detection or alarm zone.
- (g) The fire detection system must be fully addressable and provide output information to other systems which, as a minimum, include:
- (i) a high level interface with the SSISEP;

- (ii) the smoke management system to activate appropriate mechanical smoke exhaust, operate any natural ventilation louvres, and control/shut down environmental control systems that do not provide a smoke management function;
 - (iii) the Vertical Transportation control system to determine the incident modes for escalators and lifts;
 - (iv) the CCTV system to automatically identify and prioritise the feed from CCTV cameras covering the area of the alarm;
 - (v) the ticket barrier control system to open fare gates and release any additional doors/gates to facilitate egress;
 - (vi) the system to release any fire/smoke doors, fire shutters, and drop down fire/smoke curtains; and
 - (vii) local common fire alarm signal to FRNSW.
- (h) Fire signals from the fire detection and alarm system to local interfaced systems and devices must be via hard wire connection.
- (i) The existing Central Station FIP must interface with the new Metro Station FIP so that fire alarm signals received by the existing Central Station FIP are relayed to the new Metro Station FIP, in accordance with protocols to be agreed between Sydney Trains and the Operator.
- (j) The SSISEP must interface with the existing Central Station FIP, PA system, data communications network, and SMCS.
- (k) During construction, detection and alarm systems in operating parts of Central Station must remain active at all times those areas are occupied by the general public or Sydney Trains staff. Any isolations of the existing system are to occur outside operating hours or during possessions and risk mitigation measures are to be agreed with Sydney Trains prior to the isolation.
- (l) Historical drawings of existing system wiring should not be relied upon. The CSM Contractor must conduct on-site tracing of existing wiring paths that will be affected by the CSM Contractor's Activities.

2.4.5 Battery storage

- (a) Battery storage rooms must be fitted with hydrogen detection (subject to battery type), and alarms communicated back to the new Central Station BMS.

2.4.6 Gaseous suppression system

- (a) A gaseous suppression system must be provided to rooms as defined in the CSM Contractor's FLS strategy, and in accordance with AS ISO 14520-2009 and applicable ASA Standards.
- (b) Gaseous suppression must be provided to protect rooms within the Central Station Works and Central Walk Works that satisfy the following three requirements:
- (i) for Critical Equipment Rooms;
 - (ii) where fully redundant (standby) Critical Equipment cannot be provided in a separate fire separated room; and
 - (iii) where the operation of a sprinkler system is considered to pose an unacceptable risk of damage to Critical Equipment.

- (c) All gaseous suppression systems are to be of the total room flooding type.
- (d) Gaseous suppression must be of the clean agent inert gas type and a single type of gas is to be used across all rooms within the Project Works.
- (e) The type of inert gas selected must have the following characteristics:
 - (i) zero ozone depletion potential;
 - (ii) 100 year global warming potential of less than 10;
 - (iii) enable occupants to safely evacuate the room being flooded by gas;
 - (iv) the gas is approved/permitted for use in NSW and widely used in NSW; and
 - (v) non-proprietary.
- (f) Gaseous suppression is to be automatically activated by fire detection. The fire detection system must include two independent detection types. One type must be a MASDS type. Room flooding gaseous suppression must not activate until both fire detection types confirm a fire event.
- (g) For centralised gas suppression systems serving multiple rooms, a sufficient stock of fully-charged standby gas cylinders, (located in a secure maintenance location) must be provided.
- (h) Mechanical systems for pressure relief and purging must be provided in accordance with section 2.1 of this Appendix B04b.
- (i) Gas bottle storage must be located such that replacement can be undertaken from on grade access or by lifts and not by service building stairways. Alternatively on grade fill points can be provided.
- (j) Any gas control panels within Central Station Works and Central Walk Works areas must interface with the existing Central Station FIP for system control and monitoring.
- (k) Any gaseous suppression systems must be able to interface with the ECS to close fire dampers, stop mechanical systems and activate pressure relief for the protected rooms in the event of the activation of the gaseous suppression system.

2.4.7 Fire hose reel system

- (a) A fire hose reel system must be provided throughout the Central Station Works and Central Walk Works to provide full coverage to all floor areas, with the exception of:
 - (i) public access areas of platforms subject to an approved alternative solution in the CSM Contractors FLS strategy.
- (b) As a minimum the fire hose reels must be located:
 - (i) within 4 metres of fire exits; and
 - (ii) adjacent to internally located fire hydrants (including at the top and bottom of vertical transport elements).
- (c) Valves serving the fire hose reel system must be secured and padlocked in the open position.
- (d) Fire hose reel coverage is not to require the hose to cross fire compartment lines.

2.4.8 Portable fire extinguishers

- (a) Portable fire extinguishers must be provided throughout the Central Station Works and Central Walk Works as defined by the CSM Contractor's FLS Strategy.
- (b) The portable fire extinguishers must be installed in accordance with AS 2444 and applicable ASA Standards
- (c) The portable fire extinguishers must be conspicuously located in positions where they will be readily accessible and immediately available in the event of fire.
- (d) The portable fire extinguishers must be located near to room exits, corridors, lobbies and inside fire hose reel cabinets.
- (e) The portable fire extinguishers must have their locations clearly indicated by placement of the location sign and be mounted at the appropriate height.
- (f) Any portable fire extinguishers located in areas accessible to the public must be contained in cabinets with break glass release and/or door open alarms monitored by the new Central Station BMS via the fire system and displayed in the RMC.

2.5 Building management system

2.5.1 General

- (a) The CSM Contractor must provide a complete and integrated, direct digital control open protocol BMS with all necessary components, systems, and interfaces for the Central Station Works and Central Walk Works (hereafter referred to as the new Central Station BMS).
- (b) The new Central Station BMS must:
 - (i) comply with the Interface Schedule (see Appendix E2, section 17 Building Management System).
 - (ii) comply with control system requirements in accordance with ASA Standard ESB 004;
 - (iii) not rely on any existing station service control systems within the existing Central Station. The CSM Contractor must consult with Sydney Trains to identify any existing station systems that could be integrated into the new Central Station BMS;
 - (iv) be a separate system to, but must interface with the Sydney Metro BMS as defined in section 3.7 of this Appendix B04b;
 - (v) control and monitor the following, as a minimum:
 - A. ECS in accordance with section 2.1 of this Appendix B04b;
 - B. hydraulic systems, in accordance with section 2.2 of this Appendix B04b;
 - C. station lighting, in accordance with SWTC Appendix B04a;
 - D. lifts and escalators, in accordance with section 2.3 of this Appendix B04b;
 - E. digital signage and digital advertising systems in accordance with SWTC Appendix B02 and SWTC Appendix B13; and

- F. all other general station building services not controlled by a separate system level control system which interfaces with the SMCS.
- (vi) monitor but not control the following, as a minimum:
 - A. security and CCTV systems, in accordance with SWTC Appendix B02;
 - B. UPS, in accordance with SWTC Appendix B04a;
 - C. an emergency lighting system in accordance with SWTC Appendix B04a; and
 - D. fire protection and detection systems, in accordance with section 2.4 of this Appendix B04b;
- (vii) be independent of the HV electrical systems, traction power systems, and train control systems;
- (viii) interface with the SMCS via a communications fibre backbone, including;
 - A. facilitating remote control and monitoring of the new Central Station BMS connected systems from the SMCS;
 - B. raising alarms to the SMCS; and
 - C. LV energy monitoring.
- (ix) be interlinked via the communications fibre backbone so the new BMS can be remotely controlled and monitored from the RMC in the event of a failure of the SMCS;
- (x) provide a means of remotely and locally monitoring and controlling equipment and systems connected to the Central Station BMS, in a safe, predictable, reliable and accurate manner; and
- (xi) enable modular expansion for the future connection of other systems from outside the Project Works, in particular those elements identified in section 2.5.1 b) ii).

2.5.2 Functionality

- (a) The new Central Station BMS must provide:
 - (i) a means of setting the operational parameters for the Central Station BMS connected systems and controlling respective dynamic equipment;
 - (ii) a means of monitoring the operation and status of the Central Station BMS connected systems;
 - (iii) an integrated alarm system for the Central Station BMS connected systems;
 - (iv) intuitive user interfaces for monitoring and operating the Central Station BMS connected systems specific to the respective systems and relevant to their function;
 - (v) a means for consolidated maintenance management, including data logging and recording, monitoring and diagnostic services, and with interface and reporting functionality to the asset information system (AIS) (see section 2.5.10 below);

- (vi) facility for metering data acquisition, logging and recording, for water use management and reporting;
 - (vii) facility for metering data energy consumption per facility and per network for energy auditing purposes with a data collection time to support energy modelling consumption and performance;
 - (viii) interfaces with interdependent and associated systems; and
 - (ix) interface with the SMCS, including a facility for remote control and monitoring of the Central Station BMS connected systems by the RMC and reporting functionality to raise alarms to the RMC.
- (b) The new Central Station BMS must:
- (i) be a zone based management system with regard to the specific use, function or operational requirement;
 - (ii) have at least 20% spare capacity on loops and points at Completion;
 - (iii) be of modular design and capable of further expansion; and
 - (iv) have the same level of response performance as the SMCS.

2.5.3 System typology and redundancy

- (a) The new Central Station BMS must have a consistent system architecture to other Sydney Trains Stations, as agreed with Sydney Trains.
- (b) The new Central Station BMS communications typology must be resilient, fault tolerant, and interconnected with multiple redundant and spatially diverse data communications links to ensure that no single point of failure results in:
 - (i) degraded operation; or
 - (ii) any loss of control and monitoring of Critical Equipment and safety related Central Station BMS connected systems.
- (c) All active elements of the new Central Station BMS must be self-monitoring in order to facilitate rapid alert of fault conditions and to allow ease of fault finding and repair.
- (d) The new Central Station BMS must be able to operate as a standalone system from a separate BMS HMI workstation in the RMC, independent of the SMCS in the event of a failure of the SMCS.
- (e) The new Central Station BMS must:
 - (i) be powered by the Sydney Trains UPS system to maintain operation in the event of a power outage;
 - (ii) include hardware and software that is:
 - A. fully supportable by local agents and be to the type and standard that operates successfully in other similar applications; and
 - B. to recognised industry standards and open sourced, not bespoke base hardware and protocols.

2.5.4 Human Machine Interface

- (a) The CSM Contractor must utilise a HMI workstation concept in its design for the new Central Station BMS.

- (b) The new Central Station BMS HMI workstations must provide an intuitive and representative schematic display for each respective Central Station BMS connected system.
- (c) Information received from the Central Station BMS connected systems must be displayed in a consistent format to other Sydney Trains BMS terminals.
- (d) The new Central Station BMS HMI workstations must be capable of:
 - (i) acquiring data from the mechanical and electrical instrumentation or local device controllers;
 - (ii) processing data to raise programmable alarms and detect other significant issues;
 - (iii) performing control functions automatically based on acquired data or HMI operator input;
 - (iv) displaying required data to operators via intuitive graphical displays and audible sounds;
 - (v) performing system monitoring and diagnostics to detect failure of hardware or software;
 - (vi) software maintenance and upgrade, system diagnostics; and
 - (vii) storage and retrieval of data.
- (e) The location of the new Central Station BMS HMI workstation is to be agreed with Sydney Trains.

2.5.5 Access control and decision support

- (a) The new Central Station BMS and associated BMS operations must comply with the Sydney Trains Security Management Plan.
- (b) The CSM Contractor must provide access control mechanisms to the new Central Station BMS to ensure that:
 - (i) only authorised personnel can use the system; and
 - (ii) the functionality available is controlled by a user's permission level based on their role description, function and level of authority and competence.
- (c) In the event of an equipment failure or an alarm occurring which must require some form of re-configuration of the Central Station BMS connected systems, the new Central Station BMS must make recommendations as to the most appropriate reconfiguration to suit the particular failure scenario.
- (d) The new Central Station BMS must have the capability to facilitate control of the Central Station BMS connected systems in response to specific events in order to ensure the most appropriate response to any given scenario. This capability must include:
 - (i) fully automatic – where the new Central Station BMS chooses and commands a preferred scenario automatically. The configuration of the new Central Station BMS to take any such automatic actions must be subjected to a design safety study before implementation;
 - (ii) semi-automatic – where the new Central Station BMS or RMC operator chooses a preferred option from a range of options offered by the new Central Station BMS for the new Central Station BMS to then automatically

command the Central Station BMS connected systems. This must have two further sub options where:

- A. the new Central Station BMS automatically commands a pre-set preferred option if there is no operator response after a designated timeout. The configuration of the new Central Station BMS to take any such “timed out” automatic actions must be subjected to a design safety study before implementation; or
- B. the system raises a “no response” alarm and takes no further action; and
- C. manual – where Sydney Trains manually configures the new Central Station BMS to suit their own preference.

2.5.6 Control hierarchy

- (a) The CSM Contractor must develop and implement a control hierarchy for the new Central Station BMS, the Central Station BMS connected systems and Central Station BMS interfaces and these must be compatible with that developed for other Sydney Trains stations, to the extent agreed with Sydney Trains.
- (b) The new Central Station BMS must allow the SMCS to have control priority over the new Central Station BMS, Central Station BMS connected systems, and any localised control.
- (c) Parallel monitoring at all BMS HMI workstations must be possible at any time.
- (d) Where local panels or manual controls exist in any of the Central Station BMS connected systems, the Central Station BMS connected system equipment must be capable of being isolated from the new Central Station BMS to prevent remote operation of the equipment while under manual control.
- (e) The new Central Station BMS must provide a notification at the respective new Central Station BMS HMI workstation and at the SMCS that a given Central Station BMS connected system is under manual control.

2.5.7 Alarms

- (a) The CSM Contractor must apply an alarms classification to be agreed with Sydney Trains.
- (b) Audible and visual warnings must be provided to alert operators of the new Central Station BMS and SMCS to alarms requiring immediate action or situational awareness.
- (c) Alarms pertaining to the failure or warning of failure of Critical Equipment and safety related Central Station BMS connected systems or their sub-components must be reported to the SMCS and brought to the attention of the SMCS operator.
- (d) High level alarms of Central Station BMS connected systems must be raised to the SMCS but must not take reporting precedence over alarms from Critical Equipment and safety related systems.
- (e) High level alarms of Central Station BMS connected systems must include those that indicate a complete system failure.
- (f) The new Central Station BMS must raise general alarms, including maintenance alarms and sub-component failure from general Central Station BMS connected

systems, to the SMCS based on a threshold of the number of alarms. Such alarms must be stacked in order of priority based on significance.

- (g) The new Central Station BMS, in conjunction with the Central Station BMS connected systems, must utilise group alarming, to be agreed with Sydney Trains, to minimise alarm clutter.
- (h) Alarms generated must be reported in a hierarchical sequence, to be agreed with Sydney Trains.

2.5.8 Metering and data logging

- (a) Metering data received from the new Central Station BMS connected systems and sub-systems must be data logged and recorded with a time stamp.
- (b) Metering data must allow real time trend analysis and interrogation.
- (c) Metering data must be logged at no greater than 15 minute intervals, recording the time average value between intervals, and separately recording the instantaneous peak value for the interval.
- (d) Specific metering types and metered systems are identified in the respective disciplines cross referenced in section 2.5.1 of this Appendix B04b.

2.5.9 Event recording

- (a) All Central Station BMS data, controls, events, and alarms must be recorded in real time and stored in a secure and permanent manner.
- (b) All Central Station BMS records must be backed-up on a routine basis to the SMCS for long term storage.
- (c) The CSM Contractor must ensure that the Central Station BMS records are easily retrievable and capable of immediate playback from the HMI workstation and the RMC.

2.5.10 Asset information system (AIS)

- (a) The new Central Station BMS must interface to the AIS to enable real time trending analysis for maintenance scheduling, preventative maintenance, and scheduling fault repair.

2.5.11 Interfaces

- (a) Industrial standard protocols must be used to transmit data between connected field devices and the new Central Station BMS equipment.
- (b) The new Central Station BMS must receive fire alarm status from the FIP and identify affected systems and zones.
- (c) The new Central Station BMS must facilitate remote control of Central Station BMS connected systems, and remote monitoring and interrogation of local system performance and status by the SMCS.

3 Metro Station mechanical services

3.1 Environmental control systems and station ventilation

3.1.1 General

- (a) The CSM Contractor must provide a Metro Station ECS, including;
- (i) heating, ventilation, and air-conditioning (HVAC) systems;
 - (ii) equipment room cooling systems;
 - (iii) back-up cooling systems for Critical Equipment Rooms;
 - (iv) economy cycles and heat recovery systems to suit the areas being served and provide energy efficient operation;
 - (v) cooling and ventilation systems for platform and concourse public areas;
 - (vi) pressurisation systems for enclosed emergency stairs and associated corridors, and lobbies, including relief paths;
 - (vii) pressure relief and purge systems for rooms with gaseous fire suppression;
 - (viii) associated equipment and system component supports, intakes, discharges, risers, civil and structural works, and acoustic treatments;
 - (ix) power supply, control, and monitoring systems and interfaces;
 - (x) water supply, treatment, and drainage systems; and
 - (xi) fire separation, fire stopping, fire proofing, and fire system interfaces.
- (b) The CSM Contractor must provide the Metro Station ECS in accordance with the performance requirements of this Appendix B04b, the Contract, the National Code of Construction (NCC), Building Code of Australia (BCA), applicable Australian Standards and Codes, local NSW codes of practice, best practice industry guidelines, and the CSM Contractor's FLS strategy.
- (c) The CSM Contractor must provide a complete and integrated Metro Station environmental control system (ECS) with all necessary components and systems.
- (d) The Metro Station ECS and ventilation system must comply with the Interface Schedules in SWTC Appendix E1.
- (e) The ECS for the Metro Station Works must be independent from all ECS systems for the Central Station Works the Central Walk Works and any existing systems at Central Station.
- (f) Natural ventilation shall be prioritised over mechanically forced ventilation where reasonably practicable and in accordance with section 3.1.1 (b).
- (g) In the implementation of the Metro Station ECS the CSM Contractor must ensure that the design, construction testing and integration will maintain continuous rail operations at all times.
- (h) The Metro Station ECS must be coordinated and integrated with the tunnel ventilation systems in order that any infiltration rates through open Platform Screen

Doors is taken into account in the design of the Metro Station ECS system for Normal Operation.

- (i) The Metro Station ECS must be capacity rated for Normal Operation, Degraded Operation, Abnormal Operation and Emergency Operation.
- (j) The Metro Station ECS must maintain the availability of Emergency Operations systems and services.
- (k) The Metro Station ECS must:
 - (i) ventilate, heat, cool, or air-condition as required, occupied spaces for a safe and comfortable thermal environment;
 - (ii) ventilate and cool as required, BOH, equipment spaces, toilets, wet areas, lift shafts, and hazardous areas to:
 - A. maintain suitable operating conditions for safe and normal operation of equipment in accordance with manufacturers requirements;
 - B. remove heat from any embodied operating equipment and limit temperature rise within acceptable ranges for safe and normal operation of equipment, as intended by design;
 - C. provide basic amenity for Enclosed Spaces where expected occupancy is less than 30 minutes duration in any situation;
 - D. positively pressurise against dust ingress;
 - E. mitigate condensation and mould growth;
 - F. capture, contain and remove obnoxious and hazardous substances, contaminants, gases, and vapours;
 - G. prevent development of potentially hazardous or explosive environments;
 - H. maintain any respective hazardous area classifications;
 - I. relieve pressure build up in rooms with gaseous fire suppression to protect integrity of structure;
 - J. purge rooms with gaseous fire suppression to the clear room for access or to resume Normal Operations, and to avoid development of a hazardous environment in adjacent spaces; and
 - K. prevent fire and smoke spread;
 - (iii) mitigate elevated temperatures in the public platform space and provide an improved thermal comfort sensation;
 - (iv) pressurise enclosed emergency egress stairs, and associated lobbies and corridors to prevent the ingress of smoke;
 - (v) pressurise wheelchair refuge spaces;
 - (vi) support continuous operation of Critical Equipment; and
 - (vii) maintain availability of systems and services supporting responses to an emergency event.

- (l) Rooms and Enclosed Spaces served by the Metro Station ECS must employ passive measures to reduce energy use and the ECS capacity, including; thermal insulation, shading of external walls, roofs, and windows, solar treatment of glazing, and room location and orientation.
- (m) Passive thermal performance measures must be applied to cooled spaces and exceed energy reductions achieved by the performance requirements as set in Section J of the BCA.
- (n) Canopies and shade structures must be capable of restricting at least 80% of summer solar radiation to improve the thermal comfort of sheltered occupants.
- (o) The Metro Station ECS must be designed to operate efficiently both under full load and part load conditions by use of variable speed drives and high efficiency motors.
- (p) The Metro Station ECS must be installed with a minimum of 20% spare capacity including heating or cooling and ventilation capacity, against Metro Station ECS peak operations and the respective design conditions, where Metro Station ECS peak operations are defined as the peak hot summer day, the peak winter day, and the peak ventilation demand for each system.
- (q) The Metro Station ECS must be demand controlled where the purpose is to control temperature, maintain a minimum air quality, or where it is serving a normally occupied area.
- (r) Demand control must be on a respective zone basis.
- (s) Toilet ventilation must be configured to operate on demand.
- (t) The Metro Station ECS, including ventilation and refrigeration equipment, ductwork and pipework insulation must exceed the performance requirements within Section J of the BCA.
- (u) The Metro Station ECS must be able to operate at full system design capacity in ambient conditions of 2°C to 45°C dry-bulb.
- (v) The Metro Station ECS may operate with reduced capacity but must not fail to operate in ambient conditions up to 55°C dry-bulb.
- (w) Belt driven fans and pumps must not be used, with the exception of cooling tower fan drives.
- (x) Electric duct heaters must not be used.
- (y) Where no Australian Standard exists, the Metro Station ECS must be in accordance with the Australian Institute of Refrigeration Air-conditioning and Heating (AIRAH) and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards and guidelines.
- (z) Ductwork must be designed to minimise airflow resistance and system effect factors and be constructed in accordance with AS4254 and Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) standards and fan and air handling unit manufacturers' recommendations for good practice and low whole life cycle cost.
- (aa) All mitred bends in ductwork must use turning vanes.
- (bb) There must be no abrupt transitions in ductwork and pipework. Minimum transitions must be 1:4 ratios.

- (cc) Chillers with cooling capacity greater than 350kW must have a minimum Integrated Part Load Value (IPLV) of 6.5. Chillers with cooling capacity greater than 750kW must have a minimum (IPLV) of 7.5.
- (dd) Chillers shall be fitted with marine type water boxes with flanged water connections.
- (ee) Cooling towers must be fitted with side stream filtration with multiple adjustable jet nozzles covering 90% of the basin area to ensure basin cleanliness at all times and for system filtration.
- (ff) High performance, low resistance noise attenuators must be used. Noise attenuators must be lined to suit their environmental conditions.
- (gg) Metro Station ECS water services, including gravity or pressure water pipes, cooling and heating services, and condensate drainage, must be located external Critical Equipments Rooms containing equipment susceptible to water damage, including communications equipment, signalling equipment, PSD control equipment, and motor control cabinets or drives, servers, switchboards, switch gear, transformers.
- (hh) Water pipes or drainage must not be routed directly above any equipment or devices susceptible to water damage or the effects of moisture.
- (ii) Condensate drip trays must be provided under cooling coils, fan coil units, evaporator units, and where condensate may form, with trap and gravity drainage to the closest available tundish. Drip trays and drains must be insulated.
- (jj) Where a room or Enclosed Space can be defined as more than one type or area by its contents or functions, then the most onerous design criteria and extent of Metro Station ECS provisions set by its individual contents or functions must be applied to the whole room or space.

3.1.2 Environmental design conditions

- (a) The Metro Station ECS must be designed to ambient design conditions appropriate for its given application, climate change considerations, Metro Station ECS peak design condition (design hour), and most relevant to the respective geographic locations in which it operates.
- (b) Ambient design temperatures and wind characteristics must be based on recorded data from the Australian Bureau of Meteorology.
- (c) For summer Metro Station ECS comfort applications, the summer design hour ambient conditions must:
 - (i) be based on the 90th percentile summer dry bulb temperature from temperature observations for the last 30 years; and
 - (ii) not be exceeded on more than 10 days of the 92 summer days of the year.
- (d) For winter Metro Station ECS comfort applications, the winter design hour ambient conditions must be;
 - (i) based on the 10th percentile winter dry bulb temperature from temperature observations for the last 30 years; and
 - (ii) selected for the system operating hours or hours in which the serviced spaces are typically utilised.
- (e) For Metro Station Critical Equipment, the summer design hour ambient conditions must be:

- (i) based on the summer dry bulb temperature not exceeded on more than 0.25% of plant operating hours per year; or
 - (ii) the 98th percentile dry bulb temperature from data of the hottest month from temperature observations for the last 30 years, whichever is more onerous.
- (f) The ambient design condition must take into account climate change temperature increases to the ambient temperature by applying the change in environmental conditions due to climate change predicted by the representative concentration pathway (RCP) 8.5 for 2030 and 2050 scenarios. The HVAC system capacities shall be sized to accommodate the system load +20% spare or the system load and climate change growth, whichever is larger. The 20% spare capacity and climate change growth allowance are to be considered in parallel not concurrently.
- (g) Relative humidity must be that which corresponds to the respective design dry bulb temperature in each case.
- (h) Background noise levels must be based on baseline measurement reports, future land use assessments and requirements of Planning Approvals.
- (i) Wind characteristics must account for local wind effects, including prevailing wind direction, frequency, and magnitude, and minimising the likelihood of wind tunnel effects to a maximum air movement speed of 1m/s through concourse spaces.
- (j) The CSM Contractors design and installation must address the micro-climate and prevailing winds.
- (k) Remotely recorded wind data must be corrected for use at the specific geographic location based on the approach detailed in American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 2009 Fundamentals Handbook chapter 24.
- (l) Site measurements or local records must be used to support any correction factors.

3.1.3 Internal design temperatures

- (a) The Metro Station ECS must be provided to meet the internal design temperatures, as per **Table 5** below, against the respective environmental design conditions determined in section 3.1.2.

Table 5 Internal design temperatures

Area	Internal design temperature (dry-bulb)
Covered public open areas	Nominally ambient, to a maximum 5°C above ambient temperature.
Metro Station platform areas	Up to 27°C
Equipment rooms (temperature sensitive electronics)	24°C±1.5°C
Critical Equipment Rooms	24°C±1.5°C 40-65% relative humidity

Area	Internal design temperature (dry-bulb)
Garbage rooms	Nominally ambient + 5°C (maximum) by mechanical ventilation if food waste will not be present. Up to 22°C where food waste may be present
Occupied Spaces - non-transient ECS comfort applications	23°C ±1°C (summer) 21°C ±1°C (winter)
Workshops	Nominally ambient + 5°C (maximum), however in accordance with Operators strategy and agreements for respective work activities.
Lift shafts	Ambient + 5°C (maximum) Limited to 40°C (maximum)
Electrical rooms	Ambient + 5°C (maximum)
Plant rooms	Ambient + 5°C (maximum)
Electrical substations	≤50°C

- (b) The Metro Station platforms must have a high degree of thermal comfort for occupants for 90% of the space area over 90% of the operational hours in cooling conditions as outlined in Figure 5.3 in ASHREA 55 – 2010.
- (c) The CSM Contractor’s design for ECS controls will target a relative humidity in Occupied Spaces between 30-60%.
- (d) Condensation must not occur at any time on the internal surfaces of served spaces or on equipment in those spaces.
- (e) The cooling systems must be designed to prevent condensation on grilles and air terminals.
- (f) Maximum internal design temperatures of rooms and spaces must meet the equipment supplier’s requirements for any respective embodied equipment.
- (g) Maximum internal design temperatures of lift shafts must meet the supplier’s or manufacturer’s requirements.

3.1.4 Ventilation

- (a) The Metro Station ventilation systems are to be designed and operated in accordance with AS/NZS 1668.1 ‘The use of ventilation and air-conditioning in buildings – Fire and smoke control in buildings’, AS/NZS 1668.2 ‘The use of ventilation and air-conditioning in buildings – Mechanical ventilation in and the CSM Contractor’s FLS strategy.
- (b) Ventilation systems provided for temperature control, must meet the supplier’s maximum design temperatures for the respective equipment.
- (c) Occupied Spaces must have a minimum fresh air rate of 10l/s per person.

- (d) The mechanical ventilation supply (fresh air) and exhaust rates for normally unoccupied spaces must achieve the design rates in Table 6.

Table 6 Supply and exhaust air flow rates for unoccupied spaces

Room	Required Exhaust	Required Supply
Office area (basic rate, unoccupied)	Passive relief to common corridor	2 l/s/m ²
Equipment rooms	4.5 l/s/m ²	5 l/s/m ²
Locker room	5 l/s/m ²	Passive make-up
Toilets (WCs)	10 l/s/m ² or 25 l/s/sanitary fixture	Passive make-up
Archive/store	Passive relief to common corridor	5 l/s/m ²
Garbage and cleaners rooms	10 l/s/m ² - if ventilated 5 l/s/m ² – if air-conditioned	Passive make-up
Electrical rooms	Passive relief or 4.5 l/s/m ²	5 l/s/m ² or as required for room pressurisation and temperature limitation.
Corridor/lobby	-	1 l/s/m ²
UPS/battery rooms	To AS 2676.1	To AS 2676.1
Sumps	5 l/s/m ²	4.5 l/s/m ² or passive make-up
Chemical stores	10 l/s/m ²	Passive make-up

- (e) Rooms served by gaseous fire suppression must have passive pressure relief, to atmosphere where possible, and a purge ventilation system, principally extraction, to clear the room of suppression agent at a rate of 6 air changes per hour.
- (f) Gaseous fire suppression extraction systems must be ducted to atmosphere, and supported with suitable make up air to the room.
- (g) Gaseous fire suppression extraction systems must feature high and low level exhaust points in each respective room according to the gas density to ensure all discharged extinguishing agents and smoke is captured and removed.
- (h) Discharge from pressure relief and purging systems must not be allowed to enter any space in concentrations or velocities that may cause harm to occupants.
- (i) Rooms with high density heat loads and electrical rooms which contain equipment that can operate at temperatures above ambient and is not sensitive to dust must be naturally ventilated where such rooms are above ground.
- (j) Natural ventilation must be augmented with mechanical ventilation as required for temperature control, air quality requirements, and smoke control.
- (k) Ventilated rooms must not be supplied with air drawn from any underground space, including tunnel, trackway, or platform space.

3.1.5 Occupancy levels and heat loads

- (a) The CSM Contractor must design the Metro Station ECS for the specific occupancies and heat loads to the ultimate design year capacities (UDYC), where UDYC is the requirement for capacity to be safeguarded to allow for long-term patronage growth as per the Degraded Operation scenario pedestrian modelling for the Ultimate Design Year forecast defined in SWTC Appendix B16.
- (b) Design occupancies must be based on specific occupancies for the design, in accordance with section 3.1.5 (a) or on the values (people/m²) provided in Appendix A of AS1668.2.

3.1.6 Intakes and discharges

- (a) All ECS exhaust and discharge points, except cooling towers must be located greater than 12m from any surrounding intakes including:
 - (i) Central Station entrances;
 - (ii) openings from surface platforms to the concourse level including voids, open stairs and open escalators;
 - (iii) ECS fresh air intakes for cooling or ventilation;
 - (iv) stair pressurisation fresh air intakes;
 - (v) Sydney Metro City and Southwest tunnel draught relief shaft outlets/intakes; and
 - (vi) Sydney Metro City and Southwest tunnel ventilation fan intakes.

If the separation distances defined in section 3.1.6 (a) cannot be achieved, the CSM Contractor must demonstrate that any obnoxious discharge, including smoke, being drawn back into air intakes, has been adequately minimised in the Stage 1 design documentation and obtain agreement from the Principal.

- (b) Cooling tower discharges must be sited above the horizontal plane of and greater than 12 metres from any surrounding air intakes, including:
 - (i) Central Station entrances;
 - (ii) openings from surface platforms to the concourse level including voids, open stairs and open escalators;
 - (iii) ECS fresh air intakes for cooling or ventilation;
 - (iv) stair pressurisation fresh air intakes;
 - (v) Sydney Metro City and Southwest tunnel draught relief shaft outlet/intakes; and
 - (vi) Sydney Metro City and Southwest tunnel ventilation fan intakes.
- (c) Outdoor air intakes must be located and arranged to avoid drawing air in from sources of contamination and pollution above that present in the general ambient air quality for the locality.
- (d) Outdoor air intakes must not be located in the predominate downwind direction from exhaust points and cooling tower discharges.

3.1.7 Air filtration

- (a) Mechanical supply air and cooling systems must be filtered to adequately clean air delivered to occupied and serviced spaces.
- (b) Filters must be rated in accordance with and selected with consideration of energy rating set out in EN779.
- (c) Filters must be selected and provided on the basis of a whole system life cycle cost assessment.

3.1.8 Vibration criteria

- (a) The Metro Station ECS must be designed and provided with the necessary vibration isolation to keep vibration to a practical minimum and achieve the criteria defined in AS2670 series, and with reference to ASHRAE:2007 Application Handbook chapter 47.
- (b) Static and dynamic balancing of all rotating machinery must be undertaken to comply with the requirements of AS1359 Rotating electrical machines parts 50 and 51, and AS2625 Mechanical Vibration.

3.1.9 Fire rating and fire systems

- (a) The Metro Station ECS must be designed and provided to meet the fire rating and separation requirements set by the BCA and the CSM Contractor's FLS strategy.
- (b) All fans, motors, dampers, ductwork, and related components, required to provide a smoke management function (including exhaust, pressurisation, ventilation, make-up air and pressure relief) must be capable of operating in an environment of 300°C for a minimum of 2 hours.
- (c) Ventilation systems must include, as a minimum, smoke sensors in fresh air and return air intakes or mixing plenums.
- (d) Smoke sensors must be selected and positioned to minimise false alarms, notably from dust.
- (e) Two sensors must be used to provide positive confirmation of smoke entering the ventilation system.
- (f) Ventilation systems serving multiple rooms or zones must incorporate dampers and controls to isolate any fire affected compartment and continue ventilation of non-affected areas.
- (g) Fire dampers must be provided to maintain the fire resistance level of fire rated partitions.
- (h) Emergency ventilation panels for local control of station smoke management systems by the fire brigade shall be provided in the station FCR. This control shall be 'modal' only and will not enable the control of individual elements.
- (i) All cabling must be Low Smoke Zero Halogen.
- (j) Sealants and adhesives used for fire sealing of penetrations or as part of other fire safety systems must have a maximum total volatile organic compound content of 250 g/L of ready to use product.
- (k) All mechanical smoke ventilation and pressurisations systems shall be able to operate simultaneously without any reduction in the design capacity requirements,

with the exception of the over trackway exhaust which is not required to operate over both trackways at the same time in smoke exhaust mode.

3.1.10 Redundancy

- (a) For all Critical Equipment or serving lift shafts, the Metro Station ECS must apply 'n+1' duty/standby provisions to all powered active equipment, including redundant fans, pumps, compressors of equivalent duty.
- (b) The CSM Contractor must provide for the each emergency staircase pressurisation system either:
 - (i) a 'n+1' fan assembly for duty/standby provision; or
 - (ii) ensure that with a duty only system, the system is available when needed through routine operation and testing.
- (c) Duty/standby equipment must be programmed to swap duty cycle at defined intervals or start occasionally if normally dormant to ensure equal run times and check for compliant operation of the system.
- (d) To avoid providing backup power to cooling and ventilation systems, the rooms which require continuing operation during a complete power failure must have equipment and systems that are rated to operate for the UPS duration without cooling or ventilation.
- (e) All Metro Station ECS equipment must automatically restart at the previous set point following restoration of power and clearing of any fire alarms.
- (f) Standby equipment must automatically activate on detection of failure of the duty device.
- (g) Platform cooling is not considered critical to railway operations and may be a duty only system, however partial Redundancy must be provided by way of the system design. Minimum ventilation to sustain the occupied space in accordance with AS1668 and ASHRAE, whichever the greater must be maintained.
- (h) The Metro Station ECS must incorporate fail safe modes, as a minimum:
 - (i) load shedding non-critical service to support Critical Equipment in fault mode;
 - (ii) motorised dampers which spring return to close, power to open, so that in complete failure, fire separation and system and equipment isolation is maintained; and
 - (iii) interlocked or passively reactive fan and damper operation.
- (i) The design and installation must limit exposure of the passive pipework and ductwork to damage which could cause failure of the whole cooling system.
- (j) Inherent Redundancy must be provided for cooling system pipework to remote terminal units and field devices such that in the event of failure of the pipework an alternative route may be provided for the cooling medium whilst rectification is undertaken.
- (k) Back-up cooling system components, including water cooled condensers, must be located with the primary duty cooling system components, including water cooled chillers, in a common plant room.
- (l) A mechanically protected pipework route or redundant pipework, connected by normally closed isolation valves, must be provided where co-location of the back-up

cooling system components and primary duty cooling system components are not possible.

- (m) Toilets are to be fitted with an exhaust system comprising dual fans so as to provide 'n+1' standby Redundancy in accordance with ASA Standard ESB004.

3.1.11 Availability

- (a) The CSM Contractor must ensure system availability is able to be maintained during periods of high ambient conditions in accordance with in SWTC Appendix B07.
- (b) The CSM Contractor must ensure the Metro Station ECS system heat rejection is suitable to maintain Critical Equipment operations at all times.

3.1.12 Systems and components

3.1.12.1 Heating, cooling and air-conditioning and refrigerant systems

- (a) The CSM Contractor must apply a system to meet with the availability requirements of the area it serves. The system types must be water cooled, consisting of a combination of chilled water based and refrigerant based systems.
- (b) The CSM Contractor must ensure that refrigerant systems within temporary site facilities and permanent infrastructure have zero ozone depletion potential and low or zero 100-year global warming potential.
- (c) The CSM Contractor must ensure refrigerants within the permanent station HVAC and refrigerant systems have a combined total system direct environmental impact (TSDEI) less than 35, and a leak detection system and automatic refrigerant recovery system is in place. Compliance must be demonstrated in accordance with the Green Star Design and As Built Refrigerants Impacts Calculator.
- (d) The CSM Contractor must maximise the energy efficiency of HVAC power consumption and operational control. HVAC power consumption and control systems must be designed to support achievement of the Minimum Station Percentage Improvement in energy efficiency over Section J of the National Construction Code, Building Code of Australia (NCC BCA) as defined in Appendix B07.
- (e) Chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC) refrigerants must not be used.
- (f) A refrigerant leak detection system must be provided in each chiller room.
- (g) A refrigerant leak detection system must be provided where there is a significant consolidation of condensers.
- (h) Rooms containing condensers or chillers must be ventilated to mitigate refrigerant build up.
- (i) Variable refrigerant volume or flow direct expansion air conditioning systems must have inverter driven compressors.
- (j) Use of individual direct expansion split system units must be avoided.
- (k) Window mounted package units must not be used.
- (l) Primary cooling must be provided by centralised heat rejection systems so to increase the overall efficiency of the Metro Station ECS, except where remote and discrete equipment rooms or offices require cooling.
- (m) Cooling and air-conditioning systems must incorporate outdoor air economy cycles to utilise fresh outside air for cooling where ambient conditions permit.

3.1.12.2 Occupied Spaces (non-transient)

- (a) Ventilation systems serving Occupied Spaces must be separate to ventilation systems serving public space, and ventilation systems serving equipment, electrical and plant rooms.
- (b) Any backup control room must have back-up cooling provision.
- (c) Any backup control room must each have standalone back-up ventilation provisions.
- (d) Occupied Spaces must include, as a minimum; offices, staff rooms, operations rooms, meeting rooms, control rooms, meal rooms, lockers, change rooms, and backup control rooms.

3.1.12.3 Equipment, plant, and electrical rooms

- (a) For ventilation purposes Critical Equipment Rooms must include battery rooms as defined by AS2676, hazardous material stores, chemical stores, garbage rooms, fire pump rooms, and force ventilated sumps or pits.
- (b) Rooms with sensitive electronic equipment must be mechanically ventilated with filtered air supply to maintain consistent positive pressure and mitigate dust ingress.
- (c) Rooms containing potentially hazardous or obnoxious substances, including wet areas or stores, sewerage ejector rooms, sumps, and chemical stores, must be mechanically ventilated and maintained under negative pressure to contain odours, vapours and contaminants.
- (d) Rooms containing potentially hazardous or obnoxious substances must have dedicated exhaust systems that are completely ducted to their discharge point and do not mix with any other airstreams.
- (e) Ventilation systems serving plant rooms, electrical rooms, and equipment rooms must be separate to ventilation systems serving Occupied Spaces, and to ventilation systems serving public space.
- (f) The fire pump room must be naturally ventilated.
- (g) Rooms containing combustion engines must discharge exhaust directly to the outside, through a thermally lagged flue.
- (h) Plant rooms containing water cooled ECS equipment must have a graded floor to a central drainage pit which freely drains from the room, via a trap, to the Metro Station or facility drainage system.
- (i) The ECS provided for Critical Equipment must be capable of 24 hour, continuous operation.
- (j) ECS systems to Critical Equipment Rooms must be designed so that they can continue to operate during a fire alarm without contributing to smoke spread.

3.1.12.4 Cooling and public area ventilation

- (a) Cooling systems must be capable of delivering, as a minimum, a total outside air ventilation rate of 20m³/s to the platform space and must be evenly distributed to each AHU on a percentage supply air basis.
- (b) For platform cooling system the CSM Contractor must include for infiltration/exfiltration of air between the trackway and the platform through both open and closed PSDs for peak periods.

- (c) The CSM Contractor must assume 25tph during normal operations, with a trackway exhaust rate of 36m³/s per trackway.
- (d) The CSM Contractor must assume an average exfiltration rate from the platform to the trackways of 22 m³/s and an average infiltration rate of 1m³/s.
- (e) The CSM Contractor must update the design inputs above in points 3.1.12.4 (a) to (d) inclusive, at Design Stage 2. Those design inputs must be replaced by tunnel ventilation system design modelling output as determined through the process defined by section 9 of the Interface Requirements Specification in SWTC Appendix E1.3.
- (f) Cooling systems must be capable of delivering the outdoor air ventilation rate at nominally 20°C dry-bulb issuing from the air terminals, as measured at the face of the grill, register or diffuser, against the environmental design conditions as determined by clauses 3.1.2 and 3.1.3.
- (g) Cooled zones must meet the required space temperatures as per Table 5 Internal Design Temperatures when measured 1.5m above the platform level, when Platform Screen Doors are closed, and the system is operating against the environmental design conditions and service and system performance requirements. Performance requirements must be measured continuously with exception of the recovery period (minimum of 1 minute or as indicated by detailed modelled) after the PSD have been opened.
- (h) Cooling systems must prevent the average temperature in the platform space being greater than 27°C dry-bulb.
- (i) The average temperature must be determined and compliant on a plane at 1.5m above the platform level, and across the publically accessible platform area.
- (j) Air velocities in cooled zones must be greater than 0.25 m/s but not greater than 1.25m/s when Platform Screen Doors are closed.
- (k) Velocities must be compliant up to 2.1m above platform level.
- (l) Ventilation to public areas must provide sufficient general air movement to avoid air stagnation at any location within the space.
- (m) Air terminals must be selected and located to maximise platform coverage.
- (n) Supply air systems, ductwork and diffusers must cover at least 85% in total of the public access areas of the total platform space.
- (o) Supply air systems, ductwork and diffusers must be evenly spaced along the platform.
- (p) Supply air systems, ductwork and diffusers must be symmetrical about the longitudinal axis of the platform and serve each platform edge equally.
- (q) The cooling system must be arranged to avoid capture of warm air in the platform space.
- (r) The cooling system return air locations if used must not coincide with hot spots on the platform, including any other exhaust air points or uncooled outside air supply points.
- (s) The CSM Contractor must develop a thermal and aerodynamic model to visually identify the cooling coverage and distribution that will be achieved to demonstrate conformance.

- (t) The thermal and aerodynamic model must:
 - (i) be a computational fluid dynamics model;
 - (ii) accurately resolve the transient and turbulent airflow mixing and heat exchange in the platform space, including interface with the tunnel airflows, both from train movement and the tunnel ventilation system;
 - (iii) be based on a three-dimensional representation of the platform space and capture the transient airflow effects due to train operations, ventilation systems, and PSD operation;
 - (iv) be developed in conjunction with and use boundary conditions from the tunnel ventilation system thermal model;
 - (v) incorporate all applicable final design heat loads and reflect conditions to the ultimate design year capacities (UDYC);
 - (vi) be representative of Metro Station ECS peak operating conditions;
 - (vii) represent temperatures and velocities measured at 1.5m above the platform level;
 - (viii) for the Metro Station ECS peak hour, under continuous minimum headway, with varied stagger between up and down tracks, use transient results to represent average conditions of the customer waiting period, when Platform Screen Doors are closed;
 - (ix) be able to resolve turbulence effects to accurately model the diffusion of air issuing from the air terminals;
 - (x) have sufficient grid resolution, maximum 1.0 metre spacing, such that it is possible to accurately represent the local thermal condition experienced by individual occupants at any location in the occupiable public platform area;
 - (xi) be able to demonstrate a grid converged solution; and
 - (xii) be supported by appropriate validation.
- (u) Public area cooling systems must be arranged to cater for the majority of the outside air latent load via a separate outside air cooling coil to limit the upper level of the room relative humidity at both part and full load conditions.
- (v) Cooling must not be provided by direct evaporative cooling or misting systems.
- (w) The cooling systems must operate on demand and with ambient condition (enthalpy) control to limit energy use and capitalise on free cooling by fresh air when external conditions permit.
- (x) Cooling systems must operate automatically based on the average temperature measurement from at least five sensors within the public platform area as well as the temperature and relative humidity measurement of ambient air at respective fresh air intakes. Temperature sensors are to be mounted 1.5m above platform level and be protected against vandalism.
- (y) Controlling temperature sensors within the public platform area of clause 3.1.12.4(t) must be appropriately located away from air supply points and entrances and locations where the average zone temperature cannot be adequately read and evenly distributed within the space served.

- (z) Cooling systems must operate when the average platform temperature is above 27°C dry-bulb and external conditions do not permit free cooling to achieve the design criteria.
- (aa) Cooling systems must ventilate the platform public space by supplying ambient air at all other times to limit the average temperature within the platform public space to a maximum of ambient plus 5°C dry-bulb.
- (bb) Cooling ventilation must operate on temperature demand however must not supply less than the minimum fresh air requirements of AS1668.2 at any time.
- (cc) Cooling and public area ventilation must provide the capability to employ night-flushing to pre-cool spaces.
- (dd) Mechanical smoke exhaust requirements are to be determined by the CSM Contractor's FLS strategy.
- (ee) The CSM Contractor may assume for Design Stage 1, design of station mechanical smoke exhaust an exhaust capacity of 80m³/s is available from the over track exhaust (OTE) system. For Design Stage 2 and 3, this assumption must be replaced by tunnel ventilation system design modelling output as determined through the process defined in section 9 of the Interface Requirements Specification in SWTC Appendix E1.3.
- (ff) ECS systems in public access areas that are not required for smoke management must shut down on fire alarm.

3.1.12.5 Emergency stair and refuge pressurisation systems

- (a) All enclosed egress stairs, and associated transfers, corridors, lobbies and wheelchair refuges must be provided with pressurisation systems as required by the standards and codes and the CSM Contractors FLS strategy.
- (b) The CSM Contractor's design of pressurisation systems must take into account the number of doors which need to open simultaneously during an egress operation and provide at least 1m/s airflow velocity through each opening.
- (c) Pressurisation systems must incorporate ducting and distribution for pressure equalisation of openings.
- (d) A fire fan control panel must be provided adjacent to the Metro Station FIP to allow the override control for stair pressurisation systems.
- (e) Pressure relief must be used to prevent over pressurisation of the egress space.
- (f) Pressure relief must be passive not dynamic or energised.

3.1.12.6 Lift shaft and lift car ventilation

- (a) Lift shafts must be mechanically ventilated with filtered supply air to limit temperature rise and mitigate dust ingress.
- (b) Lift shafts must have louvres at the top of the shaft to allow air to exhaust and promote natural ventilation.
- (c) Lift cars must be air-conditioned as described in section 3.4 of this SWTC.

3.1.12.7 Hazardous area ventilation

- (a) Enclosed hazardous areas must be ventilated to prevent the development of potentially hazardous or explosive atmospheres.

- (b) Classifications of potentially hazardous or explosive atmospheres must be determined according to AS/NZS 60079.10.1.
- (c) Extraction ventilation serving hazardous areas must be continuously ducted to the external discharge point and not mix with any other airstreams.
- (d) Extraction ventilation systems must operate with the majority of the duct-run under negative pressure, the fan must be as close as practical to the point of discharge.
- (e) Explosion proof fans and components must be provided according to the characteristic of the medium being captured and removed.
- (f) Hazardous area ventilation systems must restrict potential sources of ignition, including exclusion of any energised equipment from any potentially explosive zone.

3.1.13 Water supply

- (a) Where the Metro Station ECS employs water-cooled systems, makeup water must be provided from a suitable non-potable source, including suitably treated harvested rainwater or an external recycled water network. Pre-treatment of non-potable water systems suitable and acceptable for the use within condenser water systems shall be provided.
- (b) The Metro Station ECS must have a failsafe connection to a potable water supply.
- (c) Where the Metro Station ECS employs water-cooled systems and serves Metro Station Critical Equipment, the system must incorporate a backup water tank to provide makeup water for a minimum three hours of Metro Station ECS peak service operation or the likely duration of outage agreed with Sydney Water Corporation.

3.1.14 Controls and monitoring

- (a) The CSM Contractor must provide the associated controls, including software, for the Metro Station ECS.
- (b) The Metro Station ECS must connect to the Metro Station BMS which provides overall monitoring and control of the ECS, and interface with sub-systems, other building management systems, the fire system, Sydney Trains CCS and Sydney Metro City & Southwest CCS.
- (c) Each Metro Station ECS sub-system must operate on demand on a room or zone basis in response to the metric it is designed to control.
- (d) The Metro Station ECS must be able to operate automatically without manual intervention, including automatic restart at the previous set point on restoration of power or clearing of any fire alarms.
- (e) Decentralised mechanical control panels must be provided in mechanical plant rooms close to the equipment they serve.
- (f) Local control must be provided in each mechanical plant room for emergency and maintenance operation.
- (g) The Metro Station ECS and sub systems must be able to detect faults within the system elements including; no or low airflow or water flow, sudden pressure loss, flooding, short circuits, motor fail to start, and power supply failure as applicable.
- (h) Equipment rooms provided with cooling or air-conditioning must have independent temperature sensors, which:

- (i) monitor the temperature in the space and report to the Metro Station BMS; and
 - (ii) raise a high temperature alarm to the Metro Station BMS when the room temperature exceeds 28°C dry-bulb.
- (i) Rooms provided with ventilation for temperature control must have independent temperature sensors, which:
- (i) monitor the temperature in the space and report to the BMS; and
 - (ii) raise a high temperature alarm when the space exceeds more than 8°C above ambient.
- (j) Localised purge ventilation system control must be provided by a keyed switch outside the rooms with gaseous fire suppression.
- (k) Water sub-meters must be installed to the water supply line of cooling towers and the water consumption must be monitored by the Metro Station BMS.
- (l) Metro Station ECS control systems provided throughout the Metro Station must be of the digital programmable type, with a facility for data output and interrogation via a digital communications network.
- (m) As a minimum, the Metro Station BMS must monitor the following characteristics of the Metro Station ECS:
- (i) operation mode of systems: normal, manual, fault;
 - (ii) operation status of dynamic equipment: on, off, standby, fail to start;
 - (iii) operating time of dynamic equipment: log of running hours;
 - (iv) position of motorised dampers and valves: actuator status, and blade or valve position;
 - (v) temperature of rooms or spaces, where Metro Station ECS is provided for temperature control;
 - (vi) air quality of rooms or spaces, where Metro Station ECS is provided to control accumulation of contaminants, specifically in a potentially hazardous area;
 - (vii) fan and pump vibration and operating temperature, for motors greater than 5kW;
 - (viii) filter resistance: clean, dirty based on the design allowance;
 - (ix) water quality of water systems: alarm on upper and lower limits;
 - (x) water level in back-up water tanks: level alarms, and analogue level;
 - (xi) leak detection in plant rooms as appropriate; and
 - (xii) fault signals, operating status, and performance metrics from packaged elements which include their own local controls, including chillers, condenser units, cooling towers, and air handling units.
- (n) Positive confirmation of dynamic equipment operation must be provided by flow or pressure switches, valves, or limit switches, as appropriate to the device.
- (o) As a minimum, the Metro Station BMS must log all alarms from the Metro Station ECS where:

- (i) dynamic equipment fails to start;
 - (ii) positive confirmation of dynamic equipment operation is not received;
 - (iii) room conditions, including temperature and accumulated contaminants, exceed design allowances;
 - (iv) high level temperature alarm set points are exceeded;
 - (v) faults are received from local device controllers or instrumentation;
 - (vi) filter resistance exceeds design allowance;
 - (vii) water quality does not meet design allowances; and
 - (viii) pre-set water alarm levels are exceeded.
- (p) Alarms that indicate complete failure of an ECS system serving a Metro Station Critical Equipment must be reported up to the Sydney Metro City & Southwest CCS and brought to the attention of the Operator, including:
- (i) failure to start standby devices;
 - (ii) failure to confirm positive operation of respective systems;
 - (iii) high level temperature alarms; and
 - (iv) accumulation of contaminants in potentially hazardous areas reaching pre-defined limits, including; 10% lower explosive limits, and depletion of oxygen.

3.2 Interface with trackway exhaust system (TES) and tunnel ventilation system (TVS)

- (a) The CSM Contractor must:
- (i) ensure provision of spatial and structural allowances are in accordance with the Room Data Sheets in Appendix F03 and the Interface Schedules in Appendix E1;
 - (ii) provide adequate access routes and temporary storage area for TVS and TES equipment delivery and storage;
 - (iii) construct concrete plinths for equipment mounting;
 - (iv) provide, fix and test lifting points and beams certify by a Registered Professional Engineer;
 - (v) supply and install anchors for mounting of lifting beam or monorail for installation of TVS and TES equipment;
 - (vi) provide space allocation for plant;
 - (vii) provide structural openings;
 - (viii) seal all openings and gaps of wall / slab penetrations with waterproof and / or fireproof materials;
 - (ix) construct upstand/kerb around floor openings for installation of dampers, cables and pipes;
 - (x) provide protective enclosures for cables and cable containment;

- (xi) provide LV cables from LV switchboard and its cable termination work at the MCC incomer terminals;
- (xii) provide UPS power supply;
- (xiii) provide main earth terminals;
- (xiv) provide floor drain with grating;
- (xv) construct the ventilation shaft and plenum walls;
- (xvi) provide reinforced concrete support framing wall for dampers;
- (xvii) construct concrete plinths around floor openings for all horizontally mounted dampers;
- (xviii) construct reinforced concrete encasement for TVS silencers;
- (xix) supply and install all acoustics / pressure sealed doors;
- (xx) supply and install platforms, stairs, ladders, handrails, doors including air locks to enable personnel and maintenance access requirements;
- (xxi) supply and install external architectural louvres;
- (xxii) supply and install acoustic treatment to structures to mitigate structural borne noise effects. This includes any acoustic treatment to walls and ceiling of plant rooms, equipment hatches and doors;
- (xxiii) construct and provide hardstand for crane establishment set up and truck access for TVS and TES equipment to be unloaded and manoeuvred for lowering down access paths;
- (xxiv) provide protective hoarding or barrier to prevent water or debris from any ongoing construction work above or inside the ventilation plenums from affecting the installed tunnel ventilation equipment;
- (xxv) ensure that all trackway exhaust system (TES) exhaust and discharge points are located greater than 12m from any surrounding air intakes, including:
 - A. Central Station entrances;
 - B. openings from surface platforms to the concourse level including voids, open stairs and open escalators;
 - C. ECS fresh air intakes for cooling or ventilation;
 - D. stair pressurisation fresh air intakes;
 - E. tunnel draught relief shaft outlet/intakes; and
 - F. tunnel ventilation fan intakes.
- (xxvi) ensure that all draught relief and tunnel ventilation fans can operate in supply or exhaust and consequently their discharge points must be located greater than 12m from any surrounding air intakes, including:
 - A. Central Station entrances;
 - B. openings from surface platforms to the concourse level including voids, open stairs and open escalators;
 - C. ECS fresh air intakes for cooling or ventilation;

- D. stair pressurisation fresh air intakes;
 - E. other draught relief shaft outlet/intakes; and
 - F. other tunnel ventilation fan intakes.
- (b) If the separation distances defined in sections 3.2 (xxix) and 3.2 (xxx) cannot be achieved, the CSM Contractor must demonstrate in the Stage 1 Design Documentation that any obnoxious discharge, including smoke, being drawn back into air intakes, has been adequately minimised and obtain agreement from the Principals Representative.

3.3 Hydraulics

3.3.1 General requirements

- (a) The CSM Contractor must provide hydraulic services to the Metro Station Works in accordance with the performance requirements of this Appendix, the Building Code of Australia (BCA), applicable Australian Standards and codes, best practice industry guidelines and the CSM Contractors fire and life safety (FLS) strategy.
- (b) The hydraulic services for the Metro Station must, as a minimum:
- (i) protect the health and safety of the public, staff, Operators and service providers;
 - (ii) support the continuous operation of train services;
 - (iii) provide potable cold water, and heated water as required, to potable water consuming fixtures and fittings;
 - (iv) provide waste water capture, conveyance, treatment where required and drainage;
 - (v) employ sustainable design initiatives;
 - (vi) provide roof drainage and downpipes;
 - (vii) provide stormwater drainage extending from the downpipes to the civil drainage infrastructure;
 - (viii) provide drainage of escalators pits and lift pits into the sewer infrastructure including oil and grease traps;
 - (ix) provide surface/subsurface water drainage pumps, sumps and rising main as required; and
 - (x) comply with Interface Schedules and SWTC Appendix E1.
- (c) The hydraulic services must be standalone systems.
- (d) The CSM Contractor must provide complete and integrated hydraulic service systems with all necessary components and approvals.
- (e) The hydraulic services detailed in this section 3.3 do not cover the fire water services, which are specified in section 3.5 and section 4 of this Appendix B04b.
- (f) The hydraulic services detailed in this Appendix B04b do not deal with overland flows or stormwater drainage, or drainage from the precinct or track. These flows are managed by the civil drainage system, specified in Appendix B1 of the SWTC.

- (g) Hydraulic services pipework, unless it specifically services the room, must be located external to rooms containing electrical equipment susceptible to water damage including communications equipment, signalling equipment, motor control cabinets or drives, servers, switchboards, switch gear and transformers.
- (h) Water pipes or drainage must not be routed directly above any equipment or devices susceptible to water damage.
- (i) Water pipes must be lagged as required to prevent condensation.
- (j) Screwed, flanged or mechanical joints must not be made in pipes concealed behind wall linings or inaccessible spaces.
- (k) Pipework must be laid out to minimise crossovers and offsets.
- (l) All pipes, valves, and fittings must be arranged to ensure neat and orderly appearance with true alignment and grade to make these elements conveniently accessible and readily replaceable.
- (m) Pipes running in the same direction must be parallel.
- (n) Pipes runs must be arranged to avoid air locks and dead ends.
- (o) Precautions must be taken to prevent water hammer.
- (p) Hydraulic services and pipework must be arranged and sized to minimise resistance and obstruction to flow.
- (q) Offsets in piping must use 45° bends wherever possible.
- (r) Flanges, unions and other approved mechanical couplings must incorporate replaceable gaskets or 'O' rings for sealing to ensure that re-sealing is achievable after servicing.
- (s) Metal-to-metal seals must not be used.
- (t) Flanged joints must be made with gaskets suitable for the service or as recommended by equipment manufacturers.
- (u) Permanently installed automatic air release vents must only be fitted in plant rooms and service areas.
- (v) Access for cleaning must be provided so that all sections of the installation can be rodded or otherwise cleaned without cutting into the pipe or damaging wall or ceiling linings, or other building elements.
- (w) The CSM Contractor must engage a Sydney Water service coordinator for the submittal of a Section 73 application.
- (x) The CSM Contractor must submit calculations, drawings and pay all associated fees for Section 73 applications and adhere to/ install all the requirements listed in Sydney Water's Notice of Requirements (NOR).

3.3.2 Water services system

3.3.2.1 General

- (a) Water supply systems must be provided with a minimum discharge pressure of 25 metres head, at the most disadvantaged outlet.

- (b) Water supply systems must be provided with a maximum pipe velocity of 1.6m/s, or a maximum pipe velocity of 1.2m/s for pipework installed in hot water circulating systems.
- (c) Water supply system infrastructure, including external connections, meters, valves, pipework, pumps, and associated components, must be provided with a minimum spare flow capacity of 20% at time of Completion, above the calculated probable simultaneous flow rate, in accordance with AS/NZS 3500.1.
- (d) Stop valves must be installed to isolate outlet groups, including:
 - (i) bathroom and amenities groups;
 - (ii) individual serviced plant rooms;
 - (iii) inlets to individual water heating units; and
 - (iv) any other discrete equipment requiring water supply.
- (e) Fixture outlets for new/temporary fixtures must meet the requirements described in Table 8.

Table 8 Minimum water efficiency ratings

Fixture Type	Minimum WELS Star Rating	Maximum Flow Rate (l/min)	Other Required Features
Basins – customer use	6	4.5	Vandal proof Timed flow push button
Basin – non public	6	4.5	Timed flow push button
Basins – disabled amenities	6	4.5	Not Applicable DDA compliant
Sink	4	7.5	Not Applicable
Shower	3	9.0	Not Applicable
Urinal – customer use	Not Applicable	Not Applicable	Vandal proof Low flush type: less than 1.0 litre per flush
Urinal – non public	Not Applicable	Not Applicable	Low flush type: less than 1.0 litre per flush
Water closet – customer use	4	Not Applicable	Vandal proof Dual flush (3litre half flush/ 4.5 litre full flush)
Water closet – non public	4	Not Applicable	Dual flush (3litre half flush/ 4.5 litre full flush)

3.3.2.2 Water supply

- (a) Flexible, non-metallic connections for the incoming water supply must be provided to accommodate differential settlement where the potential exists.
- (b) All metal pipe work must be electrically isolated by means of an insulation pipe section at the Site boundary to prevent earth leakage and egress of any Stray Current.
- (c) The CSM Contractor must provide water supply connections with backflow control and any isolation and separation provisions to meet the requirements of Sydney Water Corporation.
- (d) Supply points and length of connections must be agreed with Sydney Water Corporation.

3.3.2.3 Potable domestic cold water

- (a) The CSM Contractor must provide a new water service extending from the new water supply connection/ meter and extend to serve all the water consuming fixtures, tap fitting and the fire hose reel system.
- (b) The CSM Contractor must interconnect the potable domestic cold water to create a ring main.
- (c) Sectional isolation valves must be provided to each ring main at a maximum of two branch pipe intervals.
- (d) Isolation valves installed in-line on the system where connected to fire hose reels must be fitted with lockable isolation valves and the required statutory signage adjacent to the isolation valve.

3.3.2.4 Potable domestic heated water

- (a) Potable domestic heated water must be provided to, as a minimum:
 - (i) basins in disabled amenities;
 - (ii) non-customer basins;
 - (iii) sinks; and
 - (iv) showers.
- (b) Water must not be heated by gas fired systems.
- (c) Thermostatic mixing valves must be provided to limit the water temperature at sanitary fixtures used primarily for personal hygiene purposes and where heated water service is provided.
- (d) Heated water must be available at all times.
- (e) Dead legs in hot water pipework shall be kept to a maximum of 10 meters from hot water system/ring main to the fixture outlet.

3.3.3 Drainage system

- (a) Groundwater and subsurface water drainage from the Project Works is to interface with the tunnel drainage system and comply with the requirements of the Interface Schedule in Appendix E1 and section 3.3.3.5 of this Appendix B04b.

3.3.3.1 General requirements

- (a) Drainage pump and sump installations must meet the following minimum criteria:

- (i) inclusion of dual identical sump pumps, for duty and standby provision;
 - (ii) equipment protection level suitable for the respective hazardous area classification;
 - (iii) pumps alternate as duty and standby on a 24 hour basis;
 - (iv) duty pump are to be sized to start a maximum of 3 times per hour.
 - (v) to ensure the maximum of 3 starts, the duty pump shall be capable of removing the inflow collected in a period of 20 minutes within a maximum of 5 minutes and a minimum of 1 minute;
 - (vi) pump housing constructed of ductile cast iron;
 - (vii) impeller constructed of ductile cast iron;
 - (viii) motor constructed of cast iron;
 - (ix) vortex impeller or macerator type;
 - (x) hard piping with stainless steel guide rail system;
 - (xi) stainless steel clamps on rising main;
 - (xii) stainless steel step irons or access ladders be provided, where the internal pit depth is greater than 1 metre;
 - (xiii) stainless steel heavy duty lifting chains connecting to a stainless steel bracket below a heavy duty gas tight cover in accessible position;
 - (xiv) hose and electrical cables of sufficient length to allow removal of pumps without entering the pit;
 - (xv) valves located outside of sump;
 - (xvi) located within a plant room and not accessed by public spaces;
 - (xvii) pump control panels must be located within a plant room and not accessed by public spaces; and
 - (xviii) sump bases are to be benched and those benches must have a minimum fall of 1% to the sump well; and
 - (xix) sumps are to be sized to contain emergency storage of 8 hours inflow, assuming no outflow.
- (b) Any sewer pump-out system must not exceed the pumping flowrates outlined in Sydney Water's guidelines.
- (c) The CSM Contractor must determine and apply the classifications of potentially hazardous or explosive atmospheres in accordance with Australian Standards, including AS/NZS 60079.10.1-2009.
- (d) Explosion or flame-proof pumps and components must be provided according to the CSM Contractor's classification and risk assessment of the space in which they operate and the characteristic of the medium being conveyed.
- (e) Drainage systems must restrict potential sources of ignition, including exclusion of any energised equipment from any potentially explosive zone.

- (f) Drainage pump stations must be internally coated with a polyurea component spray applied polyurethane or polyurea water proofing system, complete with primer and 3mm basecoat, to AS3735.

3.3.3.2 Sewage drainage system

- (a) Sewage drainage system infrastructure must be provided with a minimum spare flow capacity of 20% at time of Completion, above the fixture unit ratings, calculated in accordance with AS/NZS3500.2.
- (b) All sewage drainage must be connected to the Sydney Water sewage drainage network, where available.
- (c) Gravity sewer drainage systems must be used where levels permit. New additional authority sewer drainage connection points are to be installed prior to the use/ installation of a sewer pump-out system being adopted.
- (d) Where a gravitational feed to the main is not possible, a sewer pump-out system may be incorporated into the design and installation to pump effluent to a section of the gravity sewer drainage system.
- (e) The CSM Contractor must provide a sewer drainage system extending from either the gravity sewer or pump-out systems to receive the discharge from the sanitary fixtures and fittings.
- (f) The sanitary drainage systems must be complete with boundary traps/ or inspection shafts, overflow relief gully, drainage pipe installation and vents.

3.3.3.3 Rainwater and roof drainage system

- (a) Where rainwater is not collected by the existing Central Station rainwater harvesting tanks, rainwater must be directed by guttering, pipes and drains to the respective stormwater drainage system in accordance with local codes, the BCA and Australian Standards and discharged to the nearest suitable civil stormwater pit.
- (b) The rainwater and roof drainage system must be compatible and comply with the requirements of the Hydrology and Drainage Section of Appendix B01.

3.3.3.4 Groundwater and sub-surface water drainage system

- (a) The CSM Contractor must provide:
 - (i) a groundwater and sub-surface water drainage sump;
 - (ii) all infrastructure to drain groundwater and sub-surface water generated within the Central Station Works excavation, into the groundwater and sub-surface water drainage sump; and
 - (iii) power supply to all sumps for the sump pumps.
- (b) The groundwater and sub-surface water drainage sump must:
 - (i) allow for gravity fed inlets from:
 - A. trackway collection sumps on both sides of the platform;
 - B. groundwater and sub-surface water generated within the Central Station Works excavation;
 - (ii) allow for rising main inlets from the tunnel section leading to Pitt St Station;
 - (iii) allow for rising main outlets;

- (iv) allow for 8hr Groundwater and sub-surface in-flow storage above the working level in the event of pumps being not in use.
- (v) have a minimum depth of 3.9m below all inlets;
- (vi) have access hatches with minimum total dimensions of 1.8m x 1.2m, that cannot be within the trackway; and

For Design Stage 2 and 3, the assumptions in this point b) must be replaced by the Interface Contractor design requirements determined through the process described in section 9 of Interface Requirements Specification in SWTC Appendix E1.1.

- (c) The CSM Contractor must limit the Groundwater and sub-surface in-flow rate to 4L/s into the Metro tunnel drainage system.

3.3.4 Controls and monitoring

- (a) The CSM Contractor must provide the associated controls, including software, for the hydraulics services.
- (b) The hydraulics services must connect to the Metro Station BMS.
- (c) Each hydraulic system must normally operate under local control and on demand.
- (d) Each respective hydraulic system must be able to operate automatically without manual intervention, including automatic restart on restoration of power, and clearing of any fire alarms.
- (e) Standby equipment must automatically activate on detection of failure of the respective duty device.
- (f) Local mechanical control panels must be provided in mechanical plant rooms close to the equipment they serve.
- (g) The local control must be provided in each mechanical plant room for emergency and maintenance operation.
- (h) The hydraulics services systems and sub systems must be able to detect faults within the system elements including, no or low water flow, sudden pressure loss, flooding, short circuits, motor fail to start and power supply failure as applicable for each component of active equipment.
- (i) As a minimum, the Metro Station BMS must monitor the following characteristics of the hydraulics services:
 - (i) operation mode of systems: normal (automatic), manual, fault;
 - (ii) operation status of dynamic equipment: on, off, standby, fail to start;
 - (iii) operating time of dynamic equipment: log of running hours;
 - (iv) position of motorised valves: actuator status, and valve position;
 - (v) water levels in sumps and tanks: level alarms, and analogue level;
 - (vi) water quality of the rainwater service: analogue scale and limits;
 - (vii) leak detection in plant rooms as appropriate; and

- (viii) fault signals, operating status, and performance metrics from packaged elements which include their own local controls.
- (j) Positive confirmation of dynamic equipment operation must be provided by flow or pressure switches, or limit switches, as appropriate to the device.
- (k) As a minimum, the Metro Station BMS must log all alarms from the hydraulics services systems where:
 - (i) dynamic equipment fails to start;
 - (ii) positive confirmation of dynamic equipment operation is not received;
 - (iii) high level temperature alarm set points are exceeded;
 - (iv) faults are received from local device controllers or instrumentation;
 - (v) water quality does not meet design allowances; and
 - (vi) pre-set water alarm levels are exceeded, including high level, and low level in tanks and sumps as appropriate.
- (l) Alarms that indicate complete failure of an operations critical or safety service system must be reported up to the Sydney Metro City & Southwest CCS and brought to the attention of the Operator, including:
 - (i) failure to start standby devices;
 - (ii) failure to confirm positive operation of respective systems; and
 - (iii) high level alarms of sumps.
- (m) Water sub-meters must be provided to the following areas, as a minimum:
 - (i) site potable domestic cold water supply;
 - (ii) make-up water supply to mechanical cooling systems;
 - (iii) supplies to commercial opportunity services; and
- (n) Water sub-meters must duplicate the Sydney Water Corporation meter and be provided with an analogue output.
- (o) For external water supplies, water sub-meters must be provided directly upstream of the Sydney Water Corporation meter.
- (p) Water sub-meters must connect to the Metro Station BMS to log water usage from each meter.
- (q) The Metro Station BMS must record, in real time, all local water metering data for trend analysis, interrogation, and reporting.
- (r) All cabling must be Low Smoke Zero Halogen
- (s) Sealants used for fire sealing of penetrations must have a maximum total volatile organic compound content of 250 g/L of ready to use product.

3.4 Vertical Transport

- (a) The CSM Contractor must provide all VT including lift shafts and other associated infrastructure for the Metro Station Works.
- (b) The Metro Station Works VT must be designed to meet the following requirements:

- (i) egress requirements of the CSM Contractor's FLS strategy; and
 - (ii) all safety assessments and approvals in accordance with the requirements of the relevant codes, standards and authorities.
- (c) The CSM Contractor must comply with the Interface Schedules in SWTC Appendix E1.

3.4.1 Lifts

General requirements

- (a) All lifts must incorporate facilities for disabled and mobility impaired customers. As a minimum all lifts must be compliant with AS1735.12.
- (b) All lifts must be compliant with the specification in SWTC Appendix C01.

3.4.2 Escalators

3.4.2.1 General requirements

- (a) Escalators from the Metro Station to the new North South Concourse, collectively known as "Metro Station Escalators", must:
 - (i) be capable of being utilised as means of egress as follows:
 - A. the escalator operating mode must be determined from information from the fire detection system which will determine the location of a fire, subject to confirmation from the SCR or CCR;
 - B. escalators operating in the direction of egress must keep operating in that direction;
 - C. escalators operating in the opposite direction of egress must be brought to a slow/soft stop, either locally or remotely;
 - (ii) be capable of initiating a soft stop and have an audible signal or warning message which sounds for at least 15 seconds to deter passengers from entering the escalator, prior to it coming to a stop; and
 - (iii) the option to reverse and restart escalators in the direction of egress is to be determined by the CSM Contractor's FLS strategy.
- (b) All escalators must be compliant with the specification in Appendix C01 and NFPA130 (2014) – clause 5.3.5.5 and 5.3.5.7.

3.5 Fire protection and detection systems

3.5.1 General

- (a) The CSM Contractor must provide a fire protection and detection system in accordance with relevant Building Code of Australia (BCA) requirements, relevant Australian Standards, legislative obligations and the CSM Contractor's FLS strategy.
- (b) The CSM Contractor must comply with Interface Schedules and Interface Requirements Specifications in SWTC Appendix E.

3.5.2 Fire sprinkler system

3.5.2.1 General

- (a) Sprinkler protection is to be provided to all parts of the Metro Station with the exception of:
 - (i) trackways;
 - (ii) public access areas of platforms;
 - (iii) BOH rooms provided with gaseous suppression;
 - (iv) inside tunnel ventilation system ducts and plenums;
 - (v) inside fire isolated egress stairs; and
 - (vi) substations and HV plant rooms.
- (b) The Metro Station fire sprinkler and station hydrant systems must not be combined into a single system.

3.5.2.2 Water supply

- (a) The Metro Station sprinkler system must be fed as a minimum by a Grade 2 water supply as defined by AS2118.1:1999.
- (b) If an existing water supply location cannot provide the required system or supply pressure, a fire pump or water tank system, inclusive of diesel or electric driven fire pumps, and sprinkler jockey or pressure maintenance pump must be provided in accordance with AS2118, including:
 - (i) provisions to sense changes in system pressure to start the jockey or pressure maintenance pump automatically; and
 - (ii) a water test line from the fire pump must be discharged back into the fire water tank for testing of the fire pumps.
- (c) The sprinkler booster assembly for the Metro Station sprinkler system is to be shared with the sprinkler booster assembly for the Central Station Works and Central Walk Works and must be provided as per section 2.4.2.2.

3.5.2.3 Sprinkler system design

- (a) The Metro Station sprinkler system must be wet pipe, designated according to the room hazard type it is protecting. The CSM Contractor's FLS strategy may permit some electrical rooms to be protected with a pre-action sprinkler system.
- (b) Lift shafts and escalator pits, trusses and associated machine rooms must be protected by sprinkler systems.
- (c) Fire protection systems must include isolation valves to enable sprinkler testing on a zone by zone basis.
- (d) In areas that require sprinkler protection, the minimum hazard classifications as defined in AS2118.1 are:
 - (i) Plant rooms and general BOH: OH2; and
 - (ii) Storage: OH3.
- (e) The Metro Station sprinkler system must be monitored by the Metro Station FIP.

3.5.3 Fire hydrant system

- (a) The Metro Station fire hydrant system requirements are described in section 4 of this Appendix B04b.

3.5.4 Fire and Smoke Detection and Alarm System

- (a) The CSM Contractor must provide a fire and smoke detection system and sound system and intercom system for emergency purposes (SSISEP) to all parts of the Metro Station Works with the exception of:
- (i) trackways; and
 - (ii) inside fire isolated egress stairs.
- (b) The fire and smoke detection system and SSISEP to areas defined in sections 3.5.4 (a) is to include:
- (i) detection required to activate the operation of any smoke doors, fire doors, fire shutters or drop-down fire/smoke curtains;
 - (ii) manual call points to BOH. Manual call points are not required in public access areas, subject to an approved alternative solution in the CSM Contractor's FLS strategy;
 - (iii) multipoint aspirating smoke detection system (MASDS) for early fire detection in Critical Equipment Rooms or where room flooding gaseous fire suppression systems are used. The MASDS must:
 - A. be addressed as a separate alarm zone to the Metro Station FIP;
 - B. provide an air sampling pipe network to transport air to the detection unit;
 - C. interface with Metro Station fire detection and alarm system;
 - D. house the detector, filter and aspirating fan in a mounting box arranged in such a way that air is drawn from the fire risk area through the filter and detector by the aspirator;
 - E. provide a detection unit of the integrating LASER-based type or the high intensity Xenon flash tube type, and having an obscuration range of 0.005 - 20%/meter;
 - F. incorporate in the detector controller facilities with the ability to transmit detector fault and air flow fault conditions;
 - G. provide an assembly containing sufficient relays to annunciate all required alarm and fault conditions;
 - H. the response time for the least favourable sampling point in the system must not exceed 90 seconds. Balance the system so that the volume of air drawn from the last sampling point shall not be less than 60% of the volume from the first sampling point;
 - I. include all necessary software and associated programming; and
 - J. power the system from regulated a 24 V dc supply. The battery charger and battery must comply with the requirements of AS 4428.5;

- (iv) for any MASDS system the CSM Contractor must provide computer-generated calculations showing response times, suction pressures and balance details of each sampling point for each pipe system;
- (v) a new addressable Metro Station FIP that must:
 - A. receive fire alarm signals from all areas listed in section 3.5.4 (a);
 - B. receive alarm signals from the operation of active fire safety systems within Metro Station areas including sprinklers and fire hydrants;
 - C. contain input/output modules, control modules and monitoring modules provided as required to support the functionality of the detection and alarm system;
 - D. have a minimum of 25% spare capacity of the total addresses installed on each loop at Completion;
 - E. be co-located in the existing Central Station FCR which is accessed from Eddy Avenue;
 - F. have a mimic panel that provides alarm information for Metro Station, located in the Metro Station SCR;
 - G. be capable of being remotely controlled and monitored from the Sydney Metro City & Southwest OCC; and
 - H. interface with the existing Central Station FIP in the Central Station FCR accessed from Eddy Avenue;
- (vi) SSISEP compliant with AS1670.4:2015 that must:
 - A. interface with the Metro Station FIP, PA system, data communications network, and Metro Station CCS;
 - B. integrate with the existing SSISEP system, either through an additional interfaced SSISEP panel or by adding SSISEP zones to the existing panel, subject to agreement from Operator's and FRNSW;
 - C. include SSISEP zones that are defined in the CSM Contractor's FLS strategy and agreed with Operators and FRNSW;
 - D. include a warden intercom point (WIP) phone and a manual call point in the Metro Station SCR;
 - E. cascade sequence and cascade timing of SSISEP zones as defined in the CSM Contractor's FLS strategy and agreed with Operators and FRNSW;
 - F. provide emergency audio message broadcasting coordinated with the PA system using options of pre-recorded messages and live announcements;
 - G. include a PA system that is able to be overridden by an emergency warning function from the fire alarm system to enable any emergency warning signals or announcements to have priority;

- H. include alarm systems that provide a means of alarm notification to the visually impaired and hearing impaired, SFAIRP;
 - I. be able to override PIDS and display emergency warning and evacuation instruction messages as defined in the CSM Contractor's FLS strategy and agreed with operators and FRNSW;
 - J. include PA zones covering Metro Station areas that are capable of being remotely controlled and monitored from the OCC and at the Metro Station SCR; and
 - K. include a sound system for intercom and emergency purposes that has 25% spare capacity of the total devices installed at Completion.
- (vii) Metro Station emergency ventilation panel that must:
- A. provide modal control of the mechanical smoke ventilation in the Metro Station including the platform area and the trackway within the station;
 - B. be located in the same room and in close proximity to the Metro Station FIP; and
 - C. include a minimum 10% spare capacity (including both hardware and software) of the total devices installed at Completion.
- (viii) power supplies, batteries and battery chargers to support the detection and alarm system; and
- (ix) all necessary software and associated programming.
- (c) The type of fire detection system chosen by the CSM Contractor must balance the requirements of:
- (i) alarm sensitivity to support the activation times assumed in the CSM Contractor's FLS strategy;
 - (ii) minimising the risk of unwanted false alarms; and
 - (iii) minimising the safety risk, SFAIRP, in the maintenance of the detection system.
- (d) Detection and alarm zones must be coordinated SFAIRP with the respective sprinkler system zones and smoke management control and fire separated zones.
- (e) All panel control and monitoring equipment must enable quick detection and location of line faults and component failure.
- (f) The system must be fault-tolerant in that failure of a single component must not affect the operation of more than one detection or alarm zone.
- (g) The fire detection system must be fully addressable and provide output information to other systems which at a minimum include:
- (i) a high level interface with the SSISEP;
 - (ii) the ECS to activate appropriate mechanical smoke exhaust, activate egress path pressurisation systems, operate any natural ventilation louvres, and control/shut down environmental control systems that do not provide a smoke management function;

- (iii) the vertical transportation control system to determine the incident modes for escalators and lifts;
 - (iv) the CCTV system to automatically identify and prioritise the feed from CCTV cameras covering the area of the alarm;
 - (v) the system to release any fire/smoke doors, fire shutters, and drop down fire/smoke curtains; and
 - (vi) local common fire alarm signal to FRNSW.
- (h) Fire signals from the fire detection and alarm system to local interfaced systems and devices must be via hard wire connection.
- (i) The Metro Station FIP must interface with the Sydney Trains FIP so that any fire alarm signals received by the Metro Station FIP are relayed to the Sydney Trains FIP.
- (j) The SSISEP must interface with the Metro Station FIP, Metro Station PA system, data communications network, and Metro Station CCS.

3.5.5 Fire Control Room (FCR)

- (a) Metro Station is to utilise the existing Sydney Trains FCR accessed from Eddy Ave and the FCR must contain the following Metro Station systems at a minimum:
- (i) FIP-panel;
 - (ii) SSISEP -panel;
 - (iii) Tunnel Vent Fan Mode Control Panel;
 - (iv) Metro Station Smoke Exhaust Control Panel;
 - (v) a phone link to OCC;
 - (vi) monitoring of tunnel hydrant tank water level data, diesel tank level, pump operating status and system pressure;
 - (vii) monitoring of Metro Station CCTV feed; and
 - (viii) additional systems as required to provide network visibility and communication links with the Metro CCR and the Sydney Trains existing RMC. This will allow the Central FCR to be used as an alternate Incident Control Centre.

3.5.6 Battery storage

- (a) Battery storage rooms must be fitted with hydrogen detection (subject to battery type), and alarms communicated back to the Metro Station BMS.

3.5.7 Gaseous suppression system

- (a) A gaseous suppression system must be provided to rooms in accordance with the CSM Contractor's FLS strategy, room data sheets in Appendix F, and in accordance with AS ISO 14520-2009.
- (b) Gaseous suppression is to be provided to protect rooms within the Metro Station:
- (i) which contain Critical Equipment;
 - (ii) where fully standby Critical Equipment cannot be provided in a separate fire separated room; and

- (iii) where the operation of a sprinkler system is considered to pose an unacceptable risk of damage to Critical Equipment.
- (c) All gaseous suppression systems are to be of the total room flooding type.
- (d) Gaseous suppression must be of the clean agent inert gas type and a single type of gas is to be used across all rooms within the Project Works.
- (e) The type of inert gas selected must have the following characteristics:
 - (i) zero ozone depletion potential;
 - (ii) 100 year global warming potential of less than 10;
 - (iii) enable occupants to safely evacuate the room being flooded by gas;
 - (iv) the gas is approved/permitted for use in NSW and widely used in NSW; and
 - (v) non-proprietary.
- (f) Gaseous suppression is to be automatically activated by fire detection. The fire detection system must include two independent detection types. One type must be a MASDS type. Room flooding gaseous suppression must not activate until both fire detection types confirm a fire event.
- (g) A sufficient stock of fully-charged standby gas cylinders, (located in a secure maintenance location) must be provided.
- (h) Mechanical systems for pressure relief and purging must be provided in accordance with section 3.1 of this Appendix.
- (i) Gas bottle storage must be located such that replacement can be undertaken from on grade access or by lifts and not by service building stairways. Alternatively on grade fill points can be provided.
- (j) Any gas control panels within the Metro Station Works must interface with the Metro Station FIP for system control and monitoring.
- (k) Any gaseous suppression systems must be able to interface with the Metro Station ECS systems to close fire dampers, stop mechanical systems and activate pressure relief for the protected rooms in the event of the activation of the gaseous suppression system.

3.5.8 Fire hose reel system

- (a) A fire hose reel system must be provided throughout the Metro Station Works to provide full coverage to all floor areas, with the exception of:
 - (i) public access areas of platforms subject to an approved Alternative Solution in the CSM Contractors FLS strategy.
- (b) As a minimum the fire hose reels must be located:
 - (i) within 4 metres of fire exits; and
 - (ii) adjacent to internally located fire hydrants (including at the top and bottom of vertical transport elements).
- (c) Valves serving the fire hose reel system must be secured and padlocked in the open position.
- (d) Fire hose reel coverage is not to require the hose to cross fire compartment lines.

3.5.9 Portable fire extinguishers

- (a) Portable fire extinguishers must be provided throughout the Metro Station Works as defined by the CSM Contractor's FLS Strategy.
- (b) The portable fire extinguishers must be conspicuously located in positions where they will be readily accessible and immediately available in the event of fire.
- (c) The portable fire extinguishers must be located near to room exits, corridors, lobbies and inside fire hose reel cabinets.
- (d) The portable fire extinguishers must have their locations clearly indicated by placement of the location sign and be mounted at the appropriate height.
- (e) Any portable fire extinguishers located in areas accessible to the public must be contained in cabinets with break glass release and / or door open alarms monitored by the BMS via the fire system and displayed in the SCR.

3.6 Platform screen door allowances

- (a) The CSM Contractor must comply with the Interface Schedules SWTC Appendix E1.4.

3.7 Building management system

3.7.1 General

- (a) The CSM Contractor must provide a complete and integrated Metro Station BMS with all necessary components, systems, and interfaces in accordance with the Interface Schedules in SWTC Appendix E1.3 and E1.7.
- (b) The CSM Contractor must provide a Metro Station BMS that:
 - (i) controls and monitors the following, as a minimum:
 - A. Metro Station ECS in accordance with section 3.1 of this Appendix B04b;
 - B. Metro Station hydraulic systems, in accordance with section 3.3 of this Appendix B04b;
 - C. Metro Station lighting, in accordance with section 5.9 'Lighting control, circuitry and monitoring' of SWTC Appendix B04a;
 - D. Metro Station lifts and escalators, in accordance with section 3.4. of this Appendix B04b;
 - E. Metro Station Platform Screen Doors;
 - F. Digital signage and digital advertising systems in accordance with SWTC Appendices B02 and B13; and
 - G. all other general Metro Station building services not controlled by a separate system level control system which interfaces with the CCS;
 - (ii) monitors but not controls the following, as a minimum:
 - A. security and CCTV systems, in accordance with SWTC Appendix B02;

- B. the Interface Contractors Tunnel Ventilation System for the adjacent tunnel sections;
 - C. Metro Station UPS, in accordance with SWTC Appendix B04a;
 - D. emergency lighting system in accordance with section 5.8 'Emergency lighting and exit signage' of SWTC Appendix B04a;
 - E. Metro Station fire protection and detection systems, in accordance with section 3.5 of SWTC Appendix B04a;
- (iii) be independent of the Sydney Metro HV electrical systems, traction power systems, and train control systems;
 - (iv) interface with the CCS via the communications fibre backbone or LAN, including:
 - A. facilitating remote control and monitoring of the Metro Station BMS connected systems from the CCS;
 - B. raising alarms to the CCS; and
 - C. LV energy monitoring;
 - (v) be interlinked via the communications fibre backbone or Sydney Metro City and Southwest LAN so it can be remotely controlled and monitored in the event of a failure of the CCS; and
 - (vi) provide a means of remotely and locally monitoring and controlling Metro Station BMS connected equipment and systems in a safe, predictable, reliable and accurate manner.

3.7.2 Functionality

- (a) The Metro Station BMS must provide:
 - (i) a means of setting the operational parameters for the Metro Station BMS connected systems and controlling respective dynamic equipment;
 - (ii) a means of monitoring the operation and status of the Metro Station BMS connected systems;
 - (iii) an integrated alarm system for the Metro Station BMS connected systems;
 - (iv) intuitive user interfaces for monitoring and operating the Metro Station BMS connected systems specific to the respective systems and relevant to their function;
 - (v) means for consolidated maintenance management, including data logging and recording, monitoring and diagnostic services, and with interface and reporting functionality to the asset information system (AIS);
 - (vi) facility for metering data acquisition, logging and recording, for water use management and reporting;
 - (vii) facility for metering data energy consumption per facility and per network for energy auditing purposes with a data collection time to support energy modelling consumption and performance;
 - (viii) interfaces with interdependent and associated systems; and

- (ix) interface with the CCS, including a facility for remote control and monitoring of the Metro Station BMS connected systems by the CCS and reporting functionality to raise alarms to the CCS.
- (b) The Metro Station BMS must:
 - (i) be a zone based management system with regard to the specific use, function or operational requirement;
 - (ii) have at least 20% spare capacity on loops and points at Completion;
 - (iii) be of modular design and capable of further expansion; and
 - (iv) have the same level of response performance as the CCS.

3.7.3 System typology and redundancy

- (a) The Metro Station BMS design philosophy must be to provide discrete, distributed controllers to respective BMS connected systems so that in addition to its integrated operation, each Metro Station BMS connected system can be capable of operating in a standalone condition.
- (b) The Metro Station BMS communications typology must be resilient, fault tolerant, and interconnected with multiple redundant and spatially diverse data communications links to ensure that no single point of failure results in:
 - (i) degraded operation; or
 - (ii) any loss of control and monitoring of operationally critical and safety related BMS connected systems.
- (c) All active elements of the Metro Station BMS must be self-monitoring in order to facilitate rapid alert of fault conditions and to allow ease of fault finding and repair.
- (d) The Metro Station BMS must be able to operate as a standalone system from a separate BMS HMI workstation in the SCR, independent of the CCS in the event of a failure of the CCS.
- (e) The Metro Station BMS must:
 - (i) be powered by the Metro Station UPS system to maintain operation in the event of a power outage;
 - (ii) include hardware and software that is:
 - A. fully supportable by local agents and be to the type and standard that operates successfully in other similar applications; and
 - B. to recognised industry standards and open sourced, not bespoke base hardware and protocols.

3.7.4 Human Machine Interface

- (a) The CSM Contractor must utilise a HMI workstation concept in its design for the Metro Station BMS.
- (b) The Metro Station BMS HMI workstations must provide an intuitive and representative schematic display for each respective Metro Station BMS connected system.

- (c) Information received from the Metro Station BMS connected systems must be displayed in a consistent format on all Metro Station BMS HMI workstations, on the CCS, and BMS terminals.
- (d) The Metro Station BMS HMI workstations must be capable of:
 - (i) acquiring data from the mechanical and electrical instrumentation or local device controllers;
 - (ii) processing data to raise programmable alarms and detect other significant issues;
 - (iii) performing control functions automatically based on acquired data or HMI operator input;
 - (iv) displaying required data to operators via intuitive graphical displays and audible sounds;
 - (v) performing system monitoring and diagnostics to detect failure of hardware or software;
 - (vi) software maintenance and upgrade, system diagnostics; and
 - (vii) storage and retrieval of data.
- (e) The Metro Station BMS HMI workstation must be located in the Metro Station control room to allow local monitoring and control of connected systems by the authorised personnel in attendance.

3.7.5 Access control and decision support

- (a) The Metro Station BMS and Metro Station BMS operations must comply with the Sydney Metro Northwest and Sydney Metro City & Southwest Security Management Plan.
- (b) The CSM Contractor must provide access control mechanisms to the Metro Station BMS to ensure that:
 - (i) only authorised personnel can use the system; and
 - (ii) the functionality available is controlled by a user's permission level based on their role description, function and level of authority and competence.
- (c) In the event of an equipment failure or an alarm occurring which must require some form of re-configuration of the Metro Station BMS connected systems, the BMS must make recommendations as to the most appropriate reconfiguration to suit the particular failure scenario.
- (d) The Metro Station BMS must have the capability to facilitate control of the Metro Station BMS connected systems in response to specific events in order to ensure the most appropriate response to any given scenario. This capability must include:
 - (i) fully automatic – where the Metro Station BMS chooses and commands a preferred scenario automatically. The configuration of the Metro Station BMS to take any such automatic actions must be subjected to a design safety study before implementation;
 - (ii) semi-automatic – where the Metro Station BMS or CCS operator chooses a preferred option from a range of options offered by the Metro Station BMS for the Metro Station BMS to then automatically command the Metro Station BMS connected systems. This must have two further sub options where:

- A. the Metro Station BMS automatically commands a pre-set preferred option if there is no operator response after a designated timeout. The configuration of the Metro Station BMS to take any such “timed out” automatic actions must be subjected to a design safety study before implementation; or
- B. the system raises a “no response” alarm and takes no further action; and
- C. manual – where the operator manually configures the Metro Station BMS to suit their own preference.

3.7.6 Control hierarchy

- (a) The CSM Contractor must develop and enforce a control hierarchy for the Metro Station BMS, the Metro Station BMS connected systems and Metro Station BMS interfaces and these must be compatible with that developed on Sydney Metro Northwest and Sydney Metro City & Southwest control hierarchy.
- (b) The Metro Station BMS must allow the CCS to have control priority over the Metro Station BMS, Metro Station BMS connected systems, and any localised control.
- (c) Parallel monitoring at all BMS HMI workstations must be possible at any time.
- (d) Where local panels or manual controls exist in any of the Metro Station BMS connected systems, the Metro Station BMS connected system equipment must be capable of being isolated from the Metro Station BMS to prevent remote operation of the equipment while under manual control.
- (e) The Metro Station BMS must provide a notification at the respective Metro Station BMS HMI workstation and at the CCS that a given Metro Station BMS connected system is under manual control.

3.7.7 Alarms

- (a) The CSM Contractor must apply an alarms classification in accordance with Sydney Metro Northwest and Sydney Metro City & Southwest classification.
- (b) Audible and visual warnings must be provided to alert operators of the Metro Station BMS and CCS to alarms requiring immediate action or situational awareness.
- (c) Alarms pertaining to the failure or warning of failure of Critical Equipment and safety related Metro Station BMS connected systems or their sub-components must be reported to the CCS and brought to the attention of the CCS operator.
- (d) High level alarms of Metro Station BMS connected systems must be raised to the CCS but must not take reporting precedence over alarms of Critical Equipment and safety related systems.
- (e) High level alarms of Metro Station BMS connected systems must include those that indicate a complete system failure.
- (f) The Metro Station BMS must raise general alarms, including maintenance alarms and sub-component failure from general BMS connected systems, to the CCS based on a threshold of the number of alarms. Such alarms must be stacked in order of priority based on significance.
- (g) The Metro Station BMS, in conjunction with the Metro Station BMS connected systems, must utilise group alarming, based on the Sydney Metro City & Southwest Operators developed alarm classification, to minimise alarm clutter and the grouping

of alarms shall be consistent with that on Sydney Metro Northwest providing a Sydney Metro Northwest and Sydney Metro City & Southwest group alarm protocol.

- (h) Alarms generated must be reported in a hierarchical sequence, based on Sydney Metro City & Southwest Operator's developed alarm classification and Sydney Metro City & Southwest Operator must confirm that it is consistent with that adopted on the Sydney Metro Northwest and Sydney Metro City & Southwest agreed hierarchical sequence.

3.7.8 Metering and data logging

- (a) Metering data received from the Metro Station BMS connected systems and sub-systems must be data logged and recorded with a time stamp.
- (b) Metering data must allow real time trend analysis and interrogation.
- (c) Metering data must be logged at no greater than 15 minute intervals, recording the time average value between intervals, and separately recording the instantaneous peak value for the interval.
- (d) Specific metering types and metered systems are identified in the respective disciplines cross referenced in section 3.7.1 of this Appendix B04b.

3.7.9 Event recording

- (a) All Metro Station BMS data, controls, events, and alarms must be recorded in real time and stored in a secure and permanent manner.
- (b) All Metro Station BMS records must be backed-up on a routine basis to the CCS for long term storage.
- (c) The CSM Contractor must ensure that the Metro Station BMS records are easily retrievable and capable of immediate playback from any Metro Station BMS HMI workstation and the CCS.

3.7.10 Asset information system (AIS)

- (a) The Metro Station BMS must interface to the AIS to enable real time trending analysis for maintenance scheduling, preventative maintenance, and scheduling fault repair.

3.7.11 Interfaces

- (a) Industrial standard protocols must be used to transmit data between connected field devices and the Metro Station BMS equipment.
- (b) The Metro Station BMS must interface with but not control the fire detection and alarm system.
- (c) The Metro Station BMS must receive fire alarm status and identify affected systems and zones.
- (d) Specific shutdown control of Metro Station ECS's not designed for emergency operation must be by hardwire connection from the FIP.
- (e) The Metro Station BMS must facilitate remote control of Metro Station BMS connected systems, and remote monitoring and interrogation of local system performance and status by the CCS.
- (f) Remote control and monitoring of the Metro Station BMS connected systems must be possible from the OCC communications fibre backbone or Sydney Metro City and Southwest LAN.



4 Fire Hydrant System

4.1 General

- (a) The CSM Contractor is to upgrade the fire hydrant system to the eastern part of Central Station (hereafter referred to as the Eastern Hydrant Zone) to be compliant with the BCA, ASA Standards and the CSM Contractor's FLS strategy.
- (b) The existing fire hydrant system serving the western part of Central Station (hereafter referred to as the Western Hydrant Zone), including the existing booster assembly in Eddy Ave and associated pumps, is to be retained as a separate system.
- (c) The CSM Contractor is to make allowance for the separate Sydney Metro City & Southwest tunnel fire hydrant system as described in section 4.3 and the Interface Schedules in Appendix E1.
- (d) The new Eastern Hydrant Zone system is to be independent of the Western Hydrant Zone system with the exception of the water storage as defined in section 4.1 (f).
- (e) The new Eastern Hydrant Zone system must not be combined with any existing station sprinkler system.
- (f) Any required water storage tanks for the Eastern Hydrant Zone system, the Western Hydrant Zone System and the Sydney Metro City & Southwest tunnel fire hydrant system may be combined, subject to agreement from FRNSW.
- (g) The new Eastern Hydrant Zone system is to serve Central Station Works, Central Walk Works, and Metro Station Works from a shared booster assembly, pumps, tanks and primary ring-main.
- (h) The new Eastern Hydrant Zone system is to have capacity and provide connection points for future extension to cover the whole of Central Station.
- (i) The new Eastern Hydrant Zone system is to provide complete hydrant coverage to the following areas as a minimum:
 - i) North-South Concourse and North-South Concourse BOH;
 - ii) Intercity Concourse and Intercity BOH;
 - iii) Eastern Entry Building including BOH;
 - iv) ESR Concourse and ESR Concourse BOH including sub-levels;
 - v) South Concourse and South Concourse BOH;
 - vi) Eastern Olympic Tunnel and Western Olympic Tunnel;
 - vii) Southern Suburban Interchange Tunnel;
 - viii) Southern Suburban Baggage Tunnel;
 - ix) any accessible enclosed services route;
 - x) the existing building at the north end of P16/17;
 - xi) the Central Electric Building;
 - xii) North Concourse and North Concourse BOH;
 - xiii) Elizabeth Street Entry and Elizabeth Street Entry BOH;

- xiv) Eastern Stairs Entrance and Eastern Stairs Entrance BOH;
 - xv) Chalmers Street Entrance;
 - xvi) all lift shafts connected to the Suburban Platforms, including to platform 24-25;
 - xvii) escalator pits, trusses and runs in Chalmers Street Entrance
 - xviii) lift shafts in South Concourse BOH;
 - xix) Southern Intercity Baggage Tunnel;
 - xx) ESR Ghost Platform level; and
 - xxi) ESR Platform 24/25 including BOH rooms, open stair, and escalator runs.
- (j) The new Eastern Hydrant Zone system is to include:
- (i) new primary booster assembly in a location agreed with FRNSW in the vicinity of the existing Eddy Ave booster;
 - (ii) new pumps and tanks as required; and
 - (iii) a secondary booster assembly at the Chalmers Street entrance the existing hydrant booster assembly at the Chalmers Street entrance.
- (k) Where the existing fire hydrant system extends into the Eastern Hydrant Zone described in 4.1.1 i), the CSM Contractor is to:
- (i) terminate the reticulation at the boundary to the Eastern Hydrant Zone and create ring-main loops within the Western Hydrant Zone; and
 - (ii) remove all redundant hydrant piping, outlets, support infrastructure and signage from within the Eastern Hydrant Zone.
- (l) During construction, station fire hydrant systems in operating parts of Central Station must remain active at all times to those areas occupied by the general public or staff. Any isolations of the existing system are to occur outside operating hours or during possessions and risk mitigation measures are to be agreed with the Principal Representative and Sydney Trains prior to the isolation.
- (m) Historical drawings of existing systems should not be relied upon. The CSM Contractor is to conduct on-site tracing of existing services that will be affected by the Project Works.
- (n) During construction, an operational fire hydrant system providing full coverage of the Construction Site(s) is to be provided at all times.
- (o) The CSM Contractor must provide a new Station Fire Hydrant System, inclusive of the following:
- (i) fire hydrant outlets must be located to provide coverage by a single 30m hose, including on surface platforms;
 - (ii) where fire hydrant outlets are required in addition to the hydrant outlets within the fire stairs, the first unprotected outlet is to be no more than 40m from the stair hydrant outlet, with the distance measured based on the laid path of a fire hose to avoid obstructions, and the next outlet is to be no more than 40m from the previous outlet, with the pattern repeated until full coverage is achieved;

- (iii) fire hydrant coverage of any public area open stairs or escalators is to be provided from the lower level of stairs or escalators leading to floors above the entry level, and from the upper level of stairs or escalators leading to floors below the entry level;
- (iv) platform fire hydrants must provide coverage where a single 30m fire hose can extend at least 2m inside every train door of a train in the normally stopped position;
- (v) for 'scissor' fire isolated exit stairs, two fire mains are to be provided so that there is a hydrant main within each shaft. Hydrant outlets are required at both doors serving the same level;
- (vi) a hydrant outlet is to be provided outside each Station Entrance;
- (vii) fire hydrant outlet locations must be coordinated with Fire and Rescue NSW;
- (viii) a take-off point(s) is to be provided to the Station Hydrant System that allows future extension of the hydrant system, as a ring-main to Sydney Yard;
- (ix) take-off point(s) are to be provided to the Station Hydrant System that allows future extension of the hydrant system, as a ring-main to the Western Hydrant Zone;
- (x) the fire hydrant reticulation pipework must be interconnected to form a ring main complete with cross-connections to provide alternative flow paths;
- (xi) appropriate isolation valves must be provided to allow isolation of a particular section under failure or for maintenance purposes, while still maintaining functionality to the remainder of the ring main;
- (xii) the number of isolation sections must be sufficient to avoid shutting off significant portions of the ring main; and
- (xiii) hydrant outlet valves are to be protected in a manner agreed with FRNSW to minimise the risk of misuse and vandalism, SFAIRP.

4.2 Water supply

- (a) The new Eastern Hydrant Zone system must be fed by a minimum Grade 2 water supply as defined by AS2118.1:1999.
- (b) The new Eastern Hydrant Zone system must be designed for a minimum of 3 hydrant outlets to flow simultaneously in accordance with clause 2.3 of AS2419.1-2005.
- (c) If an existing water supply location cannot provide the required system or supply pressure, a fire pump or water tank system, inclusive of diesel and electric driven fire pumps, and sprinkler jockey or pressure maintenance pump must be provided in accordance with AS2419, including:
 - (i) provisions to sense changes in system pressure to start the jockey or pressure maintenance pump automatically; and
 - (ii) a means for recycling water for testing fire pumps.
- (d) A booster assembly must be provided in accordance with the type of system, hydraulic requirements, the requirements of Fire and Rescue NSW, and relevant local council requirements.
- (e) The booster assembly is to avoid impact to Heritage structures, SFAIRP.

- (f) The location of the booster assembly must be agreed with the Principal's Representative, Sydney Trains, FRNSW, CSELR and must at a minimum:
 - (i) provide vehicle hard stand area for two general fire appliances within 8m of the booster inlet valves;
 - (ii) allow fire brigade appliances attending from the nearest fire station to directly pull up without the need to travel the wrong way down one-way streets or carry out U-turns;
 - (iii) allow for a 11.3m turning circle of the fire appliance such that when arriving and leaving, the fire appliance must be able to drive out in a forward direction without needing to reverse or carry out 3-point turns;
 - (iv) not be located in driveways or carpark entrances;
 - (v) not have access blocked by parked or stationery vehicles including buses, SFAIRP; and
 - (vi) minimise the impact, SFAIRP, of parked fire appliances impacting vehicle traffic and light rail operations.
- (g) Each booster inlet is to be labelled with the single boost pressure required to achieve the performance requirements at all points of the system.
- (h) Any upgrades required to achieve the necessary water supplies are the responsibility of the CSM Contractor.
- (i) Water supply from recycled water mains is to be used in firefighting where available. The CSM Contractor must obtain Approvals from the relevant water Authorities and Fire and Rescue NSW for its use.
- (j) Fire protection systems must include technology to detect and identify leaks.
- (k) The CSM Contractor must ensure that 80% of potable water associated with fire protection system testing is reused through recirculation systems and temporary storage.

4.3 Metro Station tunnel hydrant system allowances

- (a) The CSM Contractor must interface with the Interface Contractor and provide temporary and permanent infrastructure required to support the new Sydney Metro City and Southwest Tunnel hydrant system in accordance with the Room Schedule and Room Data Sheets in Appendix F and the Interface Schedules in SWTC Appendix E1, including but not limited to:
 - (i) independent booster assembly in a location agreed with FRNSW in the vicinity of the existing Eddy Ave booster;
 - (ii) spatial and structural provision for pumps and tanks;
 - (iii) all pipework reticulation from the new tunnel hydrant booster assembly to the tunnel hydrant pump/tank room;
 - (iv) all tanks, pumps, valves and supporting infrastructure within the station;
 - (v) all pipework reticulation from the tunnel hydrant pump/tank room to isolation valves at the tunnel portals of the Metro Station platforms;
 - (vi) construct concrete plinths within the tunnel hydrant pump/tank room for equipment mounting;

- (vii) provide drainage from the tunnel hydrant pump/tank room;
 - (viii) seal all service penetrations with waterproof and / or fireproof materials;
 - (ix) construct cable trench, supply and install chequer plates on the cable trench's in the MCC and control rooms to match MCC installation;
 - (x) supply and install any acoustic treatments to the tunnel hydrant pump/tank room; and
 - (xi) supply and install architectural louvres to provide ventilation to the tunnel hydrant pump/tank room.
- (b) The tunnel fire hydrant system at Central Station must have the functionality to:
- (i) supply hydrant water to the tunnel section to the south of Central Station, and
 - (ii) boost hydrant water to the tunnel section to the south, and the north of Central Station, and allow attending fire brigade to choose whether to boost the system in the tunnels to the north, or the south, in a fire incident.
- (c) The tunnel hydrant system is to comply with AS2419.1, and ASA Standards where that system traverses Central Station Works, Central Walk Works areas.
- (d) The tunnel hydrant system must be designed for 3 hydrants operating simultaneously.
- (e) The tunnel fire hydrant system must be monitored by the Metro Station FIP.
- (f) The tunnel fire hydrant pump and low water level alarm of the tunnel fire hydrant system water storage tank must be monitored by the Metro Station FIP.

5 Design Documentation

5.1 Requirements

- (a) In addition to the Management Requirements, the CSM Contractor must provide Design Documentation in relation to each Design Stage, for the following mechanical services:
- (i) ECS;
 - (ii) Hydraulics;
 - (iii) VT; and
 - (iv) Fire protection and detection systems; and
 - (v) Building Management Systems.

5.1.1 Environmental control systems

- (a) In addition to the Management Requirements, the CSM Contractor's Design Stage 1 Design Documentation for the Metro Station ECS must include a design report detailing:
- (i) ECS system level description;
 - (ii) primary system ventilation, cooling and heating methods;
 - (iii) system capacities for each location to +/-25% confidence;
 - (iv) ECS provisions for each room and area type, providing outline of services and sub-systems and heating, cooling and ventilation methods;
 - (v) system description of cooling, including cooling system capacities to +/-25% confidence, description of cooling and ventilation methods, description of air distribution arrangement, and identification of any unique requirements or characteristics of any particular location;
 - (vi) preliminary output from cooling thermal model detailed in sections 2.1.12.5 and 3.1.12.4, to demonstrate proof of concept;
 - (vii) description to room and area level of normal and emergency operating modes;
 - (viii) how sustainability initiatives will be achieved and minimum percentage by which the BCA Section J performance requirements will be exceeded;
 - (ix) preliminary equipment schedules for major equipment; and
 - (x) preliminary plant room schedules for major plant rooms at each geographic location;
 - (xi) a system schematic for each air, water, and refrigerant system;
 - (xii) typical plant room layouts, including:
 - A. condenser plant room;

- B. air-handling unit plant room;
- C. major fan rooms; and
- D. staircase pressurisation fan room;
- (xiii) site plans identifying major heat rejection, intake and discharge locations, orientation, and aspect; and
- (xiv) preliminary system interface block diagrams.
- (b) In addition to the Management Requirements, the CSM Contractor's Design Stage 2 Design Documentation for ECS must include:
 - (i) update to the design report provided in Design Stage 1 with +/-10% confidence on system capacities and equipment sizing;
 - (ii) final output from the cooling thermal model to confirm the cooling provision;
 - (iii) detailed equipment schedules, indicative of final equipment selections with details of the main system components including:
 - A. their operation, function, and performance requirements;
 - B. performance curves;
 - C. noise data and treatments; and
 - D. weight, dimensions and power requirements;
 - (iv) updated plant room schedule detailing the dimensions of each plant room, location and special requirements including specific service requirements;
 - (v) updated system schematics for each system showing equipment sizing, cooling and heating capacities, air and water flow rates to discrete equipment and room level detail;
 - (vi) plant and equipment maintenance, replacement and access strategy;
 - (vii) specific plant room layout drawings detailing equipment, services connections, maintenance access and plant replacement routes;
 - (viii) list of fire rated equipment or specific plant room fire rating or detection and protection requirements;
 - (ix) description of control architecture and strategy for all ECS systems;
 - (x) draft monitoring and control point schedule detailing the type of points proposed and the function of the point;
 - (xi) single line air and water distribution drawings with identified cross section sizing;
 - (xii) drawings detailing main services penetrations, risers, and main distribution corridor cross-sections;
 - (xiii) updated site plans identifying all heat rejection, intake and discharge locations, orientation, and aspects;
 - (xiv) updated system interface block diagrams;
 - (xv) detailed design deliverables list and designers initial ITP list;
 - (xvi) materials and workmanship specification for the ECS; and

- (xvii) calculations for all systems, including:
 - A. heating and cooling load calculations;
 - B. fan sizing calculations;
 - C. electrical loading calculations;
 - D. detailed hydraulic calculations;
 - E. noise and vibration calculations; and
 - F. indicative energy and water usage for each major system.

5.1.2 Hydraulics

- (a) In addition to the Management Requirements, the CSM Contractor's Design Stage 1 Design Documentation for hydraulic systems must include:
 - (i) schematic layout drawings for each system, including:
 - A. indicative main services reticulation route;
 - B. indicative main equipment location and layout; and
 - C. details of connection to Authorities' services;
 - (ii) preliminary risk analysis for the tunnel drainage system, justifying design intent, pump duties, sump volumes and rising main sizes;
 - (iii) a plant room schedule (including spatial provisions) and building showing all plant rooms and proposed servicing;
 - (iv) preliminary builder's work requirement schedules; and
 - (v) preliminary control system point schedules.
- (b) In addition to the Management Requirements, the CSM Contractor's Design Stage 2 Design Documentation for hydraulic systems must include:
 - (i) detailed risk analysis report for the tunnel drainage systems, justifying design intent, pump duties, sump volumes rising main sizes and biocide dosing rates;
 - (ii) preliminary material and workmanship specifications;
 - (iii) detailed builder's work requirement schedules; and
 - (iv) detailed control system point schedules.
- (c) In addition to the Management Requirements, the CSM Contractor's Design Stage 3 Design Documentation for hydraulic systems must include:
 - (i) detailed material and workmanship specifications, including manufacturers' technical catalogues;
 - (ii) finalised builder's work requirement schedules;
 - (iii) finalised control system point schedules;
 - (iv) plant and equipment maintenance, replacement and access strategy;
 - (v) noise and vibration control measures;
 - (vi) pump motor/starter and control panel schedules and drawings;

- (vii) technical schedules detailing the equipment performance data;
- (viii) drawings and documentations prepared by Water Servicing Coordinator for the town mains/sewer mains/stormwater connections;
- (ix) system interface block diagrams indicating the locations and details of the interface with Sydney Trains, Authorities and Other Contractors; and
- (x) equipment and material data sheets with details of the main system components, including materials and workmanship specifications for each hydraulic services system.

5.1.3 Vertical transport

- (a) In addition to the Management Requirements, the CSM Contractor's Design Stage 1 Design Documentation for VT must include:
 - (i) equipment specifications;
 - (ii) interface details with architecture, structure and rail systems;
 - (iii) risk analysis report; and
 - (iv) preliminary finishes details.
- (b) In addition to the Management Requirements, the CSM Contractor's Design Stage 2 Design Documentation for VT must include:
 - (i) materials and finishes details including:
 - A. lift car interior;
 - B. flooring;
 - C. hand rails;
 - D. lighting;
 - E. emergency lighting;
 - F. operating panels;
 - G. indication panels;
 - H. non slip treatment escalator steps;
 - I. comb plates;
 - J. escalator hand rails;
 - K. escalator stainless steel; and
 - L. escalator fall protection.
 - (ii) technical specifications;
 - (iii) equipment data sheets;
 - (iv) risk analysis report; and
 - (v) a comprehensive plant and equipment access, maintenance and replacement strategy.

5.1.4 Fire protection and detection systems

- (a) In addition to the requirements described in the Management Requirements, the CSM Contractor's Design Stage 1 Design Documentation for the fire protection and detection systems must include:
- (i) fire protection and detection systems overview;
 - (ii) description for each fire protection and detection system;
 - (iii) schematic diagrams for each fire protection and detection system;
 - (iv) fire protection and detection system interface block diagrams indicating the locations and details of the interface between different trades;
 - (v) fire protection and detection system provision schedules;
 - (vi) plant room schedules; and
 - (vii) room data sheets.
- (b) In addition to the requirements described in the Management Requirements, the CSM Contractor's Design Stage 2 Design Documentation for the fire protection and detection systems must include:
- (i) fire protection and detection system calculations including:
 - A. fire protection and detection system design calculations – sizing, quantity & capacity;
 - B. electrical loading calculations;
 - C. detailed hydraulic calculations; and
 - D. noise and vibration calculations;
 - (ii) equipment technical details including:
 - A. equipment data sheets detailing the main fire protection and detection system components including their operation function, performance requirements and power requirements;
 - B. technical data for fire protection and detection systems equipment including pump curves and performance details;
 - C. pump motor/starter and control panel schedules and drawings; and
 - D. noise and vibration control measures;
 - (iii) fire protection and detection system drawings including:
 - A. plant room equipment layout drawings for each fire protection and detection system;
 - B. service layout drawings showing the main routing for each fire protection and detection system;
 - C. services penetration drawings; and
 - D. builder's work drawings;
 - (iv) fire protection and detection system schedules including:

- A. fire protection and detection systems provision schedules;
- B. plant room schedules;
- C. drawing list and submission schedule;
- D. Sydney Metro CCS and Sydney Metro City & Southwest BMS point schedules;
- E. painting schedules; and
- F. lifting facilities schedules;
- (v) plant and equipment maintenance, replacement and access strategy;
- (vi) material and workmanship specifications; and
- (vii) system interface data and specification.

5.1.5 Building Management System

- (a) In addition to the Management Requirements, the CSM Contractor must provide the following specific Design Stage 1 Design Documentation for the BMS:
 - (i) BMS system descriptions, covering:
 - A. overall functionality;
 - B. individual element functionality;
 - C. the principles of operation during normal, degraded and emergency conditions
 - D. HMI screen philosophy;
 - E. system core software and application software; and
 - F. typical points schedules for each location;
 - (ii) schematic diagrams, showing:
 - A. overall BMS configuration;
 - B. connected systems;
 - C. interfaces;
 - D. redundancy arrangements; and
 - E. locations of BMS equipment.
 - (iii) process and instrumentation diagrams;
 - (iv) HMI workstation screen samples;
 - (v) control hierarchy strategy;
 - (vi) alarm classification strategy;
 - (vii) preliminary equipment specifications;
 - (viii) cubicle general arrangements showing workstation and equipment layout;
 - (ix) system expansion strategy;
 - (x) equipment replacement methodology;

- (xi) equipment spatial requirements; and
 - (xii) equipment environment details and requirements.
- (b) In addition to the Management Requirements, the CSM Contractor must provide the following specific Design Stage 2 Design Documentation for the BMS:
- (i) detailed specifications for the BMS covering:
 - A. software design; and
 - B. equipment and its configuration;
 - (ii) HMI workstation screen layouts; and
 - (iii) final points schedules.



- Sydney Metro City & Southwest

 - Central Station Main Works**

 - Schedule C1

- - Scope of Works and Technical Criteria
 - Appendix B05
 - Fire and Life Safety

PROJECT	Central Station Main Works	DATE	1 February 2018
GROUP	Sydney Metro City & Southwest	STATUS	Final
AUTHOR	Transport for NSW	REVISION	2.0
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1 Performance and technical requirements

1.1 General

- (a) This Appendix B05 describes the performance and methodology requirements for fire and life safety (FLS) for the Project Works and includes a description of the Design Documentation submission requirements. Specific design requirements related to FLS are contained in other Appendices for specific disciplines.
- (b) The CSM Contractor must develop a fire and life safety strategy (the CSM Contractor's FLS strategy), documented and approved in accordance with section 2, that provides a level of safety for occupants, emergency services, and the Sydney Trains Rail Emergency Response Unit (RERU), in the event of a fire, both during construction and for the operational lifetime of the facility, that at a minimum:
 - (i) meets the requirements of the Environmental Planning & Assessment Act 1979 for the Project Works and all parts of the existing Central Station directly affected by the Project Works, where the BCA is applicable; and
 - (ii) demonstrates that the risk from fire has been reduced so far as is reasonably practicable (SFAIRP) as required by the NSW Rail Safety (Adoption of National Law) Act 2012, for:
 - A. all parts of the Project Works; and
 - B. all parts of Central Station directly and indirectly affected by the Project Works.
- (c) The CSM Contractor's FLS strategy must include all areas of the Project Works and all parts of Central Station indirectly affected by the Project Works. Areas indirectly affected by the Project Works are defined as:
 - (i) areas used as an emergency egress path from the Project Works;
 - (ii) areas used as an emergency access path to the Project Works;
 - (iii) areas where a fire could create a hazard, such as the spread of heat or smoke, to the Project Works;
 - (iv) areas outside the Project Works which could be affected by a fire within the Project Works;
 - (v) areas indirectly affected by the Project Works where a hazard affects the Project Works; and
 - (vi) the Devonshire Street Tunnel and any adjustments to that Tunnel.
- (d) The CSM Contractor must complete structural integrity assessments of the Project Works. Areas indirectly affected are not to be assessed.
- (e) The CSM Contractor's FLS strategy must not reduce the existing level of fire safety in areas directly or indirectly affected by the Project Works.

- (f) The CSM Contractor's FLS strategy must not place reliance on pre-existing Fire Safety Systems under clause 94 of the Environmental Planning and Assessment Regulation 2000, as sole justification for the Fire Safety Systems required within the Project Works.
- (g) The CSM Contractor must identify upgrades in areas indirectly affected by the Project Works as part of any fire safety analysis and provide this analysis to the Principal's Representative in the Stage 1 Design Documentation.
- (h) The CSM Contractor must ensure that the FLS strategy prepared by the CSM Contractor for the Project Works is consistent and compatible with any over-arching Sydney Metro City & Southwest FLS Strategy, unless otherwise agreed in writing by the Principal's Representative.
- (i) The CSM Contractor's FLS strategy must, SFAIRP:
 - (i) reduce the risk of heat, smoke or structural failure resulting from a fire event, either within the Project Works or originating from adjacent buildings, infrastructure or property, causing injury or fatality to occupants, emergency services, RERU, neighbours or general public in the vicinity;
 - (ii) facilitate evacuation of mobility impaired person's from all publicly accessible areas and light duty Back Of House areas of the Project Works, including the scenario of train evacuation from in tunnels through Central Station;
 - (iii) provide safe evacuation of Occupants from within the Project Works, with reasonable measures to reduce the Risk, SFAIRP, from:
 - A. slips, trips and falls;
 - B. mechanical and electrical Hazards in the path(s) of evacuation;
 - C. crush injuries from an Uncontrolled Evacuation;
 - D. illness from anxiety and / or overexertion;
 - E. manual handling injuries that may be sustained in the process of assisting the evacuation of a Mobility Impaired Person;
 - F. Hazards from fire suppression systems and fire fighting operations;
 - G. train impacts to evacuating Occupants that may enter the Rail Corridor;
 - H. light rail vehicle (LRV) impacts to evacuating Occupants that may enter the light rail corridor; and
 - I. vehicle impacts to evacuating Occupants that may enter a road corridor.
 - (iv) reduce the risk of injury to Occupants sustained from operating first attack firefighting equipment;
 - (v) reduce the risk of false alarms from Fire Safety Systems that trigger unnecessary evacuations or cause disruption to timetabled services for all rail operators;

- (vi) facilitate the operations of Fire and Rescue NSW (FRNSW), the Operator's emergency response unit (if provided) and the Sydney Trains Rail Emergency Response Unit (RERU), to:
 - A. enable them to attempt rescue of living Occupants;
 - B. prevent fire spread to adjacent buildings and properties;
 - C. prevent impact on adjacent buildings and properties due to structural failure from a fire;
 - D. manage the eventual extinguishment of the fire; and
 - E. allow a timely return to Normal Operations;
- (vii) reduce the risk of fire, including the consequences of extinguishment, clean-up, repairs and reinstatement, resulting in an interruption to Normal Operations for all rail operators;
- (viii) reduce the risk of heat, smoke, structural failure or fire fighting activities from a fire resulting in significant property damage to Rolling Stock, Rail Infrastructure (irrespective of the operator), Heritage listed property, neighbouring property and neighbouring infrastructure;
- (ix) minimise the impact, SFAIRP, on the fabric of Heritage listed property from the installation and maintenance of Fire Safety Systems;
- (x) reduce the risk of heat, smoke or fire fighting operations causing disruption to surrounding road traffic and light rail operations;
- (xi) reduce the risk of heat, smoke or fire fighting activities from a fire within the Project Works resulting in environmental damage;
- (xii) minimise the water usage, energy usage and carbon footprint of required Fire Safety Systems; and
- (xiii) reduce the risk of environmental harm associated with the installation, maintenance, and operation of Fire Safety Systems.
- (j) During construction, the CSM Contractor must determine and implement interim FLS strategies, prior to each phase of construction, documented and approved in accordance with section 2 of this Appendix B05, that maintain an acceptable level of fire safety in all parts of Central Station that remain operational.
- (k) During construction, the CSM Contractor must determine and implement FLS strategies, which must be documented within the CSM Contractor's Construction & Site Management Plan and Incident, Emergency and Crisis Management Plan (which are both listed in MR-PA). Both Management Plans must be submitted in accordance with the Contract and the timeframes specified in MR-PA.

1.2 Minimum fire engineering methodology requirements

- (a) This section defines the minimum requirements to be adopted in the development of the CSM Contractor's FLS strategy. The CSM Contractor must analyse, define and justify all parts of the FLS strategy, and may need to adopt levels of performance that are more onerous than those defined here.
- (b) The fire engineering methodology must follow the principle steps shown in Figure 1.

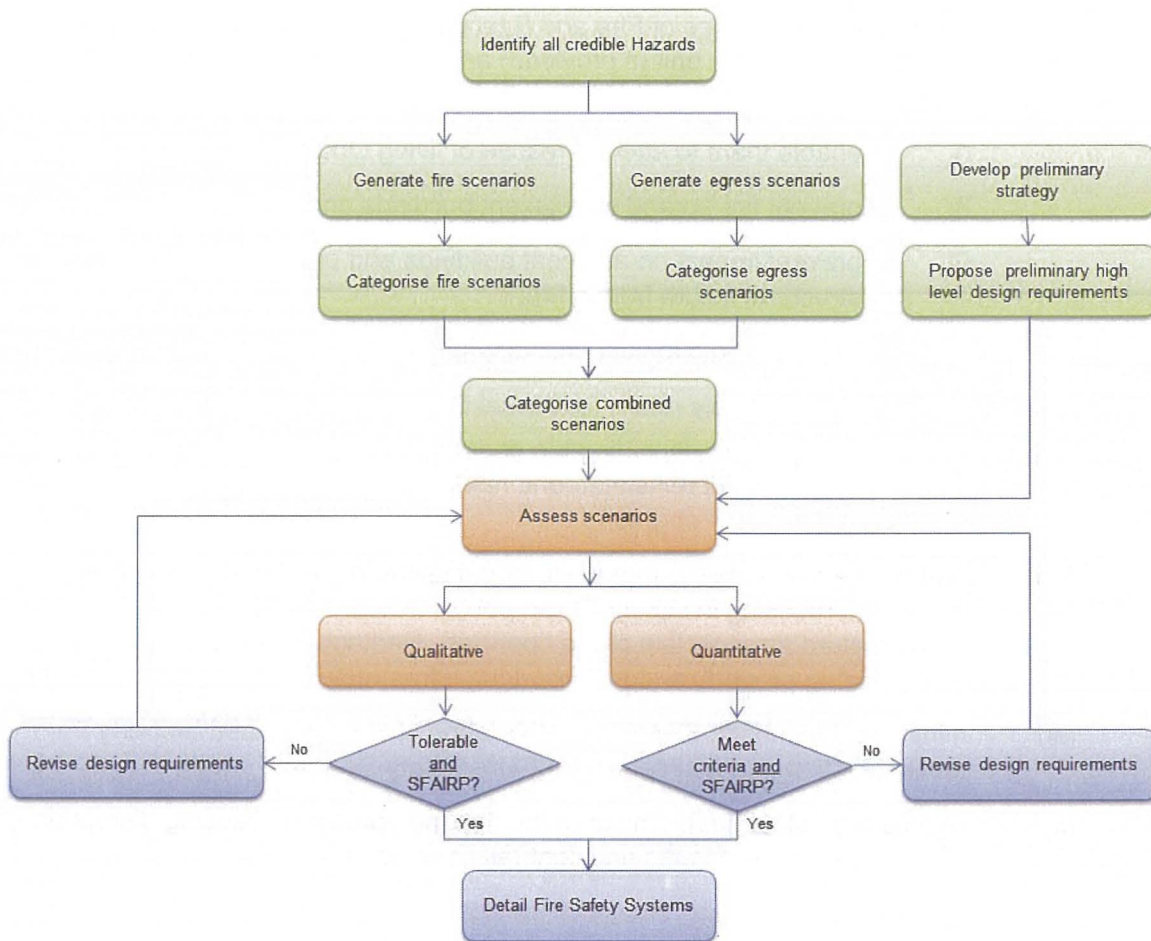


Figure 1: Fire Engineering Methodology

1.2.1 Hazard assessment

- (a) The FLS strategy must identify all credible fire related Hazards which must include:
- (i) hazards that may result in a fire starting;
 - (ii) hazards that may contribute to fire growth and the generation of heat and smoke;
 - (iii) hazards that may affect the impact of heat and smoke from a fire on Occupants, Emergency Services, RERU, building structures, rail operations, and Rail Infrastructure; and
 - (iv) hazards that may affect the efficacy of Fire Safety Systems.
- (b) All hazards identified as part of the CSM Contractor’s FLS strategy must also be recorded in the Project Works Risk Register.

1.2.2 Scenarios to be addressed

- (a) Scenarios must be developed that address all hazards identified as part of the FLS strategy.
- (b) The FLS strategy must address separate train fire scenarios that include:
- (i) fire on a Metro train; and

- (ii) fire on a Sydney Trains heavy passenger train where the fire may affect any part of the Project Works;
- (c) Train fire scenarios must include the following operational scenarios, applicable to both Metro and Sydney Trains rolling stock as defined in section 1.2.2 b):
 - (i) fire on a Sydney Metro train in the following locations:
 - A. a fire starting on the train whilst in motion and the train continuing to Metro Station from either direction and stopping wholly within the station;
 - B. a fire starting on the train whilst in motion and the train then stopped partly within Central Station and partly within the tunnel on either side of the station; and
 - C. a fire on a train stopped in the tunnel either side of Central Station, requiring passengers to detrain and evacuate to Central Station.
 - (ii) fire on a Sydney Trains heavy passenger train stopped at underground platform 24/25; and
 - (iii) fire on a heavy passenger train stopped at the surface platforms if the egress provisions for the surface platform, or the canopy configuration, is modified.
- (d) The FLS strategy must, at a minimum, assess train fires in the following locations:
 - (i) fire on the roof of a train;
 - (ii) fire beneath the floor of a train; and
 - (iii) fire within the passenger area of a train, including:
 - A. fire within an end car of the train;
 - B. fire within the middle of the train;
 - C. fire within the train car immediately adjacent to each exit from the platform; and
 - D. fire within the train car that will produce the worst credible smoke conditions on the platform and connected concourses.
- (e) The CSM Contractor must make itself aware of the current security risk level at Central Station as determined by the latest version of the security intelligence assessment of Central Station commissioned by Sydney Trains, and determine appropriate fire scenarios to address the potential risk of malicious and pre-meditated arson attack that may involve the use of accelerant and / or multiple fire starts.
- (f) Irrespective of the fire scenario likelihood assessment conducted by the CSM Contractor in accordance with section 1.2.3, the following train fire scenarios are the minimum that must be analysed through Deterministic Assessment:
 - (i) Design Fire Scenario - a 1MW medium growth rate fire in the passenger area of a Sydney Metro train;

- (ii) Design Fire Scenario - a 1MW medium growth rate fire in the passenger area of a Sydney Trains heavy passenger train;
 - (iii) High-Challenge Fire Scenario - a 3MW medium growth rate fire in the passenger area of a Sydney Metro train; and
 - (iv) High-Challenge Fire Scenario - a 3MW medium growth rate fire in the passenger area of a Sydney Trains heavy passenger train.
- (g) The FLS strategy must at a minimum assess fire scenarios within Central Station and its ancillary buildings and areas including fire on / in:
- (i) the Metro Station platform;
 - (ii) platforms 24/25;
 - (iii) the surface platforms;
 - (iv) Sydney Yard;
 - (v) the following concourses:
 - A. the new North-South Concourse;
 - B. the new East Concourse;
 - C. the ESR Concourse; and
 - D. the North Concourse.
 - (vi) other tunnels and adits used for passenger circulation and interchange;
 - (vii) the following station entrances, including the road corridor and light rail corridor:
 - A. northern entry from Eddy Ave;
 - B. new eastern entry from Chalmers St;
 - C. north-east entry from Elizabeth St; and
 - D. south-east entry from Chalmers St.
 - (viii) escalator pits;
 - (ix) Back-Of-House areas including:
 - A. any underfloor or enclosed combined services route (CSR);
 - B. the ghost platforms above platform 23/24;
 - C. the existing Heritage Central Electric Building; and
 - D. high Hazard areas outside of the Project Works area such as the lost property store.
 - (x) the Devonshire Street Tunnel; and
 - (xi) any retail tenancies connected to public access areas.
- (h) Irrespective of the fire scenario likelihood assessment conducted by the CSM Contractor in accordance with section 1.2.3, the following station fire scenarios are the minimum that must be analysed through Deterministic Assessment:

- (i) Design Fire Scenario - a 0.25MW medium growth rate fire in the Devonshire Street Tunnel;
- (ii) Design Fire Scenario - a 1MW medium growth rate fire in the station platform and concourse areas listed in section 1.2.2 g);
- (i) High-Challenge Fire Scenario - a 2MW medium growth rate fire in the station platform and concourse areas listed in section 1.2.2 g);
 - (iii) Design Fire Scenario - a paper based arson fire with an ultra-fast growth rate fire to 200kW, remaining constant for 1 minute, then decaying linearly to 0kW after 5 minutes, in station platform and concourse areas listed in section 1.2.2 g); and
 - (iv) high-challenge fire scenario - an accelerant based arson fire with an ultra-fast growth rate fire to 3MW, in station platform and concourse areas listed in section 1.2.2 g).
- (j) The FLS strategy must consider both train and station fires that are located in the worst credible position with respect to smoke conditions produced, and impact on egress, noting that these may be different locations.
- (k) Arson fires must be assessed both on trains and in the station. At a minimum, arson fire scenarios must allow for the ignition of materials available to hand.
- (l) The FLS strategy must at a minimum assess the following egress scenarios with the following categorisations, irrespective of the scenario likelihood assessment conducted in accordance with section 1.2.3:
 - (i) Design Egress Scenario – a train evacuated at Central Station where the affected platforms and concourses have been previously evacuated;
 - (ii) Design Egress Scenario – a train evacuated at Central Station with normal entraining passenger loads on all affected platforms and normal detraining passenger loads on non-incident platforms;
 - (iii) high challenge egress scenario – a train evacuated at Central Station with affected platform passenger entraining loads incorporating a missed headway.
- (m) The determination of occupant numbers for the purposes of the FLS strategy, for all egress scenarios, with the exception of section 1.2.2 l) ii) C, must:
 - (i) be based on patronage forecasts for the year 2056 (provided in Appendix B3);
 - (ii) be based on the following Metro train frequency:
 - A. Design Egress Scenario - 30 trains per hour per direction;
 - B. Design Egress Scenario - 25 trains per hour per direction; and
 - C. High Challenge Egress Scenario - 20 trains per hour per direction.
 - (iii) assess train populations in combination with station populations for both AM Peak patronage and PM Peak patronage;
 - (iv) apply a minimum peak-on-peak Factor of 1.2 to the peak hour station entry and interchange patronage forecasts;

- (v) include a minimum of 5% of Occupants, rounded up to the nearest whole number, to have a mobility impairment that prevents them self-evacuating via stairs; and
- (vi) include a minimum of 0.03% of Occupants, rounded up to the nearest whole number, to be wheelchair bound.
- (n) In addition to section 1.3.2 I), for the purposes of the FLS strategy, peak hour train passenger populations for both Metro trains and Sydney Trains heavy passenger rolling stock, must be based on, as a minimum:
 - (i) Design Egress Scenario - patronage data (provided in Appendix B3);
 - (ii) High-Challenge Egress Scenario - peak loaded train, if the patronage based population is less than a peak loaded train; and
 - (iii) High Challenge Egress Scenario - crush loaded train, if the patronage based population is more than a peak loaded train.
- (o) Where any combination of scenario requirements defined in section 1.2.2 results in conflicting scenario categorisations, the scenario categorisation with the less frequent Likelihood Return Period will apply.
- (p) For each Combined Design Scenario, as defined in section 1.2.2, or determined in accordance with section 1.2.3, the credible failure of individual Fire Safety Systems is to be assessed as a Combined High Challenge Scenario.

1.2.3 Scenario categorisation

- (a) The CSM Contractor must conduct an assessment of the likelihood of each scenario generated as required by section 1.2.2 and determine a categorisation on the following basis:
 - (i) Design Fire Scenarios or Design Egress Scenarios – those scenarios with a Likelihood Return Period of 100 years or less;
 - (ii) high challenge fire scenarios or high challenge egress scenarios – those scenarios with a Likelihood Return Period greater than 100 years and less than or equal to 10,000 years; and
 - (iii) Extreme Event Fire Scenarios or Extreme Event Egress Scenarios – those fires with a Likelihood Return Period greater than 10,000 years.
- (b) A minimum scenario categorisation defined in section 1.2.2, will supersede a scenario categorisation determined in accordance with section 1.2.3 a).
- (c) When combining fire scenarios with egress scenarios, the following categorisation of the combined scenarios applies:
 - (i) a Design Fire Scenario and a Design Egress Scenario results in a Combined Design Scenario;
 - (ii) a Design Fire Scenario and a High-Challenge Egress Scenario results in a Combined High-Challenge Scenario;
 - (iii) a High-Challenge Fire scenario and a Design Egress Scenario results in a Combined High-Challenge Scenario;
 - (iv) a High-Challenge Fire Scenario and a High-Challenge Egress Scenario results in a Combined Extreme Event Scenario; and

- (v) an Extreme Event Fire Scenario and/or an Extreme Event Egress Scenario results in a Combined Extreme Event Scenario.

1.2.4 FLS analysis

- (a) Scenarios may be grouped for the purposes of collective analysis.
- (b) For fire scenarios at underground/enclosed platforms and concourses at Central Station, the following are the minimum parameters that must be analysed through Quantitative Assessment:
 - (i) temperature, visibility and toxicity of smoke within public access areas;
 - (ii) heat radiation received by evacuating Occupants, both from the fire and the hot smoke layer, in all egress paths and areas used as a Place Of Relative Safety;
 - (iii) heat exposure to station structure; and
 - (iv) Occupant egress.
- (c) For fire scenarios at surface platforms and concourses at Central Station, the following are the minimum parameters that must be analysed through Quantitative Assessment:
 - (i) temperature, visibility and toxicity of smoke within all egress paths and areas used as a Place Of Relative Safety, if the canopy design or surrounding construction can result in a layer of smoke and heat being trapped in areas where Occupants may be evacuating;
 - (ii) heat radiation received by evacuating Occupants, both from the fire and the potential hot smoke layer, in all egress paths and areas used as a Place Of Relative Safety;
 - (iii) heat exposure to adjacent structure including any Back-Of-House areas, canopy structures or services bridges; and
 - (iv) Occupant egress.
- (d) For Quantitative Assessment of fire scenarios within Central Station the convective component of the fire heat release rate is to be a minimum of 0.7.
- (e) The following is to be adopted for egress assessments:
 - (i) the maximum average travel speed of able bodied occupants when not travelling through smoke is to be 1m/s;
 - (ii) the maximum average travel speed of the mobility impaired, aged, or children when not travelling through smoke is to be 0.8m/s;
 - (iii) the maximum average travel speed when travelling through smoke with a visibility greater than 5m, is to be 0.7m/s;
 - (iv) the maximum average travel speed when travelling through smoke with a visibility less than 5m, is to be 0.3m/s;
 - (v) boundary layers must be incorporated in all egress width calculations;
 - (vi) fire blocking an exit is to be assessed, particularly for station platform fires;

- (vii) egress using escalators is to assume 1 escalator is completely out-of-service and barricaded off;
- (viii) the omitted escalator is to be the one having the most adverse effect upon egress capacity;
- (ix) egress calculations are to assess the impact of different proportions of occupants using the stairs and escalators, and are not to rely on all exits being optimally used; and
- (x) the minimum pre-movement time for a fire on the station platform or concourse is to be 1 minute.

1.2.5 FLS analysis criteria

- (a) The following tenability criteria are the minimum to be used for Quantitative Assessment of Occupant egress from inside a train:
 - (i) maximum thermal Fractional Effective Dose (FED) of 0.3; and
 - (ii) maximum carbon monoxide (CO) Fractional Effective Dose of 0.3.
- (b) The following tenability criteria are the minimum to be used for Quantitative Assessment of Occupant egress from / through / at Central Station:
 - (i) thermal radiation received by Occupants to be less than 2.5kW/m²;
 - (ii) for smoke below 2.1m above floor level, maximum smoke temperature to be 60°C, and maximum thermal Fractional Effective Dose (FED) of 0.3;
 - (iii) for smoke below 2.1m above floor level, minimum visibility to be 5m;
 - (iv) maximum CO Fractional Effective Dose of 0.3; and
 - (v) in a fire evacuation scenario, calculated queuing times at exits, including escalators, in public areas must not exceed 8 minutes.
- (c) The following are the minimum criteria to be applied to the Quantitative Assessment of the performance of structures in fire scenarios:
 - (i) the maximum limiting temperature of structural steel is to be determined on a case by case basis in accordance with AS 4100 and / or Eurocode 3; and
 - (ii) concrete and any steel reinforcement within the concrete must be assumed to begin losing its strength at elevated temperatures as defined in section 3.2 of Eurocode 2 Part 1-2.
- (d) Where Quantitative Assessment is used,
 - (i) Combined Design Scenarios must be analysed through Deterministic Assessment and the FLS strategy demonstrated to provide adequate fire safety with a minimum safety factor of 1.5; and
 - (ii) Combined High Challenge Scenarios must be analysed through Deterministic Assessment and the FLS strategy demonstrated to provide adequate fire safety with a minimum safety factor of 1.0.
- (e) Where Qualitative Assessment is used, the FLS strategy must demonstrate that:
 - (i) the fire safety risk has been reduced to at least a Tolerable level when assessed against the risk matrix defined in the TfNSW North West Rail

Link Integrated Management System (IMS) Project Safety Management Plan (PSMP) Safety Risk Management Standard; and

- (ii) the fire safety risk has been reduced So Far As Is Reasonably Practicable as defined through the Rail Safety National Law and guidance from Office of the National Rail Safety Operator (ONRSR).
- (f) Extreme Event Fire Scenarios, Extreme Event Egress Scenarios and Combined Extreme Event Scenarios must be assessed to reduce the fire safety risk So Far As Is Reasonably Practicable as defined through the Rail Safety National Law and guidance from the Office of the National Rail Safety Operator (ONRSR).
- (g) Compliance with the Rail Safety (Adoption of the National Law) Act must be demonstrated through a risk based first-principles approach. Compliance with the Rail Safety (Adoption of the National Law) Act is not achieved solely by:
 - (i) compliance with the prescriptive deemed-to-satisfy requirements of the BCA, or demonstration of equivalence with the prescriptive deemed-to-satisfy requirements of the BCA; or
 - (ii) compliance with the prescriptive requirements of the American standard NFPA130 Standard for Fixed Guideway Transit and Passenger Rail Systems, or demonstration of equivalence with the prescriptive requirements of NFPA130.

1.2.6 Fire Safety Systems

- (a) For all credible fire scenarios, the CSM Contractor is to determine and implement default automated Fire Safety System responses SFAIRP. The FLS strategy is to minimise dependence on human intervention by staff.

2 Fire engineering process, documentation and certification

2.1 General

- (a) In addition to the Design Documentation described in the Metro Requirements – Technical (MR-T), the CSM Contractor must also provide Design Documentation specific to FLS with content as defined below for each Design Stage.
- (b) The CSM Contractor must:
- (i) consult, as a minimum, the following FLS stakeholders and obtain agreement as defined in section 2.3 b) for the Fire Engineering Brief (FEB) and sections 2.4 b) and 2.4 c) for the Fire Engineering Report (FER):
 - A. Transport for New South Wales;
 - B. Sydney Trains, including the Rail Emergency Response Unit (RERU);
 - C. Fire and Rescue New South Wales (FRNSW);
 - D. the Operator;
 - E. the Crown Certifier;
 - F. the Proof Engineer (fire life safety); and
 - G. the Independent Certifier for the Project Works.
 - (ii) brief, as a minimum, the following stakeholders on the FLS strategy and from whom comment should be sought within reasonable timeframes and their comments addressed within the FEB and FER SFAIRP:
 - A. Interface Contractors;
 - B. Other project teams undertaking modification work at Central Station (e.g. 2018 TT, PSU Upgrade);
 - C. Transport Management Centre (TMC);
 - D. New South Wales Trains;
 - E. Sydney Light Rail;
 - F. Council of the City of Sydney;
 - G. New South Wales Police;
 - H. Community and neighbouring properties (including those with direct frontage to, or a shared boundary with, Central Station);
 - I. Ambulance Service of NSW;
 - J. Disability Council NSW; and
 - K. Heritage Council of NSW.

- (c) Where the FLS strategy relies upon inputs and assumptions from third parties including information from Sydney Trains regarding existing systems and operational procedures at Central Station, the CSM Contractor must satisfy itself of the accuracy and reliability of those inputs so that the FLS strategy prepared by the CSM Contractor can be approved as an integrated strategy with the rest of Central Station.

2.2 Design Stage 1

- (a) The CSM Contractor must provide a preliminary Fire Engineering Brief (FEB) based on the CSM Contractor's F&LS strategy. The FEB must be consistent with the guidance described in AS4825 Tunnel Fire Safety, and must as a minimum contain the following:
- (i) the project scope;
 - (ii) the fire engineering design scope;
 - (iii) the fire engineering design objectives;
 - (iv) description of the regulatory framework;
 - (v) details of relevant stakeholders as required by section 2.1 b), including a summary of consultation undertaken (minutes to be attached) and all agreements achieved;
 - (vi) elemental review and description of the Project Works infrastructure, systems and operations, as it relates to the FLS, including interfaces to other rail facilities, adjoining properties and other rail operators;
 - (vii) Occupant characteristics, which must include:
 - A. population numbers to be used for egress assessment during AM Peak, PM Peak and off-peak;
 - B. the proportion of Occupants who are mobility impaired;
 - C. the proportion of Occupants travelling with luggage;
 - D. the likely location of Occupants within the station;
 - E. whether Occupants are static (e.g. staff), or transient (e.g. commuters) and general flow patterns;
 - F. the presence of homeless people sleeping rough;
 - G. the presence of those involved in anti-social behaviour (e.g. graffiti vandals);
 - H. the effect of seasonal changes and school holidays; and
 - I. special events (e.g. New Years Eve).
 - (viii) hazards identified and preventative and protective measures;
 - (ix) fire and life safety (FLS) strategy;
 - (x) the methodology for fire engineering assessment including:
 - A. identification and likelihood based categorisation of all credible fire and egress scenarios;

- B. acceptance criteria including tenability criteria and safety factors;
 - C. proposed method for assessing risk to operational impact;
 - D. identification and justification of all key input parameters for Quantitative Assessment including smoke modelling, egress assessment, structural assessment, quantitative risk assessment, radiation modelling and fire brigade response;
 - E. a description of software modelling and commentary provided as to its level of validation; and
 - F. a list of all assumptions, including assumed values as inputs to any quantitative likelihood assessment or risk assessment.
- (xi) preliminary analysis and modelling results;
 - (xii) the trial design, including:
 - A. proposed Fire Safety Systems;
 - B. required redundancies;
 - C. preliminary Cause And Effect Matrix of required responses for all credible scenarios; and
 - D. proposed management of interfaces.
 - (xiii) the proposed methodology for justification of non-compliances with:
 - A. the deemed-to-satisfy (DtS) provisions of the BCA;
 - B. ASA standards;
 - C. Sydney Metro standards; and
 - D. the Reference Documents.
- (b) The CSM Contractor must conduct associated stakeholder consultation and review of the preliminary FEB from all stakeholders listed in section 2.1 b);

2.3 Design Stage 2

- (a) The CSM Contractor must revise the preliminary FEB as appropriate to incorporate comments from project stakeholders including those listed in section 2.1 b).
- (b) The CSM Contractor must obtain agreement on the FEB from all stakeholders, acting reasonably, listed in section 2.1 b) i) to include:
 - (i) written agreement on the elements of the FEB described in sections 2.2 a) iii), 2.2 a) vii), 2.2 a) viii), 2.2 a) x), and 2.2 a) xiii; and
 - (ii) Approval-In-Principal of all other elements of the FEB.
- (c) The CSM Contractor must provide a final FEB that, in addition to the requirements of section 2.2 a), contains:
 - (i) updates in response to stakeholder review comments on the preliminary FEB;
 - (ii) document review registers applicable to the preliminary FEB, including responses and response acceptances to all review comments raised; and

- (iii) copy of all approvals required under 2.3 b).
- (d) The CSM Contractor must provide a written report from the Proof Engineer (fire life safety) containing detailed results of their review of the final FEB including an assessment of:
 - (i) the appropriateness of the FLS strategy and trial design;
 - (ii) compliance with relevant legislation, codes and standards; and
 - (iii) the appropriateness of assumptions, engineering methods, analysis and calculations.
- (e) The CSM Contractor must conduct all necessary design development, fire engineering assessment and analysis to meet the objectives described in section 1.1, including associated stakeholder consultation and review from all stakeholders listed in section 2.1 b).
- (f) The CSM Contractor must provide a preliminary Fire Engineering Report (FER) describing the FLS strategy for the final design configuration; post all Project Works. The FER must be consistent with the guidance described in AS4825 Tunnel Fire Safety, and must as a minimum contain the following:
 - (i) the project scope;
 - (ii) the fire engineering design scope;
 - (iii) the agreed fire engineering design objectives;
 - (iv) description of the regulatory framework;
 - (v) details of relevant stakeholders as required by section 2.1 b), including a summary of consultation undertaken (minutes to be attached) and all agreements obtained;
 - (vi) description of the Project Works infrastructure, systems and operations, as it relates to the FLS strategy, which must specifically address interfaces to other rail facilities, adjoining properties and other rail operators;
 - (vii) Occupant characteristics, which must include:
 - A. population numbers to be used for egress assessment during AM Peak, PM Peak and off-peak;
 - B. the proportion of Occupants who are mobility impaired;
 - C. the proportion of Occupants travelling with luggage;
 - D. the likely location of Occupants within the station;
 - E. whether Occupants are static (e.g. staff), or transient (e.g. commuters) and general flow patterns;
 - F. the presence of homeless people sleeping rough;
 - G. the presence of those involved in anti-social behaviour (e.g. graffiti vandals);
 - H. the effect of seasonal changes and school holidays; and
 - I. special events (e.g. New Years Eve).

- (viii) identified hazards and preventative and protective measures;
- (ix) an assessment of all credible scenarios identified in the FEB, and in accordance with the methodology in the agreed FEB, including:
 - A. results of all Quantitative Assessment and Qualitative Assessment;
 - B. all design inputs and assumptions;
 - C. all inputs to risk assessments as agreed during stakeholder workshops; and
 - D. demonstration that the FLS strategy meets the acceptance criteria agreed in the FEB.
- (x) a detailed description of the FLS strategy covering:
 - A. integration with fire safety elements of Rail Infrastructure, rail systems, Rolling Stock and operations;
 - B. means of escape for all occupants including the mobility impaired, including exit routes, travel distances, occupant numbers, exit widths, and fire protection of exit routes;
 - C. fire compartmentation and fire resistance, and Fire Hazard Properties of materials;
 - D. smoke control;
 - E. fire suppression systems, including sprinklers and gaseous suppression;
 - F. automatic fire detection;
 - G. Occupant warning systems;
 - H. emergency lighting and signage;
 - I. firefighting access, facilities and equipment;
 - J. manual firefighting equipment;
 - K. emergency and other power requirements;
 - L. fire incident management including communications protocols and procedures between operators and with Emergency Services; and
 - M. fire related operational requirements, maintenance and housekeeping.
- (xi) a comprehensive description and performance specification of all required Fire Safety Systems to provide sufficient information to other design disciplines to complete a 100% detailed design including:
 - A. Cause And Effect Matrix of required responses for all credible scenarios;
 - B. required redundancies;
 - C. Safety Integrity Level (SIL) ratings (where appropriate);

- D. detail not prescribed in design standards;
 - E. relevant inputs and assumptions that have formed the basis of the assessment; and
 - F. necessary parameters to facilitate the timely certification of Fire Safety Systems to Australian codes and standards.
- (xii) detailed justification for non-compliances with:
- A. the DtS provisions of the BCA;
 - B. ASA standards; and
 - C. Sydney Metro standards.
- (xiii) a detailed description of interfaces with other systems and project elements;
- (xiv) the SFAIRP assessment demonstrating compliance with the Rail Safety (Adoption of National Law) Act 2012; and
- (xv) a document map identifying linkages if the FER is dependent on other reports.
- (g) The CSM Contractor must provide a preliminary interim FER describing the FLS strategy for the design configuration for each phase of construction that addresses fire safety in all parts of Central Station that remain operational during the respective stage of construction. The IFER is to contain the same minimum information as described for the FER in section 2.3 f).
- (h) The CSM Contractor must prepare applications and obtain all necessary FLS related dispensations from ASA standards for areas that will ultimately be owned, operated and maintained by Sydney Trains.

2.4 Design Stage 3

- (a) The CSM Contractor must revise the FER and all interim FER's as appropriate to incorporate comments from project stakeholders, including those listed in section 2.1 b).
- (b) The CSM Contractor must obtain written approval of the FER and all interim FER's from all stakeholders, acting reasonably, listed in 2.1 b) i).
- (c) The CSM Contractor must obtain written approval or a Certificate Of No Objection to the FER and all IFER's from all stakeholders listed in 2.1 b) ii).
- (d) The CSM Contractor must provide testing methodologies and specifications for any fire testing programs necessary to demonstrate the Fire Resistance Levels (FRL) and / or Fire Hazard Properties of any required Fire Safety Systems defined in the Approved FER.
- (e) The CSM Contractor must provide a final FER and all IFER's that, in addition to the requirements of 2.3 f), contains:
- (i) updates in response to stakeholder review comments on the preliminary FER and all IFER's;
 - (ii) DRR's applicable to the preliminary FER and all preliminary interim FER's, including responses and response acceptances to all review comments raised; and

- (iii) copy of all approvals required under 2.4 b) and 2.4 c).
- (f) The CSM Contractor must provide a written report from the Proof Engineer (fire life safety) containing detailed results of their review of the final FER and all final IFER's, including input data, results, and a summary of findings of any Quantitative Assessment, calculations and / or computer modelling undertaken by the Proof Engineer (fire life safety), and an assessment of:
 - (i) any changes to design objectives or design input parameters from the FEB;
 - (ii) appropriateness of the FLS strategy;
 - (iii) compliance with relevant legislation, codes and standards; and
 - (iv) appropriateness of assumptions, engineering methods, analysis and calculations.
- (g) The CSM Contractor must provide the Principal an electronic copy of all input and output files generated for the purposes of smoke modelling, egress modelling, structural fire modelling, radiation modelling, fire brigade response modelling, quantified risk assessment(s) and supporting analysis that form part of the final FER and all final IFER's.
- (h) All documents referenced within the final FER and all final IFER's must be issued to the Principal and the Independent Certifier with the final FER and all IFER's before the FER and all IFER's can be approved by the Principal.

2.4.1 Certification

The CSM Contractor must provide the following certificates (and any supporting documentation as required) to the Principal and the Independent Certifier:

- (a) Certification by the QFE of the fire engineering design as documented in the Approved FER and all Approved IFER's; and
- (b) Certification by the Proof Engineer (fire life safety) of the fire engineering design as documented in the Approved FER and all Approved IFER's.

2.5 Construction, testing and commissioning

- (a) The FER and all IFER's must be approved by the Principal and the Crown Certifier prior to the commencement of any construction that may be affected by the Fire Safety Systems described in the FER and all IFER's.
- (b) During construction the CSM Contractor must as a minimum:
 - (i) undertake site inspections as required to ensure construction and installation of all Fire Safety Systems is in accordance with the FLS strategy requirements as defined in the Approved FER and all Approved IFER's;
 - (ii) undertake and witness commissioning and testing to ensure that all Fire Safety Systems required for the Project Works are constructed, installed and are operational in accordance with the Approved FER and all Approved IFER's, including:
 - A. any testing programs necessary to demonstrate Fire Resistance Levels and / or Fire Hazard Properties; and

- B. active testing to confirm all Fire Safety System responses as defined in the Cause and Effect Matrix contained in the Approved FER and all Approved interim FER's.
- (iii) provide Sydney Trains with input into all operation and emergency response plans and provide all necessary information to Sydney Trains, in their role as chief warden in a fire incident, for Sydney Trains to update their site wide Site Incident Management Plan (SIMP), First Responders Emergency Information Kit (FREIK) and other operational documents as requested by the Principal, to incorporate the Project Works and all interim stages during construction.
- (c) If design changes occur during construction that affect the Approved FER and any Approved IFER's from stage 3 design, then that FER and / or IFER is to be updated and re-approved as per 2.4 b) and 2.4 c).
- (d) The CSM Contractor must provide to the Principal an electronic copy of any modelling and analysis described in 2.4 g) that has been updated during construction.
- (e) The CSM Contractor is to provide briefings and site familiarisations as required, to all operational crews from RERU and local FRNSW stations, on the installed Fire Safety Systems for each construction phase, and at the 100% completion of the Project Works. The CSM Contractor is to comply with all reasonable requests made by RERU and FRNSW during these briefings and site familiarisations.

2.5.2 Certification

- (a) The CSM Contractor must provide the following certification (and any supporting documentation as required) to the Principal and the Independent Certifier if the FER or any IFER has been updated, re-issued and re-approved during Construction Stage:
 - (i) updated certification by the QFE of the fire engineering design as documented in the updated and Approved FER or IFER; and
 - (ii) updated certification by the Proof engineer (fire life safety) of the fire engineering design as documented in the updated and Approved FER or IFER.
- (b) The CSM Contractor must provide certification by the QFE, at the commencement of each phase of construction, that the installed and commissioned Fire Safety Systems meet the requirements of the fire engineering design as documented in the Approved IFER relevant to that phase of construction.
- (c) The CSM Contractor must provide certification by the QFE at the 100% completion of all Project Works relevant to the Fire Safety Systems, that the installed and commissioned Project Works meet the requirements of the fire engineering design as documented in the Approved FER.
- (d) The CSM Contractor must provide certification by the Proof Engineer (fire life safety) at the 100% completion of all Project Works relevant to the Fire Safety Systems, that the installed and commissioned Project Works meet the requirements of the fire engineering design as documented in the Approved FER.

- (e) Certification of the installed and commissioned Project Works by the QFE and the Proof Engineer (fire life safety) cannot be conditional on the satisfactory completion of any works, unless agreed in writing with the Principal.
- (f) Certification of the installed and commissioned Fire Safety Systems by the QFE and the Proof Engineer (fire life safety), as required in section 2.5.2 b), section 2.5.2 c) and section 2.5.2 d), must include sufficient detail and evidence that a thorough inspection has been conducted including:
 - (i) dates of inspections and names of those conducting the inspections;
 - (ii) a breakdown of the elements of the fire strategy inspected. These may have been verified by various means including:
 - A. visual inspection;
 - B. witnessing of fire tests in accredited testing facilities;
 - C. witnessing commissioning of active systems;
 - D. review of test reports, letters of opinion, and installation certificates prepared by others;
 - E. active testing of systems including interlocks between systems (including hot or warm smoke tests); and
 - F. accompanying and witnessing the inspection by others (e.g. FRNSW).

2.6 Fire engineering personnel

2.6.1 Qualified Fire Engineer

- (a) The CSM Contractor must engage an individual to act as the Qualified Fire Engineer (QFE). The QFE must:
 - (i) have a minimum of ten years' experience as a fire engineer in a rail environment;
 - (ii) have undertaken a fire engineering role on at least two projects of a similar nature including underground stations;
 - (iii) have undertaken a fire engineering role on at least two Crown projects in NSW in the last five years;
 - (iv) have undertaken a fire engineering role on at least two rail projects where the Rail Safety National Law applied, as administered by the Office of the National Rail Safety Regulator (ONRSR); and
 - (v) be chartered in the field of fire engineering.
- (b) The QFE is responsible for:
 - (i) leading the fire engineering elements of the design;
 - (ii) planning, preparing, and updating the FEB, FER, all IFER's and all other fire engineering documentation;

- (iii) communicating all necessary information regarding required Fire Safety Systems to other design disciplines so that the Fire Safety Systems are correctly incorporated into the detailed design;
- (iv) coordinating and leading all stakeholder consultation as it relates to the FLS strategy;
- (v) facilitating the approval of the FEB, FER and all IFER's as described in section 2;
- (vi) witnessing the construction of the FLS components of the Project Works;
- (vii) witnessing the installation, testing and commissioning process of the FLS components of the Project Works; and
- (viii) certifying the compliance with the CSM Contractor's Approved FER and all IFER's.

2.6.2 Proof Engineer (fire life safety)

- (a) The CSM Contractor must engage a Proof Engineer (fire life safety) to provide an independent design review and to provide proof certification of the Project Works fire engineering Design Documentation.
- (b) The Proof Engineer (fire life safety) must:
 - (i) be independent of the CSM Contractor and the CSM Contractor's design team including the QFE, and to the satisfaction of the Principal's Representative;
 - (ii) have a minimum of ten years' experience as a fire engineer in a rail environment;
 - (iii) have undertaken a fire engineering role on at least two projects of a similar nature including underground stations;
 - (iv) have undertaken a fire engineering role on at least two Crown projects in NSW in the last five years;
 - (v) have undertaken a fire engineering role on at least two rail projects where the Rail Safety National Law applied, as administered by ONRSR; and
 - (vi) be chartered in the field of fire engineering.
- (c) The Proof Engineer (fire life safety) must:
 - (i) review the FEB and the FER and provide a documented, independent assessment in a written report following the review of the FEB, FER and all IFER's, to the Principal's Representative and Independent Certifier as defined in section 2.3 d) and section 2.4 f);
 - (ii) undertake construction and commissioning reviews, including witnessing commissioning, smoke testing (if required) and fire safety control system integration as necessary to verify that the design intent of the FLS strategy and the fire engineering requirements as defined in the Approved FER are met by the constructed and commissioned Project Works; and

- (iii) provide certification that the designed, constructed and commissioned Project Works meets the fire engineering requirements as defined in section 2.5.2.

- Sydney Metro City & Southwest

 - Central Station Main Works**

 - Schedule C1

- Scope of Works and Technical Criteria
Appendix B06
Heritage Conservation Works

PROJECT	Central Station and Junction Main Works	DATE	1 February 2018
GROUP	Sydney Metro City & Southwest	STATUS	Final
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1 Overview

- (a) This Appendix B06 defines the heritage objectives, implementation measures and performance and technical requirements for the Project Works for the following:
 - (i) conservation, protection and reuse or adaptation of significant heritage fabric;
 - (ii) salvage and recycling of significant fabric to be removed;
 - (iii) archival recording; and
 - (iv) interpretation.
- (b) The implementation measures to achieve the heritage objectives are set out under the following categories:
 - (i) general best practice conservation measures applicable to all elements of the Project Works (section 3); and
 - (ii) specific measures applicable to Central Station and the buildings and other elements that contribute to its heritage significance (section 4).

2 Heritage Objectives

2.1 Heritage objectives

- (a) The heritage objectives for the Project Works are to:
- (i) minimise the adverse impacts on the significant heritage buildings, elements, fabric, spaces and vistas that contribute to the overall significance of Central Station as a place listed on the NSW State Heritage Register;
 - (ii) maximise the retention and legibility of those heritage buildings, structures, fabric, spaces and vistas that are individually significant and contribute to the overall significance of Central Station;
 - (iii) protect all significant heritage buildings, structures, fabric and moveable heritage items proposed to be retained, against damage during the CSM Contractor's Activities;
 - (iv) reuse all retained significant heritage buildings and elements for original or new uses as part of the viable ongoing function of Central Station;
 - (v) design new buildings and other elements of the Project Works to complement retained significant heritage buildings, elements, fabric, spaces and vistas, and avoid outcomes that compromise the significance of these heritage items;
 - (vi) record all significant heritage buildings, fabric, elements, spaces and vistas to be removed or subject to substantial alteration;
 - (vii) salvage and store significant elements, fabric and moveable heritage items for future interpretive or maintenance or repair purposes;
 - (viii) interpret the history and cultural value of Central Station to its future users; and
 - (ix) establish effective procedures and processes for the long-term conservation management of Central Station following the conclusion of the Project Works.

2.2 Heritage scope

- (a) In order to achieve the range of heritage objectives and to achieve an outcome that minimises the adverse impacts on significant heritage buildings, elements, fabric, spaces and vistas, the CSM Contractor must demonstrate within the Design Documentation at each Design Stage, how the following has been addressed:
- (i) compliance with all heritage consent conditions within the Planning Approvals. Evidence of compliance at the conclusion of each Design Stage must be by providing a summary tracking register in the Design Documentation;
 - (ii) identification, retention and appropriate conservation of all heritage buildings, fabric, elements, spaces and vistas proposed to be retained. The CSM Contractor must perform, and provide a report called 'Heritage Impact Assessment (HIA)' with the Design Documentation for each Design Stage, so that the overall trend (either positive or negative) of heritage impact is clearly identified;

- (iii) measures for protection against damage of all heritage buildings, elements, fabric and moveable heritage items to be retained must be contained in the HIA included the Design Stage 3 Design Documentation;
- (iv) development and implementation of a strategy for appropriate adaptive reuse of retained heritage buildings and elements must be prepared prior to commencement of construction works;
- (v) photographic archival recording of Central Station, particularly significant buildings, fabric, elements, spaces and vistas to be removed or subject to substantial alteration, both within and outside the boundaries that define the heritage listed area for the Central Station complex, must be prepared prior to commencement of and during construction works;
- (vi) measured drawings must be prepared for all exceptional or high significance heritage buildings, fabric, elements, spaces and vistas to be removed or subject to substantial alteration. Drawings must be included as an appendix in the final design report;
- (vii) salvage, safe storage and reuse of significant elements, fabric and moveable heritage items must be undertaken for interpretive or maintenance/repair purposes;
- (viii) appointment and utilisation of suitably qualified and experienced heritage professionals to assist the CSM Contractor's project team to achieve the heritage objectives; and

3 General heritage conservation measures

3.1 General

- (a) This section sets out best practice conservation measures applicable to all elements of the Project Works. These measures must be implemented to achieve the best possible conservation outcome for Central Station and the various buildings, elements, fabric, spaces and vistas that contribute to its heritage significance.
- (b) In particular in areas where there is an interface between retained significant buildings, fabric, elements, spaces and vistas and new structures, a design approach using simple forms and restrained, but well resolved, detailing using high quality materials is appropriate.

3.2 Experienced heritage specialists

- (a) Suitably experienced and qualified heritage specialists must be appointed by the CSM Contractor to guide the design, documentation and implementation of the heritage component of the Project Works. The appointments must include, as a minimum:
 - (i) a heritage architect with at least 10 year's demonstrated experience in working with design teams on projects involving major redevelopment of heritage places;
 - (ii) a heritage engineer with at least 10 years' demonstrated experience in working with design teams on projects involving major redevelopment of heritage places and infrastructure;
 - (iii) an archaeologist with at least 10 years demonstrated experience working on urban historical archaeological investigations in NSW; and
 - (iv) a materials conservator with at least 5 years demonstrated experience.
- (b) The heritage specialists must, at a minimum, undertake the following:
 - (i) supervise conservation work, protection and removal of significant fabric, reuse of retained significant heritage buildings and elements, archival recording and interpretation; and
 - (ii) contribute to the detailed design of new buildings and other elements where they interface with those significant heritage buildings, elements, spaces and vistas that are to be retained.

3.3 Heritage Construction Management Plan

- (a) The CSM Contractor must prepare a Heritage Construction Management Plan (HCMP), as required by MR-E to guide the identification, retention, protection, conservation, salvage and reuse of significant heritage elements within the overall Project Works program.
- (b) The HCMP must set out both the methodology and critical stages within the overall Project Works program for the identification, retention, protection, conservation, salvage and reuse of significant heritage elements.

- (c) The preparation of the HCMP must be undertaken by the heritage specialists appointed in accordance with section 3.2.

3.4 Retention of heritage elements

- (a) Prior to the commencement of construction of the Project Works, a detailed inventory must be prepared of all buildings, structures, fabric, spaces and vistas of heritage significance that are to be retained. The inventory must:
 - (i) be prepared by the heritage specialists appointed in accordance with section 3.2;
 - (ii) provide an assessment of the heritage significance of each element and the sub-elements that comprise it;
 - (iii) specify its consequent tolerance for change;
 - (iv) include appropriate recommendations for its conservation, relative to the level of heritage significance; and
 - (v) be approved by the Principal's Representative.
- (b) Based on the inventory of significant heritage elements, a scope of work that comprises conservation, repair and appropriate adaptation work for buildings and other structures to be retained must be prepared and implemented. The heritage specialists appointed in accordance with section 3.2 must review and approve the scope of work and oversee its implementation.
- (c) The scope of conservation work must utilise accepted best practice conservation techniques and traditional materials, as specified by the heritage specialists appointed in accordance with section 3.2, avoiding the use of contemporary sealants, acrylic paints, high strength mortars etc that could result in accelerated deterioration of significant fabric.
- (d) Cleaning of significant retained buildings and other structures to be retained must use non-damaging techniques appropriate to the material and its condition, as specified by the heritage specialists appointed in accordance with section 3.2. Aggressive sand or glass bead blasting or similar techniques would usually not be acceptable.
- (e) Subject to section 3.4(a)(v), unsympathetic elements, alterations or additions assessed by the relevant heritage specialist as not being in keeping with significant buildings, fabric, elements, spaces or vistas may be removed and any damage repaired.
- (f) Where unsympathetic elements, alterations or additions or significant heritage elements proposed for recycling have been removed, any damage to significant fabric must be made good using accepted best practice conservation techniques and traditional materials, as specified by the heritage specialists appointed in accordance with section 3.2.
- (g) The placement and design of new buildings or structures in proximity to significant buildings and other structures to be retained, or within spaces or vistas that have been identified as significant, must consider these and avoid adverse impacts on their heritage significance.

3.5 Protection of retained heritage elements

- (a) Prior to the commencement of construction of the Project Works, detailed measures must be prepared for the protection of all significant heritage buildings, structures and fabric

proposed for retention with the potential to be damaged by construction of the Project Works. The measures for the protection of these elements must be implemented prior to the commencement of the Project Works in their immediate vicinity.

- (b) For elements to be retained in-situ, the measures identified in section 3.5(a) must comprise either the provision of protective covering, screens, barriers etc.
- (c) For elements of moveable heritage, the measures identified in section 3.5(a) must entail careful removal and relocation to a secure storage area in the Greater Sydney area.
- (d) Proposed protection measures identified in section 3.5(a) must be reviewed and approved by the relevant heritage specialist appointed in accordance with section 3.2 and the Principal's Representative prior to implementation.

3.6 Reuse of retained heritage elements

- (a) Central Station will continue to be used for its original purpose as a railway station. However, the use of retained significant buildings and elements may change. Prior to the commencement of construction of the Project Works, the CSM Contractor must prepare a report defining an Adaptive Reuse Strategy for the ongoing use of significant buildings and other structures to be retained. The Adaptive Reuse Strategy must:
 - (i) include a detailed analysis of the external and internal components of significant buildings and other structures;
 - (ii) assess the ability of significant buildings and other structures to contribute to the ongoing functionality of Central Station;
 - (iii) prioritise continued use of significant buildings and elements for their original purpose, or alternatively for the purpose to which they have been adapted where this is compatible with their design, fabric and heritage significance, whilst ensuring the continued use does not:
 - A. result in the removal of significant elements, fabric or design integrity;
 - B. require the subdivision of significant interior spaces; and
 - C. require the addition of obtrusive new elements or signage.
 - (iv) where it is not practicable to continue to use these significant buildings and elements for their original or later compatible purpose, ensure that the proposed new use is compatible with their design, fabric and heritage significance, and does not:
 - A. result in the removal of significant fixtures, fabric or design integrity;
 - B. require the subdivision of significant interior spaces; and
 - C. require the addition of obtrusive new elements or signage.
 - (v) be reviewed and approved by the heritage specialists appointed in accordance with section 3.2; and
 - (vi) be submitted to the Principal's Representative for approval prior to implementation.
- (b) Where it is not practicable to use identified elements for any viable purpose that is compatible with their design, fabric and heritage significance, the CSM Contractor must

undertake necessary conservation work to secure and protect elements against damage pending their possible future reuse.

3.7 Salvage and recycling of heritage fabric

- (a) The CSM Contractor must undertake salvage and recycling of significant heritage elements and fabric in accordance with the Sydney Metro Chatswood to Central; Metro Heritage Salvage and Storage Policy.
- (b) Where significant elements are to be removed and not reinstated, these elements must be salvaged and safely stored for future reuse, repair and maintenance or for heritage interpretation purposes.
- (c) The salvage and recycling of significant heritage elements and fabric must be supervised and approved by the relevant heritage specialist appointed in accordance with section 3.2.

3.8 Photographic archival recording

- (a) The CSM Contractor must prepare a detailed methodology for photographic archival recording of the affected elements of Central Station and immediate context that:
 - (i) outlines the proposed approach to capturing all the significant heritage elements being recorded; and
 - (ii) includes the use of annotated plans to show the points from which the images were taken.
- (b) The CSM Contractor must undertake the following photographic archival recording activities:
 - (i) general photographic archival recording, including the capture of images from key points within and outside the heritage listing boundary, showing the relationship of the impacted significant buildings and elements in the context of Central Station as a whole and within their streetscape;
 - (ii) detailed photographic archival recording of the interiors and exteriors of Exceptional, High or Moderate significance buildings and elements identified for removal, or subject to substantial alteration;
 - (iii) recording of the exterior only of significant buildings and elements that are being retained with no change of use, but with a change of setting owing to the Project Works; and
 - (iv) a similar methodology to that described in sections 3.8(b)(i) to section 3.8(b)(iii) is required for key spaces and vistas subject to change.
- (c) The CSM Contractor must undertake photographic archival recording in accordance with:
 - (i) NSW Heritage Council guideline “Photographic Recording of Heritage Items Using Film or Digital Capture” (2006); and
 - (ii) NSW Heritage Office publication “How to Prepare Archival Records of Heritage Items” (1998).

- (d) The CSM Contractor must undertake documentary research to obtain, if possible, original drawings of the buildings and elements to be removed or altered and include them as part of the archival recording.

3.9 Measured drawings

- (a) A detailed inventory must be prepared that lists the buildings and elements to be recorded as a part of a measured drawing set.
- (b) Measured drawings must be prepared for all significant buildings and elements to be removed.
- (c) In the event that original drawings are available, the CSM Contractor may use these as an alternative to the requirements of section 3.8(b), but must confirm that the original drawings are consistent with the actual construction of the buildings and elements in question.

3.10 Interpretation

- (a) The CSM Contractor must prepare and submit, for approval of the Principal's Representative, a Heritage Interpretation Plan (HIP). The HIP must document the story of the development of Central Station and its contribution to the development of the broader Surry Hills/Chippendale/Ultimo/Haymarket context through to the present day. The Heritage Interpretation Plan must include a review of all existing interpretation so that a consistent approach can be developed for Central Station precinct.
- (b) The CSM Contractor must develop an interpretation methodology that delivers the outcomes identified in the Heritage Interpretation Plan. This methodology must be approved by the Principal's Representative and the relevant heritage specialist appointed in accordance with section 3.2.
- (c) The CSM Contractor must submit a list of items that will be subject to this interpretation methodology for the approval of the Principal's Representative.
- (d) Interpretation is likely to be undertaken in a number of stages, in accordance with accepted methodology. It would include the following
 - (i) Stage 1 would comprise the preparation of an interpretation strategy, based on historic research, development of themes, identifying potential audiences and possible media formats, and preliminary concept development;
 - (ii) Stage 2, the Heritage Interpretation Plan would comprise content development, formulation of text and selection of images, and the design of the media or installations; and
 - (iii) Stage 3 would comprise the actual installation of the interpretive media.
- (e) Interpretation at Central Station must recognise and utilise the significant buildings, structures, fabric and spaces to tell the story of the evolution of the station and the role these elements have played in that process.
- (f) Where practicable, interpretation must utilise relevant material or elements salvaged from the demolition of buildings and other structures. The use of salvaged material or elements for in-situ interpretation must take precedence over delivery of the material to the Principal's Representative for the repair and maintenance of other stations.

- (g) The CSM Contractor must undertake documentary research to obtain, if possible, original drawings of Central Station as part of the interpretation methodology.

3.11 Long-term conservation management

- (a) Prior to completion of the Project Works, an updated Central Station listing nomination form (refer to attachment C) must be prepared by the CSM Contractor in consultation with all relevant stakeholders including the Heritage Division under the authority of the Heritage Council of NSW).
- (b) The listing nomination form must include all information relating to changes made to Central Station (within the Central Station curtilage) as a result of the CSM Contractors Activities and include a revised assessment of significance for elements that are altered as a result of the CSM Contractors Activities. As built drawings may be included to provide additional information.
- (c) The CSM Contractor must submit the listing nomination form to the Heritage Council of NSW and obtain their endorsement for the proposed changes to the listing.



4 Central Station heritage conservation measures

4.1 General

- (a) The CSM Contractor must note that the existing Central Station complex as a whole is of State heritage significance, is listed as a heritage item on the State Heritage Register, and must be substantially retained and conserved. The CSM Contractor must implement the heritage conservation measures outlined in this section, in addition to the general heritage conservation measures identified in Section 3, to achieve the best possible heritage conservation outcome for Central Station and the various buildings, structures, fabric, spaces and vistas that contribute to its heritage significance.

4.2 Heritage design

- (a) The placement and detailed design of the North-South Concourse, East Concourse, Eastern Entrance, platforms and related infrastructure works and other structures must consider and minimise impacts on significant heritage buildings, fabric, elements and spaces, as well as key views from within and outside Central Station.
- (b) The detail design of new infrastructure must be compatible with the retained significant heritage buildings and elements in its immediate vicinity. In these situations, a design approach that provides a compatible and contemporary interface between the new and the old, avoiding a historicist replication of the latter, would be generally appropriate.
- (c) The design of all new infrastructure elements must be of high architectural quality and use materials that continues the tradition of design innovation and excellence through the earlier main phases of development at Central Railway Station.
- (d) Where new infrastructure elements (for example canopies) are required to be connected to retained significant heritage buildings and elements, these connections must be designed to avoid damage to the fabric of the retained items, and be reversible.

4.3 Retention of heritage elements

- (a) The elements directly affected by the Project Works that are to be retained in-situ and conserved in accordance with section 3.4 must include, as a minimum:
- (i) retained sections of the canopies to Intercity Platforms 8-11 except for the sections required to be altered to by the Project Works;
 - (ii) retained section of the canopies to the Suburban Platforms 16-23, except for the sections required to be altered to accommodate new vertical transportation and other services;
 - (iii) any items on connecting canopies section between the Grand Concourse roof and Intercity Platforms 8-11 canopies, including arched latticework and cast-iron columns;
 - (iv) basic fabric and geometry of brick faced platforms to Intercity platforms 8-11;

- (v) brick fabric and geometry of Suburban platforms 16-23, except for the sections that are altered by the Project Works, sections where brick fabric has been removed must be reinstated as per existing conditions;
 - (vi) North Concourse, except for the section required to be removed for connection to the North-South Concourse;
 - (vii) ESR Concourse, except for the section required to be removed for connection to the East Concourse;
 - (viii) subway passage tunnels except for the section required to be removed for the Metro Box;
 - (ix) Devonshire Street Tunnel, except for the section required to be removed for construction of the North-South Concourse;
 - (x) eastern brick boundary wall fronting the Chalmers Street public domain (excluding any sections to be removed and reinstated); and
 - (xi) Prince Alfred Sewer, located within the Sydney Yard Cess Area;
- (d) The work set out under section 4.3 must be supervised by the heritage specialists appointed in accordance with section 3.2. The CSM Contractor must engage other specialist expertise required for the conservation work.

4.4 Protection of retained heritage elements

- (a) The CSM Contractor must take particular care to avoid impact and vibration damage to the retained significant buildings and elements that could be susceptible to damage from construction works.
- (b) The methodology used by the CSM Contractor for demolition and construction of new structures must avoid vibration that could cause damage to retained significant heritage elements.
- (c) The CSM Contractor must erect hoardings or screens to protect retained significant buildings or elements susceptible to damage.

4.5 Heritage design guidelines

- (a) Design a new connection from the North South Concourse that is a compatible and contemporary transition to the heritage fabric and spatial qualities of the North Concourse.
- (b) Design a new Intercity Concourse canopy that is a high quality contemporary element to express the contextual place of the Project Works while being compatible with the broader Central Station.
- (c) Design new platforms 12-14 and canopies as high quality contemporary elements that express the contextual place of the Project Works while being compatible with the broader Central Station platforms context.
- (d) Design a contemporary connection from the East Concourse to the ESR Concourse as a compatible transition to the heritage fabric and spatial qualities of the ESR Concourse.
- (e) Design the new canopies to Intercity platforms 12-14 as contemporary elements that express the contextual place of the Project Works while being compatible with the broader Central Station platforms context.

- (f) Design the integration of necessary rail systems, such as overhead wiring, to be compatible with existing fabric of retained significant canopies.
- (g) Resolve the junction detailing between retained and new canopies to achieve an overall high quality and integrated canopy complex, avoiding as far as practicable direct connections between the new and the old.
- (h) Integrate high quality contemporary design new lifts and escalators to Suburban Platforms 16-23, while minimising direct interventions or penetrations to retained significant canopies, level changes around significant retained stairs, column bases and other significant elements.
- (i) Investigate and remove all redundant services attached to platform canopies. As far as practicable, consolidate services and allow for the future expansion of service needs.
- (j) Retain, and where subject to intervention, support during the Project Works and reinstate affected sections of the eastern brick boundary wall of Central Station within the Chalmers Street public domain.
- (k) Stabilise and conserve the original subway passage tunnel where retained and at the point of intersection with the North South Concourse.
- (l) Provide opportunities for limited access to and interpretation of the original subway passage systems from within the North South Concourse.
- (m) Design the proposed new Chalmers Street entrance to the station to be compatible with the other heritage items in the immediate vicinity in terms of scale, street wall alignment and architectural language.
- (n) Reinstate the basic geometry and spatial continuity of section of the Devonshire Street Tunnel temporarily removed for construction of the North South Concourse.
- (o) Confirm the location of and implement measures to avoid impacts on the Prince Alfred Sewer, located within the Sydney Yard Cess Area.
- (p) New services such as security cameras and lighting must, as far as practicable:
 - (i) be attached to new elements rather than significant heritage fabric or be attached in a sympathetic manner as approved by the heritage specialists;
 - (ii) be rationalised according to need and number;
 - (iii) where services must be attached to significant fabric, use existing penetrations in preference to disturbing significant fabric; and
 - (iv) ensure new cabling is concealed rather than surface-mounted.

4.6 Salvage and recycling of heritage fabric

- (a) The CSM Contractor must undertake salvage and recycling of significant heritage elements and fabric that are required to be removed during the Project Works.
- (b) Elements to be salvaged may include, but are not limited to the following:
 - (i) joinery (including doors, windows and architraves);
 - (ii) hardware and metalwork;
 - (iii) balustrades

- (iv) indicator boards, clocks, communications equipment & other functional elements;
 - (v) roof tiles;
 - (vi) fireplaces;
 - (vii) bricks and sandstone; and
 - (viii) structural wall and roof timbers.
- (c) A preliminary Salvage Register for significant elements is attached to this Appendix B06 as Attachment A (Sydney Metro, Chatswood to Sydenham (CSM Works)—Salvage Register) but does not include every such element that will be displaced by the Project Works. The CSM Contractor must comply with the recommendations and instructions included in this register, but must also prepare a comprehensive Salvage Register for all significant elements to be displaced using the same criteria prior to any removal, and implement the appropriate recommendations and instructions.
- (d) The CSM Contractor must carefully remove, protect and transport all salvaged stored items to a Principal's facility, in accordance with the comprehensive Salvage Register. This facility will be in the Greater Sydney area.
- (e) The work set out under section 4.6(d) and section 4.6(e) must be supervised and approved by the relevant heritage specialist appointed in accordance with section 3.2.

4.7 Archival recording

- (a) In accordance with section 3.8(b)(ii), detailed photographic archival recording must be undertaken of the following:
- (i) Intercity Platforms and canopies 12-15, to be removed for the Metro Station box;
 - (ii) Sections of the canopies to Intercity Platforms 11-14 to be removed and replaced with new canopies;
 - (iii) Sections of the canopies to Suburban Platforms 16-23 to be altered to accommodate new vertical transportation and other services;
 - (iv) Suburban Platforms 16-23, to be regraded and new finishes and services installed;
 - (v) The existing canopy over the Intercity Concourse, to be removed and replaced;
 - (vi) Sections of subway passage tunnels to be removed for the Metro Station box;
 - (vii) Sydney Yard Garden (as defined in the CMP), to be removed;
 - (viii) Rolling Stock Officers Building, to be removed;
 - (ix) Cleaners Amenities Building, to be removed;
 - (x) Original connecting stairs from the Grand Concourse to the North Concourse;
 - (xi) 'Entrance to City Railway' signage, if required to be relocated;
 - (xii) Former MGM Building located at 20-28 Chalmers St (interior and exterior), to be removed.

4.8 Measured drawings




- (a) Measured drawings must be prepared for all significant buildings and elements to be removed (including buildings listed on the Sydney LEP 2012 as items of Local significance), including:
- (i) Former MGM Building located at 20-28 Chalmers St;
 - (ii) Rolling Stock Officers Building; and
 - (iii) Cleaners Amenities Building.




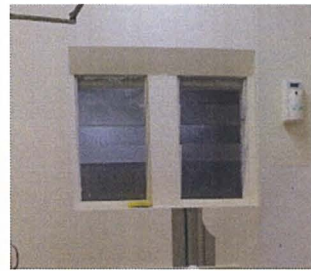
ATTACHMENT A

Sydney Metro, Chatswood to Sydenham (CSM Works)—Salvage Register





Guide Notes and Scope of Work—CSM Works Contractor




- All Items noted for salvage must be tagged, with the ID reference as noted in the Reference/Tag ID column of the register, prior to removal from the site.
- Delivery location, tracking and receipt (by Transport for NSW or Local Councils) of an item must be recorded by the CSM Contractor.
- Items noted for transport to storage located at 87 -103 Espon Rd Roseberry NSW 2018, or any other location instructed by the Principal, must be loaded transported and unloaded by the demolition contractor. Transport for NSW will take possession of the item after it is unloaded and will be responsible for storage and movement within the store.
- Unless it is otherwise noted in the 'Special Protection/ Methodology required' column of the Salvage Register, a methodology for salvage is not required to be submitted. When a salvage methodology is required to be submitted for approval, it must be submitted not less than 10 days prior to scheduled removal of the item. Unless otherwise noted, special packaging and additional protection is not required.
- The CSM Contractor must take reasonable care during removal and transport of all elements, however the Principal acknowledges that intact recovery of some items may not be possible, for example pressed metal ceilings and tiled surfaces.
- The CSM Contractor must advise the Principal, prior to its removal, if in its opinion an item is likely to be significantly damaged during salvage (beyond minor damage incurred during its removal). Significant damage means that it would no longer be suitable for reuse, incurs structural damage or would require major cosmetic repair. The Principal at its discretion may request a detailed methodology and or issue instructions to engage a specialist for removal of an item. This would apply to items of State significance only (refer to the 'Heritage Listing' column of the Salvage Register).





Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
21/03/2017	Sydney Yard, Central Station	Cen/Ext/H1	Rolling Stock Officers Building	Entrance, Ground Level	Entrance doors and fan light above	4	State	Local Significance and could be made available to Sydney Trains for reuse. If Sydney Trains does not have a use, the item could be made available for use by the local community.	Good	No	-		Central TSE	Salvage and deliver to Metro Store	
21/03/2017	Sydney Yard, Central Station	Cen/Ext/H2	Rolling Stock Officers Building	Throughout the exterior of the building	Steel windows and fixtures	4	State	Local Significance, see comment above for Cen/Ext/H1.	Good	No	Steel windows are in good condition, however many are painted shut. Conservation work to make the windows operable should be deferred until a use is established.		Central TSE	Salvage and deliver to Metro Store	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H1	Rolling Stock Officers Building	Ground floor beneath staircase	Light fitting under stair, 'Wiggan Brand'	3A	State	Local significance, illustrating the use of industrial fixtures in rail buildings.	Good	No	-		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	




Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
21/03/2017	Sydney Yard, Central Station	Cen/Int/H2	Rolling Stock Officers Building	First floor	Timber skirtings	4	State	Local Significance, see comment above for Cen/Ext/H1.	Good	No	-		Central TSE	Salvage and deliver to Metro Store	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H3	Rolling Stock Officers Building	First floor	Canvas fabric and timber and steel stretcher	3A	State	Local significance, evidence of past practices of customer and staff care.	Good	No	-		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H4	Rolling Stock Officers Building	First floor	Original timber and glazed internal doors to locker room & northern room of offices	4	State	Local Significance, see comment above for Cen/Ext/H1.	Good	No	-		Central TSE	Salvage and deliver to Metro Store	
21/03/2017	Sydney Yard, Central Station	Cen/Ext/H3	Rolling Stock Officers Building	First floor	Fixed glass louvres in upstairs bathrooms	4	State	Local Significance, see comment above for Cen/Ext/H1.	Good	No	-		Central TSE	Salvage and deliver to Metro Store	


Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
21/03/2017	Sydney Yard, Central Station	Cen/Int/H6	Rolling Stock Officers Building	First floor	Sliding door configuration to stairwell	4	State	Local Significance, see comment above for Cen/Ext/H1.	Good	No	Entire sliding door configuration including fixed glazed panels to sides and above. Particular care should be taken regarding the removal and storage of the track system.		Central TSE	Salvage and deliver to Metro Store	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H8	Cleaners Amenities Building	Ground floor workshops	Rail carpet runner steam cleaning equipment	3A	State	State significant as rare custom made machinery for the maintenance of the railways. May have been manufactured at Eveleigh Workshops. Every effort should be made to make the machinery publicly accessible through permanent or temporary display.	Fair	Yes	Detailed analysis and documentation of the system is required prior to disassembly and storage.		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	Methodology to be submitted prior to removal. Load to pallet to transport pallet retained by STH
21/03/2017	Sydney Yard, Central Station	Cen/Int/H9	Cleaners Amenities Building	Ground floor workshops	Air vacuum pumps associated with the rail carpet runner steam cleaning equipment	3A	State	State significant as rare custom made machinery for the maintenance of the railways. May have been manufactured at Eveleigh Workshops. Every effort should be made to make the machinery publicly accessible through permanent or temporary display.	Good	Yes	Detailed analysis and documentation of the system is required prior to disassembly and storage. The pumps are mounted on mass concrete footings, detailed measurements should be gathered to make reassembly possible.		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	Methodology to be submitted prior to removal. Load to pallet to transport pallet retained by STH



Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
21/03/2017	Sydney Yard, Central Station	Cen/Int/H12	Cleaners Amenities Building	Ground floor	Workshop items including steel locker	3A	State	Local significance as illustrating past maintenance activities associated with the railways.	Good	No	All moveable items tagged by Sydney Trains Heritage should be salvaged and stored.		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H13	Cleaners Amenities Building	Ground floor	Glass carrying equipment and moveable workshop items as tagged by Sydney Trains	3A	State	Local significance as illustrating past maintenance activities associated with the railways.	Good	No	All moveable items tagged by Sydney Trains Heritage should be salvaged and stored.		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H14	Cleaners Amenities Building	Ground floor	Internal doors throughout ground floor as tagged by Sydney Trains (simple boarded style)	4	State	Local Significance, see comment above for Cen/Ext/H1.	Fair	No	-		Central TSE	Salvage and deliver to Metro Store	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H15	Cleaners Amenities Building	Ground floor	Bevelled mirror w/ NSW Railways logo etched in bottom left corner	3A	State	Local significance, as evidence of the changing institutional arrangements in the management of the railways.	Good	No	The mirror is fixed to the wall, possibly using glue. Every effort should be made to remove the mirror intact.		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	


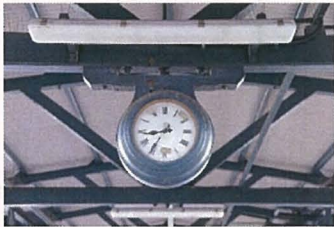
Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
21/03/2017	Sydney Yard, Central Station	Cen/Int/H16	Cleaners Amenities Building	Ground floor	Employee Bundy Clocks (digital)	3A	State	Local significance, as evidence of changing workplace practices.	Good	No	-		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H17	Cleaners Amenities Building	Ground floor (above Bundy clocks)	Wooden employee notice board	3A	State	Local significance.	Good	No	Identified by Sydney Trains.		Central TSE	Salvage and deliver to Metro Store	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H18	Cleaners Amenities Building	Ground floor storage room under central stairs	Old set carriage seats	3A	State	Local significance, as evidence of changing train carriage detailing and fitout.	Fair	No	All moveable items tagged by Sydney Trains Heritage should be salvaged and stored.		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	



Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
21/03/2017	Sydney Yard, Central Station	Cen/Int/H19	Cleaners Amenities Building	Ground Floor (in ladies change room and shower)	Long wooden bench seat	3A	State	Local significance, as evidence of early railway furniture.	Good	No	Identified by Sydney Trains.		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H20	Cleaners Amenities Building	Ground floor (meal room)	Wooden notice board (painted)	3A	State	Local significance.	Good	No	Identified by Sydney Trains.		Central TSE	Salvage and deliver to Metro Store	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H21	Cleaners Amenities Building	First floor toilets/showers	Bathroom mirrors with NSW Rail & Track Corporation logo	3A	State	Local significance, as evidence of the provision of staff facilities as part of the railway operations.	Good	No	Identified by Sydney Trains.		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H23	Cleaners Amenities Building	First Floor	Doors throughout (various styles from a range of periods)	4	State	Local Significance, see comment above for Cen/Ext/H1.	Fair	No	Identified by Sydney Trains.		Central TSE	Salvage and deliver to Metro Store	




Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
21/03/2017	Sydney Yard, Central Station	Cen/Ext/H4	Cleaners Amenities Building	Ground floor and first floor	Timber 4 pane double hung sash windows throughout	4	State	Local Significance, see comment above for Cen/Ext/H1.	Good	No	The exterior timber windows have recently been restored. Any further conservation work should be deferred until an intended use is established.		Central TSE	Salvage and deliver to Metro Store	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H26	Cleaners Amenities Building	First Floor	Wooden Employee Notice Board	3A	State	Local significance.	Good	No	Identified by Sydney Trains.		Central TSE	Salvage and deliver to Metro Store	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H27	Cleaners Amenities Building	First Floor	Wooden Employee Notice Board	3A	State	Local significance.	Good	No	Identified by Sydney Trains.		Central TSE	Salvage and deliver to Metro Store	
21/03/2017	Sydney Yard, Central Station	Cen/Int/H28	Cleaners Amenities Building	First floor	Cast iron wall hung sinks with cast iron bracket (x 2 on 1st floor)	3A	State	Local significance, as evidence of the provision of staff facilities as part of the railway operations.	Good	No	Identified by Sydney Trains.		Central TSE	Remove and deliver to Sydney Trains Heritage Store in Bankstown	

Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
21/03/2017	Sydney Yard, Central Station	Cen/Ext/H5	Garden	Sydney Yard	Plastic station seating	3A	State	Local significance. The cream seating and blue chairs located to the east of the Cleaners Amenities Building may originate from the Eastern Suburbs Line stations. The chairs should be retained and reused.	Good	No	-		SYAB	Remove and deliver to Sydney Trains Heritage Store in Bankstown	
21/03/2017	Sydney Yard, Central Station	Cen/Ext/H6	Shunters Hut	Sydney Yard, west beyond buildings	Shunters Hut	3A	State	Local significance as a component of Central Station. Pre-cast concrete Shunters Hut are common throughout the network. Further consultation should be undertaken with Sydney Trains heritage to determine the value of this element and whether salvage is warranted.	Poor	Yes	Remove asbestos cement cladding to roof prior to storage. For extant examples still in use throughout the network, it is common for the roofing material to be replaced with corrugated iron sheeting.		SYAB	Following hazmat removal this item is to be relocated within the Central yard site. Location to be agreed (operations, design and heritage) and will be noted in the Heritage Interpretation Plan.	Methodology to be submitted prior to removal

Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
13/04/2017	Central Station	Cen/Ext/A1	Central	Country and Interstate Platforms 12/13	Original timber platform canopies 12/13 and later steel extension	3A	State	State significant as an historic component of the original Sydney Terminus configuration.	Good		Canopies, including timber trusses, hardwood timber columns, iron brackets and ties, skylights, roofing configuration, cast iron downpipes, decorative valance boards and equivalent elements in the steel extension section to be carefully disassembled and stored for the duration of the project according to the approved methodology. Platform canopies to be reconstructed and reinstated in full at the conclusion of Sydney Metro works.		Central TSE	Deliver to Sydney Metro Store	
13/04/2017	Central Station	Cen/Ext/A2	Central	Country and Interstate Platforms 12/13	Platform signage and bracket, Platforms 12/13	3A	State	Local significance as an historic component of the original Sydney Terminus configuration	Good		Metal signage and bracket to be carefully dismantled, salvaged and stored for the duration of the project and reinstated within reconstructed canopies.		Central TSE	Deliver to Sydney Metro Store	

Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
13/04/2017	Central Station	Cen/Ext/A3	Central	Country and Interstate Platforms 12/13	Metal balustrade to subway stairs, Platforms 12/13	3A	State	Locally significant as an historic component of the original Sydney Terminus configuration	Good	No	Salvage and reconstruct balustrade as part of reconstruction of Platform 12/13 ?		Central TSE	Deliver to Sydney Metro Store	
13/04/2017	Central Station	Cen/Ext/A4	Central	Country and Interstate Platforms 12/13	Early clock and bracket	3A	State	Locally significant as an early component of the original Sydney Terminus configuration and a component of the large collection of railway clocks and timekeeping devices held by Sydney Trains.	Good	No	Clock and bracket to be carefully dismantled, salvaged and stored for the duration of the project and reinstated within reconstructed canopies.		Central TSE	Deliver to Sydney Trains Store	

Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
13/04/2017	Central Station	Cen/Ext/A5	Central	Country and Interstate Platforms 14/15	Platform canopies, Platforms 14/15	3A	State	State significant as an historic component of the original Sydney Terminus configuration.	Good	No	As per recommendations for Platform 12/13-Canopies, including timber trusses, hardwood timber columns, iron brackets and ties, skylights, roofing configuration, cast iron downpipes, decorative valence boards and equivalent elements in the steel extension section to be carefully disassembled and stored for the duration of the project according to the approved methodology. Platform canopies to be reconstructed and reinstated in full at the conclusion of Sydney Metro works.		Central TSE	Deliver to Sydney Metro Store	
13/04/2017	Central Station	Cen/Ext/A6	Central	Country and Interstate Platforms 14/15	Platform signage and bracket, Platforms 14/15	3A	State	Locally significant as an historic component of the original Sydney Terminus configuration	Good	No	Metal signage and bracket to be carefully dismantled, salvaged and stored for the duration of the project and reinstated within reconstructed canopies.		Central TSE	Deliver to Sydney Metro Store	

Date of Inspection	Location	Reference/Tag ID	Site Name	Item Location	Item Name	Category	Heritage Listing	Justification/Heritage Significance	Condition	Treatment required prior to transport and storage (Y/N)	Recommendations	Photo	Contract	Metro Instructions	Special Protection/ Methodology required
13/04/2017	Central Station	Cen/Ext/A7	Central	Country and Interstate Platforms 14/15	Remnant goods lift, platforms 14/15	3A	State	Locally significant as an historic component of the original Sydney Terminus configuration		No	Deconstruction, salvage and reinstatement (?)		Central TSE	Deliver to Sydney Metro Store	
13/04/2017	Central Station	Cen/Ext/A8	Central	Platform access area between 12/13 and 14/15	Early clock and bracket	3A	State	Locally significant as an historic/early component of the original Sydney Terminus configuration	Unknown	No	Clock and bracket to be carefully dismantled, salvaged and stored for the duration of the project and reinstated within reconstructed canopies.		Central TSE	Deliver to Sydney Trains Store	
21/03/2017	Sydney Yard, Central Station	Cen/Ext/H6	Shunters Hut	Sydney Yard, west beyond buildings	Shunters Hut	3A	State	Local significance as a component of Central Station. Pre-cast concrete Shunters Hut are common throughout the network. Further consultation should be undertaken with Sydney Trains heritage to determine the value of this element and whether salvage is warranted.	Poor	Yes	Remove asbestos cement cladding to roof prior to storage. For extant examples still in use throughout the network, it is common for the roofing material to be replaced with corrugated iron sheeting		Central TSE	Following hazmat removal this item is to be relocated within the Central yard site. Location to be agreed (operations, design and heritage) and will be noted in the Heritage Interpretation Plan.	

ATTACHMENT B – not used



ATTACHMENT C

State Heritage Register Nomination Form

Guide Notes and Scope of Work—CSM Works Contractor

- Before completing this form, read the Guideline for Nominations to the State Heritage Register.



Transport
for NSW

- Sydney Metro City & Southwest

 - Central Station Main Works**

 - Schedule C1

- - Scope of Works and Technical Criteria
 - Appendix B07
 - Sustainability Requirements

PROJECT	Sydney Metro City & Southwest	DATE	1 February 2018
GROUP	Sydney Metro City & Southwest	STATUS	Final
AUTHOR	Transport for NSW	REVISION	2.0
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00000458
FILE NAME	Central Station Main Works (CSM) SWTC App B07		

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1 General

1.1 Introduction

- (a) This Appendix B07 contains the sustainability requirements that the CSM Contractor must comply with. These requirements relate to the Project Works and Temporary Works and are in addition to the Management Requirements - Sustainability (MR Sy) which describes requirements and processes in relation to the management of sustainability related aspects for the project.

1.2 Scope

- (a) The CSM Contractor must:
- (i) deliver on the sustainability requirements across the key themes outlined in the Sydney Metro City & Southwest Sustainability Strategy including:
 - A. governance;
 - B. climate change resilience;
 - C. carbon and energy management;
 - D. community benefit;
 - E. water efficiency;
 - F. waste and materials;
 - G. heritage conservation;
 - H. biodiversity conservation;
 - I. pollution control;
 - J. liveability; and
 - K. supply chain;
 - (ii) implement design and construction initiatives which contribute to the CSM Contractor meeting the sustainability targets included in this SWTC and MR Sy;
 - (iii) implement design and construction initiatives which are included in the Sustainability Management Plan; and
 - (iv) use the Infrastructure Sustainability Council of Australia's IS Rating Tool and the Green Building Council of Australia's Green Star Rating Tool to achieve the minimum ratings specified in MR Sy.

2 Performance and Technical Requirements

2.1 Climate Change

- (a) The CSM Contractor must implement design and construction initiatives to ensure compliance with the climate change risk mitigation requirements included in the MR-Sy.

2.2 Carbon Management and energy efficiency

- (a) The CSM Contractor must implement design and construction initiatives to ensure compliance with the greenhouse gas emission reduction target included in the MR Sy.
- (b) For those activities where ISCA IS Ratings are required, The CSM Contractor must achieve or exceed the following ISCA IS Rating Scheme Version 1.2 credit requirements:
 - (i) Level 2 for credit Ene-1 'Energy and carbon monitoring and reduction target' demonstrating a greenhouse gas emissions reduction of 20 % below a base case footprint; and
 - (ii) Level 1 credit Ene-2 'Use of renewable energy' to fully investigate opportunities for use of renewable energy.
- (c) The CSM Contractor must provide design and as-built inputs to the Operator's operational Electricity Consumption Software Model, at a frequency and timing to be agreed with TfNSW.
- (d) The CSM Contractor must ensure that refrigerants and fire suppression systems within temporary site facilities and permanent infrastructure have zero ozone depletion potential and a low or zero global warming potential.
- (e) The CSM Contractor must ensure that all vehicles, plant and equipment, are:
 - (i) selected and operated for optimum energy efficiency;
 - (ii) not left idling when not in use;
 - (iii) fitted with catalytic converters, diesel particulate filters or equivalent devices where reasonable and feasible; and
 - (iv) well maintained and serviced in accordance with relevant equipment maintenance documentation to reduce emissions due to poor engine performance.
- (f) The CSM Contractor must ensure that, the energy efficiency of all new plug-in electrical equipment within any site facilities meets the minimum standards outlined in the NSW Government Resource Efficiency Policy 2014 requirement E3 "Minimum standards for new electrical appliances and equipment".

- (g) The CSM Contractor must use a minimum 5% bio diesel mix for all diesel powered plant and equipment and a minimum 10% blended ethanol mix for all petrol powered plant and equipment wherever possible.
- (h) The CSM Contractor must identify and implement opportunities for using onsite sources of renewable energy during the CSM Contractor's Activities.
- (i) The CSM Contractor must provide a photovoltaic (PV) system integrated within the reinstated or new canopies as part of the Project Works that:
 - (i) produces a minimum 450 kW array peak power output; and
 - (ii) is connected to the Central Station LV distribution network constructed as part of the Project Works.
- (j) The CSM Contractor must ensure all eligible PV rebate applications are submitted on behalf of Sydney Trains, unless directed otherwise by Sydney Trains.
- (k) The Metro Station must be designed to achieve a minimum 15% improvement over a reference station based on Section J minimum performance requirements as defined by the National Construction Code Building Code of Australia (NCC BCA). The 15% design improvement and reference station must include all building related energy end uses (excluding process, communication and specialist equipment energy loads).
- (l) Central Station Works and Central Walk Works must be designed to achieve a minimum 15% improvement over a reference case based on Section J minimum performance requirements as defined by the National Construction Code Building Code of Australia (NCC BCA). The 15% design improvement and reference case must include all building related energy end uses (excluding process, communication and specialist equipment energy loads).

2.3 Community benefit

- (a) The CSM Contractor must ensure that metering and data collection equipment and systems are able to provide real-time information on the generation and consumption of renewable energy at the Metro Station, and interface with other Interface Contractor's public information display and communication systems.

2.4 Resource – water

2.4.1 Water efficiency

- (a) The CSM Contractor must minimise water demand management including total water consumption and potable water consumption during the construction phase by:
 - (i) using water efficient controls, fixtures and fittings;
 - (ii) harvesting rainwater wherever available;
 - (iii) using water from recycled water networks where available; and
 - (iv) collecting, treating and reusing stormwater and wastewater.

- (b) For those activities where ISCA IS Ratings are required, the CSM Contractor must achieve or exceed the following ISCA IS Rating Scheme Version 1.2 credit requirements:
 - (i) Level 2 for credit Wat-1 'Water use monitoring and reduction', demonstrating a reduction in water use of 10% compared to a base case footprint; and
 - (ii) Level 1 for credit Wat-2 'Replace potable water', demonstrating that at least 33% of water used is from non-potable sources. If it is demonstrated by the Contractor, to the satisfaction of the Principal's Representative, that achieving Level 1 for credit Wat-2 is not economically viable, or requires the supply of water from outside the site boundary, then this requirement will be waived.
- (c) The CSM Contractor must not use potable water as a substitute for non-potable water where on-site or local sources of non-potable water are suitable for the CSM Contractor's Activities and are available.
- (d) The CSM Contractor must ensure that new and extended roofs and canopies drain to any existing and functioning Central Station rainwater harvesting tanks and associated recycled water network.
- (e) The CSM Contractor must connect new toilets and irrigation systems to any existing and functional Central Station recycled water network.
- (f) The CSM Contractor must ensure that all construction equipment requiring water is selected taking into account the water efficiency of the equipment and associated construction methodology.
- (g) The CSM Contractor must ensure that water efficient construction methods are described in all construction method statements to be applied by the CSM Contractor.
- (h) For water used in onsite and offsite concrete batching plants which supply the CSM Contractor's Activities:
 - (i) The CSM Contractor must ensure that 80% of offsite and onsite batching plant concrete production operation water is recycled and incorporated into concrete production; and
 - (ii) Suspended solids content of recycled concrete production water must be controlled such that the water density is less than 1.01 g/mL and the suspended solids content does not exceed 15,000 ppm.

The CSM Contractor must pass requirements relating to concrete production operation water down through its supply chain.

2.4.2 Water sensitive urban design

- (a) The CSM Contractor must adopt an integrated approach to urban water cycle management during design and construction to minimise impacts on stormwater quality.
- (b) The integrated approach must achieve:

- (i) a reduction in potable water demand through the use of rainwater and/or greywater where a reticulated reuse is not available, and adopt the use of water efficient appliances and fittings;
 - (ii) a reduction in wastewater generation;
 - (iii) stormwater quality targets which are suitable for either reuse or discharge into local streams and waterways; and
 - (iv) a maximum use of stormwater in the urban landscape.
- (c) The CSM Contractor must demonstrate in the Design Documentation how it will achieve a reduction in urban stormwater pollutants in accordance with **Table 1**.

Table 1 Urban stormwater pollutants

Pollutant	Requirement
Litter	Retention of litter greater than 50mm for flows up to 50% of the 1 year ARI peak flow.
Coarse Sediment	Retention of sediment coarser than 0.125mm for flows up to 50% of the 1 year ARI peak flow.
Oil and Grease	In areas with concentrated hydrocarbon deposition, no visible oils for flows up to 50% of the 1 year ARI peak flow.

2.4.3 Water monitoring and Information Systems

- (a) The CSM Contractor must meter water supply from recycled water networks and potable sources for the CSM Contractor’s Activities.

2.5 Resource – waste and materials

2.5.1 Waste

- (a) The CSM Contractor must ensure that at least 95% of inert and non-hazardous construction and demolition waste, excluding spoil, and at least 60% of office waste generated during the CSM Contractor’s Activities is recycled or alternatively beneficially reused.
- (b) The CSM Contractor must identify and implement opportunities for recycling and reuse of non-putrescible general solid wastes (other than construction and demolition waste and office waste) during the CSM Contractor’s Activities.
- (c) The CSM Contractor must negotiate and implement packaging take-back arrangements with suppliers.
- (d) The CSM Contractor must use compostable or reusable temporary erosion control devices where practicable.
- (e) The CSM Contractor must provide recycling facilities within the Site where practicable.
- (f) The CSM Contractor must include the following waste management measures in the development of the Design Documentation:

- (i) co-mingled recycling bins adjacent to all general waste bins within all areas accessible by customers and in BOH Areas;
- (ii) separate bins for storage of specialist waste streams, including oil, electrical and electronic waste, and equipment waste; and
- (iii) sufficient on-site storage space for the safe storage of recyclable waste and general waste prior to collection for treatment and disposal.

2.5.2 Materials

- (a) Materials used by the CSM Contractor for the CSM Contractor's Activities must comply with the requirements set out in the MR Sy.
- (b) The CSM Contractor must undertake life-cycle assessments in accordance with the requirements of MR Sy, and must use the results of the assessments to inform the selection and use of materials during design and construction.
- (c) For those activities where ISCA IS Ratings are required, The CSM Contractor must achieve or exceed the following ISCA IS Rating Scheme Version 1.2 credit requirements:
 - (i) Level 2 for credit Mat-1 'Materials footprint measurement and reduction', demonstrating a 20% reduction in materials lifecycle impacts compared to a base case footprint.
- (d) The CSM Contractor must use recycled and recyclable materials where possible, without compromise to the structural integrity, longevity and visual quality of materials and structures.
- (e) The CSM Contractor must use reusable formwork where practicable.

2.5.3 Volatile Organic Compounds

- (a) The CSM Contractor must use low Volatile Organic Compounds (VOC) paints, finishes, sealants and adhesives and zero or low formaldehyde emission composite wood products (as defined in the Green Star Design and As Built Rating Tool) in the CSM Contractor's Activities.
- (b) All surface coatings used by the CSM Contractor must comply with the Australian Paint Approval Scheme (APAS) Volatile Organic Compounds Limits where fit for purpose (to be agreed with TfNSW).
- (c) All paint products must comply with the following table for maximum Total Volatile Organic Compounds (TVOC).

Product Type/Sub Category	Max TVOC content (g/l of ready-to-use product)
Walls and ceilings – interior semi gloss	16
Walls and ceilings – interior low sheen	16
Walls and ceilings – interior flat washable	16
Ceilings – interior flat	14

Product Type/Sub Category	Max TVOC content (g/l of ready-to-use product)
Trim – gloss, semi gloss, satin, varnishes and woodstains	75
Timber and binding primers	30
Latex primer for galvanised iron and zincalume	60
Interior latex undercoat	65
Interior sealer	65
One and two pack performance coatings for floors	140
Any solvent-based coatings whose purpose is not covered in table	200

- (d) All adhesives and sealants must comply with TVOC emissions limits in the following table.

Product Type	Maximum TVOC content (g/litre of product)
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and Laminate adhesive	100
Rubber flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Dry Wall and Panel adhesive	50
Multipurpose construction adhesive	70
Structural glazing adhesive	100
Architectural sealants	250

2.5.4 Spoil management

- (a) The CSM Contractor must identify and implement initiatives to both reduce spoil quantities which will be generated during the performance of the CSM Contractor’s Activities and beneficially reuse 100% of reusable spoil, including topsoil.
- (b) The CSM Contractor must where appropriate reuse site-won materials onsite.

2.6 Biodiversity conservation

- (a) The CSM Contractor must minimise clearance of vegetation, particularly native vegetation.
- (b) The CSM Contractor must undertake any landscaping and revegetation works as soon as practicable.

2.7 Pollution control

- (a) The CSM Contractor must identify and implement pollution control initiatives in design and construction which target zero major pollution incidents.
- (b) The CSM Contractor must, where practicable, ensure that all excavators and mobile cranes used for the CSM Contractor's Activities, which are onsite for more than three months, comply with USEPA Tier 4 exhaust emission standards.

3 Design Documentation Requirements

- (a) Sustainability must be addressed by the CSM Contractor within Design Documentation for all relevant design packages at each Design Stage.
- (b) The CSM Contractor must produce estimates of operational electricity consumption at each of the Design Stage 1, Design Stage 2 and Design Stage 3. The estimates must include a breakdown of electricity consumption, by system, and document the assumptions which have been used in the development of the estimates.
- (c) The CSM Contractor must produce climate change impact assessment reports at Design Stage 1, Design Stage 2 and Design Stage 3 which demonstrates how climate change risks have been mitigated in design.
- (d) The CSM Contractor must produce life-cycle assessment reports at Design Stage 1, Design Stage 2 and Design Stage 3 which describes how life-cycle assessment has been used as a decision making tool for material selection and sourcing and design to minimise life cycle environmental impacts.
- (e) The CSM Contractor must produce completed Green Star Design and As Built Refrigerants Impacts Calculator for all station heating, ventilation, air conditioning and refrigerant (HVAC&R) systems at Design Stage 2 and Design Stage 3.
- (f) At Design Stage 2 and Design Stage 3, the CSM Contractor must produce Design Documentation demonstrating that the Project Works have been designed to achieve a minimum 15% improvement over relevant reference cases based on Section J minimum performance requirements as defined by the National Construction Code Building Code of Australia (NCC BCA). The 15% design improvement and reference cases must include all building related energy end uses (excluding process, communications and specialist equipment energy loads) and:
 - (i) where works are classified under a particular NCC BCA, Design Documentation must include energy simulation modelling and associated reporting against minimum performance requirements. Design Documentation provided at Design Stage 2 must be updated throughout design to reflect changes;
 - (ii) where works are not classified under a particular NCC BCA building classification, appropriate NCC BCA Section J benchmarks must be used to determine the minimum performance benchmark and improvements must be demonstrated by energy simulation modelling or detailed calculations; and
 - (iii) the hourly use profiles and the relative levels for occupancy, energy consuming systems and equipment such as artificial lighting, air-conditioning, ventilation, lifts and internal transport devices, domestic hot water and variable energy using systems and equipment such as computers, Datacom equipment and machinery must be developed, tested for appropriateness and stated within the CSM Contractor's energy simulation and/or calculations provided.

- (g) The CSM Contractor must produce a quarterly sustainable design report which includes:
- (i) a compliance table which shows the status of compliance with sustainability requirements from this Appendix B07 and the MR Sy which are addressed in design;
 - (ii) evidence of how the sustainable design initiatives achieve the targets in MR Sy and this Appendix B07;
 - (iii) a graphical representation of the achievement of sustainability targets in MR Sy and this Appendix B07;
 - (iv) illustrations of key sustainability initiatives;
 - (v) evidence to show where climate change mitigation and adaptation measures or changes have been implemented in design;
 - (vi) scoring achieved using the Green Star and ISCA's IS Rating Tool 'Design' Rating including supporting completed checklists and scorecards;
 - (vii) demonstration of progress toward achieving ISCA Ene-1, Ene-2, Mat-1, Wat-1 and Wat-2 credits;
 - (viii) details of where low carbon initiatives have been implemented in the design and construction of the Project Works and Temporary Works;
 - (ix) initiatives which have been implemented to minimise the embodied carbon emissions of concrete mixes which will be used in the Project Works and Temporary Works;
 - (x) updates on sustainable procurement activities which have been completed in the quarter; and
 - (xi) a demonstration and description of innovative sustainable design initiatives.

4 Sustainability Manager

- (a) The CSM Contractor must provide a Sustainability Manager who must:
- (i) possess a recognised qualification relevant to the position and the CSM Contractor's Activities and have recent relevant experience in sustainability management on projects similar to the Project Works;
 - (ii) have at least five years' sustainability management experience in the design and construction of sustainable infrastructure or buildings;
 - (iii) be available as the Principal's Representative's primary contact with the CSM Contractor on sustainability matters;
 - (iv) be responsible for and have the authority to develop and implement the Sustainability Management Plan; and
 - (v) be engaged, with responsibilities limited to sustainability management of the CSM Contractor's Activities:
 - A. full-time during the execution of the CSM Contractor's Activities, from the date of the Contract through to the completion of Design Stage 3; and
 - B. part-time (a minimum of 0.5 full-time equivalent) from the end of Design Stage 3 until the time of Construction Completion of the last Portion; and
 - C. following Construction Completion of Portion 3, and until the time of Construction Completion of the last Portion, the responsibility for sustainability management may be undertaken by a sustainability engineer with a minimum of 2 years relevant sustainability experience.

- **Sydney Metro City & Southwest**

- Central Station Main Works**

- Schedule C1

- **Scope of Works and Technical Criteria**
Appendix B09
Customer Centred Design (CCD)
Requirements

PROJECT	Central Station Main Works	DATE	15 June 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.0
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00000297
FILE NAME	Central Station Main Works (CSM) SWTC App B09		

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1 Overview

- (a) This Appendix B09 describes:
 - (i) the performance and technical requirements for Customer Centred Design (CCD) outcomes; and
 - (ii) the process requirements in relation to the application of CCD through the design development process.

2 Requirements

2.1 General

- (a) The CSM Contractor must place the customer at the centre of all design decisions that impact upon customer experience outcomes. The CSM Contractor must acknowledge that the engagement of customers in the design process is critical in providing assurance that solutions are fit for purpose.
- (b) Where there is a customer interface or where constraints exist that impact upon the customer experience, the CSM Contractor must be able to demonstrate through options analysis and testing that proposed design solutions:
 - (i) maximise to the greatest extent possible, the needs of all customer segments (as defined in section 2.2(a) (iii) and section 2.2(a)(iv));
 - (ii) are socially inclusive; and
 - (iii) do not preclude the operator(s) from meeting their obligations under legislation including DDA and DSAPT.
- (c) The CSM Contractor must comply with the requirements of the CCD process defined in this Appendix B09 in the design and delivery of any design package that provides a customer-facing element, or facilitates the delivery of a customer service.
- (d) Where the design and delivery of Project Works requires the interaction and/or integration between more than one area of scope (e.g. Help Point design, placement, signage and operation), the CSM Contractor must:
 - (i) co-ordinatedesign solution(s) across design packages;
 - (ii) incorporate operator(s) input;
 - (iii) apply the CCD process to ensure customer issues are identified and addressed; and
 - (iv) demonstrate how the design solution(s) applies across the full door-to-door journey.

2.2 Incorporation of customer service principles in design and operation

- (a) The CSM Contractor must incorporate the TfNSW customer service principles in the design and construction of the Project Works. These include:
 - (i) **Balanced:** Functional performance is balanced with customer service to achieve high levels of customer satisfaction. To ensure that the solution *balances* the needs of customers, the CSM Contractor must demonstrate:
 - A. how the design aligns with relevant operator(s) Station Operations Management Plan / Interchange Access Plans, including:
 - the Sydney Metro operator;
 - Sydney Trains;

- NSW Trains;
 - Bus operators;
 - Light Rail operators; and
 - RMS.
- B. any aspects of the proposed solution where operational measures will be required to deliver on the customer outcomes; and
- C. alternative design options that may negate the requirement for operational measures.
- (ii) **Efficient assisted self-service:** A self-service system that is designed for easy intuitive use. Where assistance may be required, support is available and easy to get. To ensure that the solution supports efficient assisted self-service the CSM Contractor must demonstrate how the principle of efficient assisted self-service has been interpreted and incorporated into the design solution in a way that:
- A. delivers a socially inclusive design;
 - B. facilitates interchanging from all access/egress modes;
 - C. promotes assistance-free travel for all who want it; and
 - D. facilitates timely and effortless access to assistance for those who require it.
- (iii) **Universally accessible:** Meets the needs of all members of the community with service features that accommodate the distinct needs of customer segments. The CSM Contractor must demonstrate that the full range of customer segments has been addressed in the Project Works. The customer segments are defined by the following characteristics:
- A. demographic factors, including:
 - age-related considerations; and
 - gender-related considerations.
 - B. physical access considerations, including:
 - mobility impairment;
 - visual and auditory impairments;
 - families with young children;
 - customers travelling with carers or assistance animals;
 - customers travelling with bulky items; and
 - customers with medical conditions (e.g. diabetics).
 - C. cognitive impairment factors.
- (iv) **Flexible:** Able to adapt to a range of typical usage patterns and service whilst delivering a consistent level of service outcomes. To ensure that the solution is flexible, the CSM Contractor must demonstrate that the design and operations it facilitates, addresses a range of usage patterns by

different customer segments. These include consideration and allowance for:

- A. customer segments that relate to the customer's jobs to be done, including:
 - Meeters: customers that use the station environment as somewhere to act as a meeting place, where they can wait in comfort and safety for others before continuing their journey.
 - Homers: customers for whom the purpose of the journey is to return home at the end of their day – whether that is after school, work or a social activity.
 - Taskers: customers that are using the public transport system as an enabler to completing tasks and errands.
 - In-timers: customers for whom the focus of their trip is to be somewhere by a specific time. In-timers are sensitive to delays and indirect paths of travel.
 - Out and abouters: customers for whom the journey is a part of the activity.
- B. cultural and linguistically diverse (CALD) customers;
- C. customers familiar or unfamiliar with the station;
- D. time of travel (note, the reference to CBD in the below is not intended to suggest that the focus should solely be on CBD journeys):
 - Early AM (pre-7am arrival in CBD);
 - AM peak (7am-10am arrival in CBD);
 - Interpeak (10am-12pm arrival in CBD; 12pm-3pm departure from CBD);
 - PM peak (3pm-7pm departure from CBD);
 - Early evening (7pm-10pm departure from CBD);
 - Late evening (post-10pm departure from CBD); and
 - Weekend.
- E. operational modes which are:
 - Normal Operations;
 - Abnormal Operations;
 - Degraded Operations; and
 - Emergency Operation.
- F. unplanned demand surges.

- (v) **Legible and consistent:** Reflects a service style and tone that is easily understood and consistent with the experience of an integrated transport

network. The CSM Contractor must demonstrate how the design addresses the following TfNSW policy and guidelines. These guidelines include:

- A. Wayfinding Planning Guide Introduction;
- B. TfNSW Branding Guidelines;
- C. Sydney Metro City & Southwest Public Art Master Plan;
- D. TfNSW SSM Placement Guidelines;
- E. Sydney Metro Easy Door-to-door-to-door Journey Map; and
- F. Sydney Metro Easy Customer Principles.

(vi) **Responsive:** A service system open to feedback from customers that adjusts over time as needs and preferences change, and continuously improves. To demonstrate that the solution is responsive, the CSM Contractor must demonstrate:

- A. any and all facets of the Project Works that provide future-proofing for long-term customer growth; and
- B. any and all facets of the Project Works that provide flexibility in how Central Station and Metro Station areas might be used to deliver customer-facing solutions (e.g. provision for pop-up retail, temporary art etc.).

2.3 Operational customer outcomes

- (a) The CSM Contractor must work with the operator(s) to understand the proposed customer service, operational and maintenance approaches for the Project Works.
- (b) The CSM Contractor must demonstrate that the design and delivery of the Project Works incorporates, supports and facilitates the operator(s) in delivering the following timeliness outcomes for customers, including:
 - (i) journey time will be consistent, and transit to customers destinations will help them to make the most efficient use of their time;
 - (ii) customers will have confidence of service availability through international best practice for reliability; and
 - (iii) overall travel times will be minimised, including walk-up access and the time taken to transfer between cars, light-rail, buses, taxis and bicycle facilities.
- (c) The CSM Contractor must design and deliver Project Works to enable the operator(s) to deliver personal safety and security outcomes for customers by providing:
 - (i) stations, Station Precinct(s), Public Domain and trains will incorporate environmental design principles and service features that give customers a high degree of confidence about personal safety and security in accordance with crime prevention through environmental design principles (CPTED); and
 - (ii) effective lighting and active Station Precincts that enhance passive surveillance and facilitate a safe customer environment.

- (d) The CSM Contractor must deliver Project Works that enable the operator(s) to provide customers with the following ticketing outcomes:
 - (i) a consistent ticketing system and service across all transport modes through the implementation of the Electronic Ticketing System (ETS); and
 - (ii) seamless connections across public transport modes, facilitating multi-modal journeys that are not dependant on the car.
- (e) The CSM Contractor must deliver the Project Works that enable the operator(s) to provide customers with the following convenience outcomes:
 - (i) facilities provided across public transport modes, car parks and Interchanges that are part of integrated Station Precincts;
 - (ii) amenities at stations have well-located facilities; and
 - (iii) secondary revenue opportunities (such as retail and advertising) are appropriate to the social expectations of the local community and reflect the NSW Government's public policy outcomes.
- (f) The CSM Contractor must design and construct Project Works that enable the operator(s) to deliver the following accessibility outcomes to customers:
 - (i) the Station Precinct integrates pathways, cycle paths, Kiss and Ride areas and other transport facilities;
 - (ii) the system provides the benchmark for compliance with requirements for disability access in public transport; and
 - (iii) customers' special needs, whether cognitive, physical or sensory, and when travelling with children or handling luggage, are accommodated by the operation of the Project Works.
- (g) The CSM Contractor must provide comfort features and facilities in stations and Station Precinct including shelter, seating and service amenities for customers.
- (h) The CSM Contractor must deliver Project Works and Temporary Works ensuring that the station and Station Precinct materials, fixtures and fittings are kept clean and maintain a high quality appearance at all times.
- (i) The CSM Contractor must provide a design that safeguards the infrastructure for the effective cleaning and maintenance by the Operator, contributing to the customer's feeling of comfort and safety, as well as their satisfaction with the standard of cleanliness.
- (j) The CSM Contractor must deliver Project Works that enable the operator(s) to provide customers with the following information outcomes:
 - (i) wayfinding and signage helps customers to navigate the transport network easily and intuitively, and is consistent with the TfNSW wayfinding system;
 - (ii) customers get accurate, reliable real-time information as they need it to help them use the transport network and be properly informed;
 - (iii) customers are kept informed to help them work out how to get to their final destination if a service is disrupted; and
 - (iv) infrastructure that provide information about the services the system provides and are fully integrated into customer information channels.

- (k) The CSM Contractor must deliver Project Works which enable the Operator(s) to provide the following customer service outcomes;
 - (i) assist those with special needs, respond to questions about the transport system and ETS, and provide advice on connecting services and locality information;
 - (ii) accurate, prompt and responsive service, particularly when delays occur and during Abnormal Operations; and
 - (iii) understanding of the accepted norms for social behaviour on the system.

3 Customer centred design process

3.1 Application of Customer Centred Design (CCD) methodology

- (a) To facilitate the effective application of CCD, the CSM Contractor must use an iterative design process that delivers a CCD report associated with the design at the following points in time:
- A. at 50% completion of each Design Stage; and
 - B. at the end of each Design Stage.
- (b) The CSM Contractor must apply CCD to iterate the design based on relevant customer engagement and insights garnered throughout each Design Stage.
- (c) The CSM Contractor must use a CCD process that is aligned with the following stages:
- (i) **Understand:** The CSM Contractor must demonstrate an advanced knowledge of global trends and innovations relevant to the context of the design. The CSM Contractor must demonstrate the use of this knowledge to inform the proposed customer interaction and how this interaction is reflected in the design.
 - (ii) **Empathise:** The CSM Contractor must demonstrate its understanding of the needs of the people for whom it is designing and the customer outcomes to be delivered.
 - (iii) **Define:** The CSM Contractor must demonstrate its understanding of the problems to be solved for each customer segment as defined in section 2.2(a)(iii) and section 2.2(a)(iv). The CSM Contractor must demonstrate how its design focuses on problem solving for each customer segment and how the CSM Contractor will make specific design decisions based on those needs identified in the Empathise stage of the CCD process.
 - (iv) **Ideate:** The CSM Contractor must demonstrate that it provides and participates in independently facilitated ideation sessions in conjunction with TfNSW and third parties to explore all possible solutions for customers in solving anticipated customer problems in the proposed designs. The CSM Contractor must provide independent facilitation to ensure the integrity of the process and that idea generation and idea evaluation are maintained as separate activities. The CSM Contractor must demonstrate whether the global trends and innovations (identified in the Understand stage of the CCD process stage) are suitable as solutions to address anticipated customer needs identified in the Empathise phase.
 - (v) **Prototype:** The CSM Contractor must undertake prototyping (both low fidelity and high fidelity) in the iteration of its design. The CSM Contractor must demonstrate how the prototype contributes to the journey experience for each customer segment in addressing the needs identified in the earlier Empathise, Define and Ideate CCD process stages.

- (vi) **Test:** The CSM Contractor must undertake customer testing, using prototypes at each Design Stage. In these testing rounds the CSM Contractor must capture all feedback provided by customers to TfNSW and provide evidence of how this feedback is being used to refine the CSM Contractors design for the Project Works.
 - (vii) **Synthesise:** The CSM Contractor must synthesise the findings from the customer testing against the Contract requirements. Through this process, the CSM Contractor must identify any requirements that conflict with the achievement of customer outcomes, require clarification, or are potentially not required.
 - (viii) **Refine:** Following feedback and review of findings supplied by the CSM Contractor, from the Synthesis stage of the CCD process, TfNSW may instigate a Change.
- (d) The CSM Contractor must establish a Customer Reference Panel (CRP) for the purposes of customer interaction that is:
- (i) comprised of members of the public who are external to, and independent of, any entity involved in the Sydney Metro City & Southwest Project;
 - (ii) reflective of the demographic and customer segments defined in section 2.2(a)(iii) and section 2.2(a)(iv) relevant to the Project Works; and
 - (iii) of not less than 60 people and of sufficient depth to allow for patterns and themes of customer behaviour to be identified to support design decisions.
- (e) The CSM Contractor must undertake customer testing through the CRP against the customer service principles (as detailed in section 2.2) to demonstrate that the design solution is fit for purpose and that design excellence is achieved.
- (f) The CSM Contractor must demonstrate through customer testing with the CRP during design that the customer outcomes (as detailed in section 2.3) are able to be realised in operation.
- (g) The CSM Contractor must undertake customer testing of the design through the CRP against the Sydney Metro Easy Customer Principles (Easy Principles) to provide evidence through attitudinal feedback that customers agree that the designs promote an easy journey experience. The 'Easy Principles' that must be tested include:
- (i) **Understood:** designs demonstrate awareness and appreciation of customers requirements for certainty, safety and value by providing easy and effective transport experiences that match specific needs and wants as outlined in section 2.2.
 - (ii) **Confident:** designs demonstrate a clear appreciation for the integrated service offerings available through Sydney Metro. Customers are assured that they can trust Sydney Metro to provide dependable, safe and secure solutions that meet individual needs as part of a timely and comfortable journey.
 - (iii) **Informed:** designs provide easy access to clear, accurate, relevant and up-to-date information at appropriate points in the journey and through convenient channels that enable pro-active journey planning, execute

against plans and share details with others to easily achieve personal goals with the least amount of effort, confusion and with minimal disruption.

- (iv) **Guided:** designs provide solutions that show customers the best way to get to their destination, in order to get there in time, with the least amount of frustration, stress or uncertainty by directing, instructing and managing flow, crowding or impediments. It also means helping customers resolve any problems that might be encountered that might negatively impact on the overall experience.
- (v) **Reliable:** designs provide solutions that provide an effective frequency of integrated services that meet customer needs, whilst dependably collecting and delivering according to scheduled times that enables customers to successfully manage their commitments and life.
- (vi) **Valued:** designs facilitate effective transport solutions that can be accessed with the minimum amount of effort, at the right times and through convenient channels that truly respects customer's time. In addition, safety, security, health and wellbeing are all being considered and provided for in the design and delivery of services and customer facilities.
- (vii) **Controlled:** designs empower customers with the necessary knowledge and ability to make choices. It means reducing uncertainty and stress by allowing customers to play an active role in journey management. Providing advanced notice of problems with guidance and real-time updates that keep customers informed gives the freedom to update arrangements with others that may be impacted by the situation.
- (viii) **Connected:** designs bring customers closer to the people and things that are most important to them. A more effective transport solution provides a vital contribution to meeting customers interpersonal needs including a sense of belonging, self-esteem, friendship, love and security. Being connected is an integral enabler and a key component of the broader community experience.
- (h) The CSM Contractor must ensure that during any testing activities involving the CRP that participants are informed that what is being interacted with is a prototype and whilst input will inform the refinement of solutions, that ultimately the final solution may be considerably different to that shown in the session.
- (i) The CSM Contractor must include the following questions at all rounds of customer testing:
 - (i) Based on what you have seen today, on a scale of 1 to 10 – where 0 is not at all likely and 10 is extremely likely – please rate how likely you would be to recommend Sydney Metro to others?
 - (ii) What was the main reason for your rating?
- (j) The CSM Contractor must incorporate relevant 'Customer Pain Points' in its CCD process at each Design Stage. 'Customer Pain Points' include:
 - (i) customer flow and conflict at:
 - A. Gatelines;
 - B. top and bottom of all Vertical Transport, including stairs;

- C. junctions of concourses and precincts;
 - D. in front of information points including ticket machines, information cases, PIDS, vending machines;
 - E. at critical changes of direction; and
 - F. in front of PSDs.
- (ii) placement of, and security around:
- A. toilets; and
 - B. bike storage.
- (iii) ease of interchange, in particular, between public transport modes.
- (k) The CSM Contractor must incorporate any relevant 'Customer Pain Points' nominated by the Principal's Representative in addition to those listed in section 3.1(j), in its CCD process at each Design Stage. Relevance will be determined by:
- (i) whether it is the appropriate point in the design process for the CSM Contractor to reasonably address the issue identified; and
 - (ii) the ability of the CSM Contractor to adequately address the 'Customer Pain Points' without requiring known amendments to contractual requirements.
- (l) The CSM Contractor must apply its CCD process in tandem with the Design Stages for all other parts of the design.

3.2 Development and provision of plans

3.2.1 CCD Design Management Plan

- (a) Within 60 days of the commencement of the Contract the CSM Contractor must provide its CCD Design Management Plan and submit to the Principal's Representative and Independent Certifier for approval.
- (b) The CCD Design Management Plan must be used by the CSM Contractor to define the process for embedding customer engagement across all relevant design processes for the Project Works and must:
 - (i) identify all design packages where customer touch-points exist and where the CCD process will be applied;
 - (ii) detail how customer input, feedback and validation will be incorporated at, and between, each Design Stage;
 - (iii) how the CSM Contractor will ensure an appropriate cross-section and quantum of CRP members are engaged at each Design Stage to avoid individual bias in feedback;
 - (iv) how the CCD lead will work collaboratively with design managers across the design process; and
 - (v) detail the governance structure, roles and decision rights of parties within the CSM Contractor to ensure CCD is embedded within the organisation's design and decision making processes for the Project Works.

3.2.2 Design package CCD implementation plans

- (a) At least 20 days before the commencement of each Design Stage for each design package, the CSM Contractor must submit to the Principal's Representative and Independent Certifier a Design Package CCD Implementation Plan.
- (b) The Design Package CCD Implementation Plan must, detail and describe the proposed CCD methodology for each design package, including:
 - (i) which elements of the design are going to be tested using CCD and why, including any identified 'Customer Pain Points' (in accordance with section 3.1(k), supported by evidence from the 'Understand' phase, as per section 3.1(c)(i);
 - (ii) how the application of the methodology will address the requirements of sections 3.1(e), 3.1(f) and 3.1(g);
 - (iii) how the inter-relationship between product, services, systems and spaces is to be addressed; and
 - (iv) any change in methodology, between iterations of the design or between different stages of the design process and supporting rationale.

3.3 CCD capability

- (a) The CSM Contractor must have demonstrated capability in CCD as a core capability within the team. Demonstrated capability for the purpose of this Appendix B9 is defined as:
 - (i) a minimum 10 years' experience applying a recognised CCD methodology in product and service design; and
 - (ii) at least 3 examples from the last 5 years where CCD has been used successfully in a project of significant value (>\$100m) to influence and maximise customer outcomes.



**Transport
for NSW**

Sydney Metro City & Southwest

Central Station Main Works

Schedule C1

Scope of Works and Technical Criteria
Appendix B10
Wayfinding and Signage

PROJECT	Central Station Main Works	DATE	15 June 2017
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1 Overview

1.1 General

- (a) This Appendix B10 describes the technical and performance requirements for wayfinding for the Project Works.
- (b) The TfNSW Wayfinding System includes all of the elements that support customers to use and navigate the transport network, including printed maps and customer information, static signs, digital signs, audible signs and information, ground markings and other elements as described in the TfNSW Wayfinding Planning Guide and Kit of Parts, as may be updated from time to time.
- (c) This Appendix B10 should be read in conjunction with the requirements of:
 - (i) Management Requirements – Technical
 - (ii) SWTC Appendix B01 – Civils and Structural
 - (iii) SWTC Appendix B03 – Architectural and Urban Design
 - (iv) SWTC Appendix B04 – Mechanical and Electrical
 - (v) SWTC Appendix B09 – Customer Centred Design

2 Requirements

2.1 General

- (a) The CSM Contractor must:
- (i) plan, procure and install signage and wayfinding assets in accordance with the TfNSW Wayfinding System in all customer-facing areas of the Project Works;
 - (ii) design, procure and install a signage and wayfinding system to all non-customer-facing areas that meets the requirements of relevant operators, building codes and other statutory requirements; and
 - (iii) procure, install and manage temporary wayfinding measures during construction to ensure customers are able to safely and efficiently navigate areas impacted by Project Works.
- (b) The CSM Contractor must ensure that signage schemes are contemporary and relevant to customers at the commencement of operations, reflecting the expectations and requirements of customers that is present-day. To achieve this, the CSM Contractor must:
- (i) provide flexibility for signage at all design stages, to allow signage schemes to be adjusted or new sign types and requirements to be included during construction;
 - (ii) identify opportunities for innovation in the application of signage and wayfinding, based on the needs of the station environments, world's best practice, and customer requirements;
 - (iii) collaborate with TfNSW to develop new signage elements and wayfinding solutions, for incorporation into the TfNSW Wayfinding System;
 - (iv) integrate the signage and wayfinding requirements with other elements of the station environment; and
 - (v) use the most current versions of the Wayfinding Planning Guide and Kit of Parts at all stages of the Project.
- (c) The CSM Contractor must develop a fully integrated signage and wayfinding application that integrates the Sydney Trains requirements with the new Metro requirements for all customer facing and operational signs seamlessly throughout the station(s) and transport interchange(s) in accordance with the TfNSW Wayfinding Planning Guide and Kit of Parts, including:
- (i) station entry, concourses and platforms;
 - (ii) areas within the existing station environment which are impacted by the new Metro requirements;
 - (iii) bus stops, taxi stands, Kiss and Ride bays, bike storage, parking and other transport mode areas within each station and transport interchange;

- (iv) Station Precinct; and
 - (v) other general advisory and information signage regarding wayfinding.
- (d) The CSM Contractor must undertake the design, manufacture, supply and installation of all general, safety and statutory signage to augment, upgrade and replace the general, safety, statutory and street signage throughout the station(s), transport interchange(s) and adjacent streets in accordance with Codes and Standards (and the Principal's and Authority (including the local council) requirements), including:
- (i) all safety and emergency signage;
 - (ii) all statutory signage;
 - (iii) fire hydrant and hose reel signs;
 - (iv) street signs and traffic control signs;
 - (v) removal and disposal of all redundant signage;
 - (vi) repairs and reinstatement of all surfaces and substrates from which existing signage is removed, to match the surrounding surfaces; and
 - (vii) any other signage requirements in this SWTC.

2.2 Wayfinding and signage in customer-facing environments

- (a) The CSM Contractor must apply the TfNSW Wayfinding System in all customer-facing areas of the Project Works.
- (b) The CSM Contractor must procure and install TfNSW Wayfinding System-related assets from a supplier on an agreed panel provided by TfNSW.
- (c) The CSM Contractor must procure and install any necessary signage to ensure compliance with relevant Codes and Standards, statutory regulations and the Principal's and Authority (including the local council) requirements.

2.3 Wayfinding and signage planning in non-customer-facing environments

- (a) The CSM Contractor must implement a wayfinding and signage system in non-customer-facing areas that:
 - (i) complies with relevant Codes and Standards, statutory regulations and the Principal's and Authority (including the local council) requirements;
 - (ii) is not based on the customer-facing TfNSW Wayfinding System, signage or graphics;
 - (iii) complies with the design requirements outlined in Appendix B03;
 - (iv) complies with Sydney Trains requirements in non-customer-facing areas of the Project Works operated and maintained by Sydney Trains; and
 - (v) complies with the Operator's requirements in non-customer-facing areas of the Project Works operated and maintained by the Operator.

- (b) All wayfinding and signage assets must be appropriately tagged and recorded in the asset management system (AMI).

2.4 Construction signage

- (a) The CSM Contractor must apply and install temporary wayfinding during construction in accordance with the TfNSW Disruption Wayfinding guidelines.

3 Process

3.1 Development and provision of plans

3.1.1 Wayfinding design management plan

- (a) The CSM Contractor must appoint the wayfinding Project Manager within 30 days of the commencement of the Delivery Phase.
- (b) Within 60 days of the commencement of the Delivery Phase, the CSM Contractor must provide its initial Wayfinding Design Management Plan and submit to the Principal's Representative and Independent Certifier for approval.
- (c) The CSM Contractor must submit a revised Wayfinding Design Management Plan for approval by the Principal's Representative within 30 days of receiving feedback from the Principal's Representative on the initial Wayfinding Design Management Plan.
- (d) Further revisions to the Wayfinding Design Management Plan must be submitted at the conclusion of Design Stage 1 and Design Stage 2 for review and approval by the Principal's Representative in accordance with the Contract.
- (e) The Wayfinding Design Management Plan must be used by the CSM Contractor to define the process for addressing customer and non-customer facing wayfinding requirements in each Design Stage:
 - (i) for customer-facing elements, detail how:
 - A. the TfNSW wayfinding team will be engaged during, and between, each Design Stage; and
 - B. customer input, feedback and validation will be incorporated at, and between, each Design Stage.
 - (ii) for non-customer facing elements, detail how:
 - A. the Sydney Trains operational team will be collaboratively engaged across the design process; and
 - B. the Operator will be collaboratively engaged across the design process.

3.1.2 Wayfinding production plan

- (a) Prior to the submission of Design Documentation for Design Stage 3, the CSM Contractor must submit a Wayfinding Production Plan for review and approval by the Principal's Representative in accordance with the Contract. The Wayfinding Production Plan must include:
 - (i) implementation and installation plan;
 - (ii) sign-off procedures from TfNSW Wayfinding Program for customer-facing wayfinding and signage;

- (iii) sign-off procedures from operator(s) for non-customer-facing wayfinding and signage;
- (iv) production and installation program;
- (v) sign removals schedules and plans; and
- (vi) interface schedules and location plans.

3.2 Appointment of a wayfinding designer

- (a) The CSM Contractor must engage a wayfinding designer with a minimum of 5 years' experience in the application of wayfinding and signage in major public transport systems to deliver the requirements of this SWTC.
- (b) The wayfinding designer must:
 - (i) be selected from an agreed panel provided by TfNSW; or
 - (ii) where the wayfinding designer is not on a TfNSW panel:
 - A. the CSM Contractor must submit details to demonstrate adequate capability and experience to undertake the design; and
 - B. be approved by the Principal's Representative.

3.3 Appointment of the wayfinding Project Manager

- (a) The CSM Contractor must engage a wayfinding Project Manager with a minimum of 5 years' experience in the delivery of wayfinding and signage in major public transport systems to deliver the requirements of this SWTC.
- (b) The wayfinding Project Manager must act as the primary point of contact for the wayfinding designer and the TfNSW wayfinding team.

3.4 Stakeholder engagement

3.4.1 TfNSW signage and wayfinding team

- (a) The CSM Contractor must engage with the TfNSW signage and wayfinding team on the design, manufacture, installation and commissioning of all the Customer-facing signage. This process is to include the following activities:
 - (i) the development of the initial strategy;
 - (ii) the development of the proposed procurement strategy and program;
 - (iii) the design;
 - (iv) the location and provisioning;
 - (v) the developing and testing of samples and prototypes; and
 - (vi) the manufacture, installation and commissioning.
- (b) Each of the activities in section 3.4.1(a) requires the approval of the Principal's Representative before proceeding to each subsequent activity.

3.4.2 Sydney Trains operational team

- (a) The CSM Contractor must engage with the Sydney Trains – operational team on the design, manufacture, installation and commissioning of all Sydney Trains operational signage. This process is to include the following activities:
 - (i) the development of the initial strategy;
 - (ii) the development of the proposed procurement strategy and program;
 - (iii) the design;
 - (iv) the location and provisioning;
 - (v) the developing and testing of samples and prototypes; and
 - (vi) the manufacture, installation and commissioning.
- (b) Each of the activities in section 3.4.2(a) requires the approval of the Principal's Representative before proceeding to each subsequent activity.

3.4.3 Sydney Metro City & Southwest Operator

- (a) The CSM Contractor must engage with the Operator on the design, manufacture, installation and commissioning of all operational signage relating to Metro Station. This process is to include the following activities:
 - (i) the development of the initial strategy;
 - (ii) the development of the proposed procurement strategy and program;
 - (iii) the design;
 - (iv) the location and provisioning;
 - (v) the developing and testing of samples and prototypes; and
 - (vi) the manufacture, installation and commissioning.
- (b) Each of the activities in section 3.4.3(a) requires the approval of the Principal's Representative before proceeding to each subsequent activity.



Transport
for NSW

- Sydney Metro City & Southwest

 - Central Station Main Works**

 - Schedule C1

- Scope of Works and Technical Criteria
Appendix B11
Public Art

PROJECT	Central Station Main Works	DATE	25 August 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.1
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00000299
FILE NAME	Central Station Main Works (CSM) SWTC App B11		

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1 Overview and scope

1.1 General

- (a) This Appendix B11 describes the requirements for public art, in relation to the Project Works.
- (b) Public art is specified in the Sydney Metro City & Southwest Public Art Master Plan (Public Art Master Plan) produced by the Principal.
- (c) The Public Art Master Plan:
 - (i) defines the vision, locations, number, size, scale, placement, and process for art to be commissioned and procured, and approach to art-related heritage interpretation; and
 - (ii) addresses the requirements for public art for both the construction phase of the Project Works and the operational phase of the completed Project Works.

2 Requirements

2.1 Public art in the operations phase

- (a) The CSM Contractor must develop a Public Art Management Plan (as described in section 3 below) that is consistent with the Public Art Master Plan for the Project Works.
- (b) Through the Public Art Management Plan and otherwise, the CSM Contractor must:
 - (i) demonstrate provisions throughout the design and construction process for the delivery of public art both during construction of the Project Works and when the Project Works become operational. This must include demonstration in relation to public art of:
 - A. spatial provisioning;
 - B. structural integrity, including hanging points, foundations and the like;
 - C. lighting;
 - D. power and data provision;
 - E. earthing and bonding;
 - F. security, anti-theft and anti-vandalism provisions;
 - G. installation and replacement access; and
 - H. maintenance access.
 - (ii) allow for the following:
 - A. removal, transportation to the TfNSW storage facility in the Greater Sydney area, and re-installation of public art as directed by the Principal's Representative, which was in place prior to, and removed to enable the Project Works;
 - B. permanent and temporary public art that is procured, managed, curated, and commissioned by TfNSW;
 - C. artworks on loan displayed in secure and purpose-designed cases and/or fixings for which TfNSW will manage the loan;
 - D. future art programs (including performance art) which may require services (utilities) and/or built elements to support them; and
 - E. public art involving community input coordinated by artist(s) commissioned by TfNSW.
 - (iii) install public art in accordance with the Public Art Master Plan, including construction and provision of:
 - A. Utility Services required for ongoing operation;

- B. construction of purpose-designed secure display cases and fixings to facilitate display of on-loan (temporary) public art; and
- C. construction of purpose-designed secure display cases and fixings to facilitate the display of permanent public art.

2.2 Public art during construction

- (a) To support the Principal's Representative in developing a hoarding content strategy, the CSM Contractor must provide the Principal's Representative with details of:
 - (i) all locations where hoardings are required during construction in relation to the Project Works; and
 - (ii) the period during which hoardings will be in situ.

3 Process

3.1 Public Art Management Plan

- (a) The CSM Contractor must prepare and submit to the Principals Representative for approval an initial Public Art Management Plan that describes how the CSM Contractor will work and collaborate with the Principal to deliver the relevant parts of the Public Art Master Plan within 90 days of Contract award.
- (b) The CSM Contractor must submit the final Public Art Management Plan for approval by the Principal's Representative within 30 days of receiving feedback from the Principal's Representative on the initial Public Art Management Plan.
- (c) A revised Public Art Management Plan must be submitted at the conclusion of each Design Stage for approval by the Principal's Representative.
- (d) The Public Art Management Plan must be updated every 6 months.
- (e) The Public Art Management Plan must include and address:
 - (i) a statement on how the artistic vision and public art projects outlined in the Principal's Public Art Master Plan are to be managed and protected from damage and/or theft;
 - (ii) how any public art that was in place prior to the Project Works commenced is to be protected or removed, stored and re-installed;
 - (iii) the approach and methodology for the installation and integration of public art procured by the Principal into Central Station and Central Station Precinct;
 - (iv) the way that Utility Services required to operate/present art can be managed and maintained;
 - (v) the way that any element of the Project Works which performs dual functions such as screens, which may be used for public art and/or advertising will be installed, operated and maintained;
 - (vi) the management of all technical interfaces for public art supplied by TfNSW;
 - (vii) a specification of the additional resources (other than the Public Art Project Manager) required to manage the implementation of the Public Art Management Plan. This plan is to include:
 - A. roles and responsibilities required;
 - B. a resource plan;
 - C. a resource schedule; and
 - D. other as required.
 - (viii) a program which includes activities for the implementation of the Public Art Management Plan and the commissioning of each location that is to

display public art. The program must be consistent with the CSM Contractor's Program for the Project Works;

- (ix) how heritage or archaeological materials resulting from any demolition works, can be retained, interpreted and incorporated into the locality from which they are found, in line with Appendix B06;
- (x) how further recommendations which relate to heritage interpretation made in any salvage or excavation heritage reports will be incorporated into public art; and
- (xi) detailing consultation with heritage specialists.

3.2 Public art working group

- (a) The Principal's Representative will operate a public art working group to oversee the execution of the Public Art Master Plan.
 - (i) In the event that a final Public Art Master Plan is not available, the public art working group must agree the scope of work at each location.
- (b) The public art working group will include:
 - (i) the CSM Contractor's Public Art Project Manager;
 - (ii) the Principal's Representative;
 - (iii) the Principal's Public Art Curator who is responsible for development and realisation of the Public Art Master Plan;
 - (iv) other relevant contracted parties; and
 - (v) other parties nominated by the Principal's Representative.
- (c) The purpose of the public art working group is to provide a forum for considering and discussing the best approach to curating, procuring, integrating, installing and decommissioning public art as outlined in the Public Art Master Plan and the Public Art Management Plan.
- (d) The CSM Contractor must confirm the actions arising from the public art working group sessions, and confirm any ambiguous requirements with the Principal's Representative.

3.3 Appointment of a public art project manager

- (a) The CSM Contractor must appoint an experienced and expert public art project manager who has:
 - (i) a minimum of 5 years demonstrated experience in the co-ordination and installation of public art, project management in similar scale art-architectural commissions, urban design and architectural management skills; and
 - (ii) be approved by the Principal's Representative.
- (b) The CSM Contractor must appoint the public art project manager within 60 days of the commencement of Contract award.

- (c) The role of the CSM Contractor's public art project manager is to:
 - (i) interface with the Principal's Representative to facilitate all technical interfaces that will ensure the efficient and smooth installation of artworks to be supplied and installed;
 - (ii) advocate, educate and promote a strong understanding of public art and its role as part of the Project Works within the CSM Contractor team during design and construction; and
 - (iii) be the responsible person for the CSM Contractor to execute the Public Art Management Plan.
- (d) The CSM Contractor's public art project manager will be involved on the project until the expiry of the final Defects Correction Period.

- Sydney Metro City & Southwest

Central Station Main Works

Schedule C1

- Scope of Works and Technical Criteria
Appendix B12
Asset Management Information

PROJECT	Sydney Metro City & Southwest	DATE	15 June 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.0
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00000293
FILE NAME	Central Station Main Works (CSM) SWTC App B12		

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1 General Requirements

- (a) In this Appendix B12:
 - “Asset Handover” has the meaning given in MR-Prelude.
- (b) The requirements below apply to all the asset management information (AMI) to be provided by the CSM Contractor to the Principal’s Representative.
 - (i) The CSM Contractor must progressively prepare and submit all AMI to the Principal’s Representative as stipulated in the Contract for review in accordance with the Contract in three stages, “Initial Draft Version”, “Final Draft Version” and “Final Version”.
 - (ii) The Initial Draft Version must be submitted in accordance with MR-T.
 - (iii) The CSM Contractor must provide Final Versions of all AMI for each Portion as a condition precedent prior to the Completion of the relevant Portion, and where required by the Principle’s Representative, prior to Asset Handover.
 - (iv) The CSM Contractor must structure AMI into packages and schedule their staged submission as per the configuration change management process described in MR-T.
 - (v) Final Version AMI packages, in accordance with this Appendix B12, which are acceptable to the Principal’s Representative, must be completed prior to achieving Completion of any Portion.
 - (vi) Each submission of the AMI must be validated and verified in terms of accuracy and compliance with the requirements of the Contract by the CSM Contractor prior to submission to the Principal’s Representative, or as otherwise required under the Contract.
- (c) The CSM Contractor must comply with the requirements for AMI for the Metro Station Works specified in section 2 of this Appendix B12 and the requirements for AMI for Central Station Works and the Central Walk Works specified in section 3 of this Appendix B12. In addition, the CSM Contractor must consult with Operator(s) and incorporate their requirements into the AMI prepared by the CSM Contractor.

2 Asset management information for the Metro Station Works

AMI must be prepared for the Metro Station Works in accordance with the requirements of:

- (a) this section 2 of Appendix B12;
- (b) Sydney Metro Employers Information Requirements SM EM-ST-203; and
- (c) Sydney Metro CAD/GIS/BIM Manual SM EM-PW-304.

2.2 Document Identification

- (a) The numbering system generated by the Principal's Document Control System (PDCS) (as defined in MR-PA) must be used for all AMI.
- (b) The Principal's project descriptors and drawing band numbers will be provided by the Principal's Representative upon request by the CSM Contractor.
- (c) Revision numbers for the initial draft versions of the AMI must be in an alphabetic format (e.g. "A", "B", "C").
- (d) Revision numbers for the Final Draft Version and Final Version of the AMI must be in a numeric format (e.g. "1", "2", "3") with no decimal places.
- (e) AMI must, as a minimum, be identified in the following ways:
 - (i) by the document number and revision number in the electronic file name, separated by a unique divider (e.g. "-" or ".") that is not used elsewhere in the file name;
 - (ii) by the document number and a fully descriptive title on the front page of the document; and
 - (iii) by the above document number and revision number on all pages of the document.

2.3 Document file types

The CSM Contractor must:

- (a) submit each AMI document in its own file. Multiple AMI documents must not be contained in a compressed (zipped) file;
- (b) submit the AMI documents in an acceptable format for the document type. Acceptable electronic formats are Microstation CAD files, TIF format image files, JPG format photographs, Microsoft Excel spreadsheets, Microsoft Word, word-processing files, Microsoft PowerPoint presentation files, Microsoft Access relational data base files and Adobe Acrobat portable document format (PDF);
- (c) submit drawings in the format required by the Principal's Representative;
- (d) submit native 'updateable' files for the final draft versions of the AMI, including:

- (i) drawings, 3D drawings, or other modelled data;
 - (ii) work-as-executed Design Documentation;
 - (iii) asset registers;
 - (iv) operation and maintenance manuals;
 - (v) schedules of finishes;
 - (vi) Technical Maintenance Plans;
 - (vii) technical descriptions and operating guides;
 - (viii) service schedules;
 - (ix) failure modes, effects, and criticality analysis (FMECA) and/or reliability availability maintainability and safety (RAMS) calculations;
 - (x) equipment software and configuration files (including software programs necessary to access such files);
 - (xi) training programs; and
 - (xii) forms required for maintenance activities;
- (e) include all required data within the designated file (whether view file or native file). Links between files are not acceptable;
 - (f) submit all AMI in digital form as individual computer files via the project document control system (PDCS);
 - (g) submit a separate PDCS document transmittal that includes an index to these documents where large numbers of documents (more than 100) are submitted on one subject (e.g. certificates and concrete records); and
 - (h) identify each AMI document submitted, with appropriate metadata as defined by the Principal's Representative.

2.4 Document transmittals

- (a) The CSM Contractor must adhere to the standard transmittal format generated by the PDCS.
- (b) The PDCS document transmittals must, as a minimum, include the following metadata for each document:
 - (i) document number;
 - (ii) revision number;
 - (iii) full document title / description matching that written in the document front page;
 - (iv) the discipline responsible for the preparation of the document;
 - (v) document type (e.g. "manual", "drawing", "certificate"); and
 - (vi) the location of the Asset to which the document relates.

2.5 Project description

The CSM Contractor must provide a report called 'Project Description' detailing the following:

- (a) details of the scope of the Project Works;
- (b) details of the major stakeholders;
- (c) details of any interfaces with adjoining existing assets including identification of those assets not forming part of the Project Works;
- (d) any new or altered services or systems;
- (e) datelines i.e. Completion and Commissioning dates for elements of the Project Works; and
- (f) any other relevant information.

2.6 Schedule of contact details

The CSM Contractor must provide a 'Schedule of Contact Details', including:

- (a) the names of the CSM Contractor's key personnel and the Subcontractors' key personnel involved in the design, construction, commissioning and certification and the corresponding initials utilised on drawings and documentation;
- (b) the correct name of all Subcontractors, including the ABN number;
- (c) the role of all Subcontractors under the Contract;
- (d) address, telephone and fax numbers for all Subcontractors;
- (e) primary contact names within the CSM Contractor's and Subcontractors' organisations for enquiries relating to the Project Works; and
- (f) website addresses of all Subcontractors.

2.7 Asset register

The CSM Contractor must provide an Asset register that:

- (a) is a comprehensive data collection system for all assets forming the Project Works which includes a digital version of the Asset register in a single relational database format that is acceptable to the Principal's Representative;
- (b) provides details of all assets forming the Project Works other than architectural floor, wall and ceiling finishes which must be included in the Schedule of Finishes (see section 2.9(j) below);
- (c) is divided into sub-asset groups containing items that are commonly grouped together e.g. systems. There must be an index to the groups in the front of the Asset register;
- (d) can be uploaded to the Operator's asset management system without further manipulation by reflecting their required asset breakdown structure of sub assets, systems and nomenclature.

2.8 Work-as-executed Design Documentation

The CSM Contractor must provide “work-as-executed” Design Documentation, whereby the CSM Contractor must:

- (a) submit sample work-as-executed Design Documentation for all assets for review by the Principal’s Representative prior to production of any work-as -executed Design Documentation;
- (b) show on work-as-executed Design Documentation the details of the locations of existing infrastructure within the Site and the location and extent of the completed works;
- (c) update the approved for construction Design Documentation to produce the work-as-executed Design Documentation and other drawings as necessary to fully describe the Metro Station Works;
- (d) ensure that work-as-executed Design Documentation for any building components of the Metro Station Works include all drawings produced for the building component of the Metro Station Works, including but not limited to design drawings, shop drawings and drawings produced by specialist trades (for example, combined services layouts, structural electrical and mechanical drawings, and equipment installation drawings);
- (e) ensure the content, accuracy and level of detail of work-as-executed Design Documentation are equivalent to those in the Design Documentation used for construction and are sufficient to describe, to enable and to facilitate the safe and efficient operation and maintenance of the assets forming the Metro Station Works;
- (f) include in work-as-executed Design Documentation, the final survey drawings undertaken and signed by a licensed surveyor, in accordance with the *Surveying and Spatial Information Regulation 2012 (NSW)*, certifying the positioning of the Metro Station Works relative to the primary survey grid and the cadastral boundaries and that the Metro Station Works are located within any nominated minimum and maximum clear opening tolerances;
- (g) include in the work-as-executed Design Documentation the locations and extremities of all ground and infrastructure support including rock bolts;
- (h) certify, via a statutory declaration that each item of work-as-executed Design Documentation is accurate, complete and correct, and that the Metro Station Works as completed are wholly contained within the Site;
- (i) ensure the work-as-executed Design Documentation complies with AS 1100 Technical drawing and the Sydney Metro CAD/GIS/BIM Manual SM EM-PW-304 November 2016, unless otherwise instructed by the Principal’s Representative; and
- (j) where necessary to describe the Metro Station Works, or where directed by the Principal’s Representative, include digital photographs of specific aspects of the Metro Station Works in work-as-executed Design Documentation.

2.9 Operations and Maintenance Manuals

The CSM Contractor must produce operations and maintenance manuals (O&MM) which:

- (a) provide an O&MM for each key element of the Project Works as identified in the Asset Management Information Delivery Plan (AMIDP);

- (i) The CSM Contractor must develop a AMIDP and submit a draft in accordance with the timing described in MR-PA for the Principal's review and approval;
- (ii) The CSM Contractor must undertake the ongoing development, amendment and updating of the AMIDP throughout the duration of the CSM Contractor's Activities including to take into account AMI not already covered by the AMIDP in place;
- (iii) The AMIDP must fully address the CSM Contractor's obligations, processes, procedures and management systems in relation to AMI;
- (iv) The Asset Management Information Delivery Plan must, as a minimum, address and detail:
 - A. the AMI management team structure, including key personnel, authority and roles of key personnel, lines of responsibility and communication, minimum skill levels of each role and interfaces with the overall project organisation structures;
 - B. processes and procedures for producing and collecting AMI;
 - C. processes and procedures for the verification and validation of AMI;
 - D. processes and procedures for the submission of AMI to the Principal's Representative and for the further development and updating of AMI;
 - E. a schedule of all of the CSM Contractor's AMI deliverables, including documents to be provided by Subcontractors;
 - F. the key elements of the Project Works that will be addressed in individual operation and maintenance manuals and guides;
 - G. processes and procedures for the development of work-as-executed Design Documentation, including Design Documentation drawings derived from 3D models building information models (BIM);
 - H. processes and procedures for the development of a work-as-executed version of the BIM and the related work-as-executed version of the construction operations building information exchange (COBie), Data Drop and Asset register; and
 - I. relationships between each part of the AMI.
- (b) provide descriptions of the location, functions performed, and operating instructions for all assets forming the Metro Station Works;
- (c) are written from the perspective of the Operator looking to locate and identify the operation and maintenance requirements of a 'single system';
- (d) are written using clear concise english;
- (e) provide a central document that provides cross-references to all other relevant documentation for the system;

- (f) include all the standard format listed and detailed in Annexure A of this Appendix B12. Where a section is not applicable to a particular asset, the words 'Not Applicable' or similar must be included under the relevant section heading;
- (g) include a reference document number and the location within that document where the relevant information can be found, should references to other documents be included in the O&MM;
- (h) include figures and pictures where appropriate to present information which is difficult to describe by text alone and provide identification of tools, parts and other such items;
- (i) include only halftone figures (photographs) which are suitable for electronic scanning and photocopying without loss of detail;
- (j) include "Schedule of Finishes" that provide the following data for any internal and external architectural materials and finishes on the Metro Station Works:
 - (i) description or name of material or finish;
 - (ii) thickness/weight/gauge;
 - (iii) profile or size;
 - (iv) colour/finish details unless scheduled in a separate colour schedule;
 - (v) manufacturer or supplier name and contact details;
 - (vi) cleaning and maintenance recommendations or standards;
 - (vii) warranty details; and
 - (viii) a location schedule such that details of materials and finishes in each room, space, area or building component can be located.
- (k) include "Technical Descriptions" which provide:
 - (i) a short description of all assets, even if it is a proprietary item, with relevant technical tables, a table of dimensions, performance ratings;
 - (ii) operating guidelines, procedures and principles for all of the assets;
 - (iii) a basic working description of all of the assets, including novel features, any automatic control, and the operational purposes and functions of the various components and systems;
 - (iv) a location plan to identify and locate all of the assets, or a written description if more appropriate;
 - (v) details of any utilities critical to the operation of the assets and where necessary the isolation points; and
 - (vi) functional specifications for software oriented systems (hardware and software), systems programs, individual program modules, including flow charts and source codes.
- (l) include individual "Operating Guides" for each key element of the Metro Station Works which provide comprehensive details of technical information relevant to all elements of the asset with a step by step procedure arranged into sections relating to the following where applicable:

- (i) safety procedures;
 - (ii) operating limitations due to temperature, pressure and flow, or other relevant factors;
 - (iii) checks before, and procedures for, equipment start-up, operations and shutdown;
 - (iv) emergency shutdown and abnormal operation;
 - (v) full information on alarm and trip settings;
 - (vi) links to inspection, servicing and maintenance schedules as defined in the Technical Maintenance Plan to be prepared by the CSM Contractor (see Annexure A points (a)(iii) and (a)(xiii));
 - (vii) component manuals covering maintenance and repair of all items of installed equipment;
 - (viii) fault finding guides, for use at the operating maintenance level;
 - (ix) illustrated parts catalogues;
 - (x) supply contract details;
 - (xi) name of supplier;
 - (xii) address for service calls; and
 - (xiii) any other information needed by operating staff to ensure the safe and efficient operation of the equipment.
- (m) provide copies of all compliance and certification documents in a register, including:
- (i) Building Code of Australia compliance reports and certificates;
 - (ii) Disability Discrimination Act compliance reports and certificates;
 - (iii) Fire and Life Safety compliance reports and certificates;
 - (iv) a description of the quality assurance systems utilised by the CSM Contractor and the location of all detailed test results, inspection and test plans and other quality assurance data;
 - (v) the first registration certificate for every asset that requires annual or periodic registration;
 - (vi) all other Authority Approvals received; and
 - (vii) all licenses.
- (n) include Technical Maintenance Plans including a schedule of services, and template records that are required for maintenance actions. Sample forms are to be delivered as separate documents in native format (e.g. Microsoft Word or Microsoft Excel).
- (o) include a "Spares Schedule" that has adopted the following methodology in its development to ensure:
- (i) the Spares Schedule is developed using a clearly defined methodology that is acceptable to the Principal's Representative;

- (ii) long lead time spares (those with a one month or greater supply time) and high-value spares are identified and listed;
 - (iii) nominated spares have been considered at the equipment level and not at the part level (e.g. a fuel pump or motor is a spare, not an impellor or bearing);
 - (iv) the assessment methodology adopts established in-service failure rates and the related maintenance policies, and identifies the range and quantity of spares required to be made available at any time to maintain the systems and ensure they meet the availability requirements;
 - (v) the need for insurance spares to meet unplanned needs has been addressed, and a separate assessment process used to identify, quantify and list those insurance spares is included; and
 - (vi) the methodology used for the assessment of spares requirements is included in the Technical Maintenance Plans;
- (p) include a Spares Schedule which details the recommended range and quantity of consumables and the spares required to support the operational and maintenance requirements of the assets forming the Project Works, and includes the following information:
- (i) item identification (name, manufacturer's part or reference number and specification, as appropriate);
 - (ii) recommended spares quantities;
 - (iii) price expected;
 - (iv) source;
 - (v) procurement lead time;
 - (vi) failure rate;
 - (vii) number of items installed in the Project Works;
 - (viii) predicted usage rate and whether the item is consumable or is used in support of scheduled preventative maintenance;
 - (ix) proposed location of spares; and
 - (x) the probability of the required item being available to suit the recommended spares quantity;
- (q) include data on spare parts, listed under the following headings:
- (i) "List of Suppliers" listing: manufacturer, ABN number; manufacturer's nearest representative; company address; telephone and fax numbers; and website;
 - (ii) "Illustrated Parts List", including a list (or lists) of parts with part numbers referenced to an illustration, preferably an exploded view of a sectional drawing and a specification;

- (iii) "Recommended Spare Parts", including a list of recommended spare parts with part numbers and quantities, and highlighting critical spares (to be held at all times);
 - (iv) "Availability of Spare Parts", including a short statement quoting the worst case procurement lead time/availability to suit the quantities of parts from suppliers; and
 - (v) "Ordering Information" including specific details that would be required when ordering replacement parts, such as serial number, model number, name and reference number.
- (r) include a "Schedule of Special Tools, Facilities and Equipment" that contains:
- (i) the recommended number of special tools, facilities and equipment required for the operation and maintenance of the Metro Station Works;
 - (ii) identification of the items required to perform specific maintenance, repair and recovery tasks on the systems, including scheduled preventative maintenance of the systems, the removal, installation and testing of rotatable and repairable items, and other procedures, such as temporary repairs during normal operating periods for unscheduled failures with follow-up maintenance and emergency recovery;
 - (iii) details of any special purpose test equipment and facilities needed in support of the maintenance tasks, including specialist hand-tools;
 - (iv) details of, and a specification for, each item;
 - (v) a description of the purpose of the item;
 - (vi) maintenance requirements for each item;
 - (vii) the supplier's name and contact details;
 - (viii) the quantity required;
 - (ix) price and validity period expected; and
 - (x) lead times.
- (s) include manuals and documents provided by suppliers and manufacturers, only where they comply with the requirements of MR-T and are integrated into the O&MMs.

3 Asset management information for the Central Station Works and Central Walk Works

- (a) AMI must be prepared for the Central Station Works and Central Walk Works in accordance with the ASA Standards, and the Sydney Trains AMI documents listed below.
- (i) T MU AM 01001 ST - Life Cycle Costing
 - (ii) T MU AM 01002 MA - Maintenance Requirements Analysis Manual
 - (iii) T MU AM 01003 ST - Development of Technical Maintenance Plans (Standard) + Technical Note
 - (iv) T MU AM 01003 F1 - Blank FMECA Sheet
 - (v) T MU AM 01003 F2 - Blank Service Schedule Sheet
 - (vi) T MU AM 01003 F3 - Blank TMP Sheet
 - (vii) T MU AM 01003 F4 - TMP Review and Authorisation Form
 - (viii) T MU AM 01004 ST - Maintenance Service Schedule Classification and Compliance
 - (ix) T MU AM 01005 ST - Asset Handover Requirements (Standard)
 - (x) T MU AM 01006 ST - Asset Reference Codes
 - (xi) T MU AM 01006 F1 - Asset Reference Code Form
 - (xii) T MU AM 01007 TI - Asset Reference Codes Register
 - (xiii) T MU AM 01008 ST - Technical Maintenance Plans and Coding System
 - (xiv) T MU AM 01009 TI Technical Maintenance Coding Register
 - (xv) T MU AM 01010 ST - Framework for Developing an Asset Spares Assessment and Strategy
 - (xvi) T MU AM 01010 F1 - Blank Spares Requirements Analysis Model Form
 - (xvii) T MU AM 01012 ST - Engineering Document Requirements
 - (xviii) T MU AM 01012 F1 - Metadata Spreadsheet for Engineering Documents
 - (xix) T MU AM 02001 GU - Developing Configuration Information Delivery Plans
 - (xx) T MU AM 02001 ST - Asset Information and Register Requirements (Standard)
 - (xxi) T MU AM 02002 TI_1 - Asset Classification System

- (xxii) T MU AM 02003 TI - Register of Asset Information Systems and Repositories
 - (xxiii) T MU AM 06007 GU - Guide to Requirements Definition and Analysis
 - (xxiv) T MU AM 06009 ST - Maintenance Concept Definition
- (b) The AMI for the Central Station Works and Central Walk Works must be provided in a format that is able to be loaded into SAP Equip Platform (SAP) in accordance with the ASA Asset Classification and Information Standards and Sydney Trains' data specifications.

4 Annexure A – O&MM Standard Format

Reference	Description
General	<p><u>Front Cover</u></p> <p>The front cover of the O&MM must contain:</p> <ul style="list-style-type: none"> • the Transport for NSW logo; • the project name; • the document description consisting of the key element description (e.g. asset type or discipline) and the words “Operation and Maintenance Manual”; and • the document number.
General	<p><u>Page Headers</u></p> <p>The page headers of the O&MM must contain the project name and the document description.</p>
General	<p><u>Page Footers</u></p> <p>The page footers of the O&MM must contain:</p> <ul style="list-style-type: none"> • the document number and revision number; and • page numbers in the format “Page x of y”. Page numbers must be continuous throughout the document and not reset at section breaks.
General	<p><u>Revision History</u></p> <p>The revision history of the O&MM must be included in a "Revision Control Table" at the start of the manual. The revision control table must provide, for each revision:</p> <ul style="list-style-type: none"> • revision letter or number with no decimal places; • date of revision; and • summary of change(s) in comparison to the previous version.
General	<p><u>Glossary of terms</u></p> <p>A glossary of terms for each O&MM must be included at the start of the manual, including all acronyms and technical terms listed in the manual.</p>
General	<p><u>Table of contents</u></p> <p>A table of contents, listing sections and sub-sections of the O&MM.</p>
Section 1	<p><u>Purpose of the O&MM</u></p> <ul style="list-style-type: none"> • Brief description of the O&MM’s purpose, structure and content; • Identification of Asset owner, Contractor, Subcontractors and other involved parties; and • Tabulation of Subcontractors and utilities/service providers, together with contact details for each significant element of the assets.

Reference	Description
Section 2	<p><u>Description of the system</u></p> <ul style="list-style-type: none"> • An overview of sufficient detail to provide the reader with immediate understanding of the whole of the system; • A location plan / diagram with introductory text to identify the main components of the system and the interfaces; and • Detailed description of each of the elements of the assets covered by the O&MM to complement the location plan, including all equipment, components, systems and items, with a tabulation of dimensions, performance ratings, and asset number, information and attributes.
Section 3	<p><u>System interfaces</u></p> <ul style="list-style-type: none"> • Details of all systems with which this system interfaces; • Description of how these interfaces operate (i.e. how this system works with / impacts on the other systems); • Description of the limits of responsibility and other parties responsibility at each interface; • Impacts of system failures either by this system or by other systems, impacting on this system; • Summary diagrams of the various utilities and services including communication services, electrical services, drainage, fire services, water treatment and utilities, gas, sewer, stormwater and water; and • References of where further information for the interfacing systems can be found.
Section 4	<p><u>Detailed technical descriptions and operating guides</u></p> <ul style="list-style-type: none"> • Detailed technical descriptions of the asset, aimed at the Operators, and covering each element of the system, including all equipment, components, systems and items in accordance with section 2.9(k) of this Appendix B12; and • Detailed operating guides in accordance with section 2.9(l) of this Appendix B12.
Section 5	<p><u>Safety and environment</u></p> <ul style="list-style-type: none"> • Consolidation of all relevant safety issues associated with the system (may be duplicating content of supplier/manufacturer manuals located elsewhere in the manual), noting all hazards and highlighting specific risks; • A tabulation or listing of emergency contact organisations, personnel or positions, phone/fax numbers and operational procedures relating to emergencies; and • Suppliers' material safety data sheets.
Section 6	<p><u>FMECA/RAMS</u></p> <ul style="list-style-type: none"> • Statement of whether FMECA was carried out. Provide an explanation of the basis for original design and equipment selected for installation (e.g. performance requirements); and • Statement of whether RAMS was carried out. Reports are to include

Reference	Description
	actual calculations.
Section 7	<p><u>Asset register</u></p> <ul style="list-style-type: none"> Comprehensive Asset register including system details relevant to the assets included in each O&MM.
Section 8	<p><u>Schedule of spares (refer section 2.9(o) of this Appendix B12)</u></p> <ul style="list-style-type: none"> Details of the methodology used to develop the 'Spares Schedule' (e.g. based on FMECA/RAMS, manufacturers' recommendations, etc.) and the operating period addressed by the spares and include details of: The level at which spares are to be held (e.g. component, assembly, sub-system or system level); Expected failure rates; Maintenance policies that the spares selection is based on; Expected procurement lead time; Ongoing availability of spares; Storage requirements, including storage environmental constraints such as temperature and humidity; and Spares Schedule, divided into "General Spares" and "Insurance Spares" categories.
Section 9	<p><u>Maintenance</u></p> <ul style="list-style-type: none"> Comprehensive step by step instructions in preventative and corrective maintenance procedures, nominating the work to be carried out by qualified tradespersons and others, and the designated service periods, such as weekly, monthly, quarterly, semi-annually, annually; A schedule of refurbishment and replacement reflecting asset design life and maintenance standards; Maintenance standards; <p>Technical Maintenance Plans in accordance with section 2.9(n) of this Appendix B12</p> <ul style="list-style-type: none"> Maintenance instructions for each of the service periods subdivided into the following categories: unit running, unit stopped; Location of maintenance action (on-system, in workshop etc.); Consumables and special tools required; List of recommended consumables, greases and oils, stating quantities, methods and frequency for application; Troubleshooting instructions in tabular form listing "fault", "possible cause" and "remedial action", with testing regimes and instructions; A Schedule of Special Tools, Facilities and Equipment in accordance with section 2.9(r) of this Appendix B12; and A Schedule of Finishes in accordance with section 2.9(j) of this Appendix B12.

Reference	Description
Section 10	<p><u>Training program</u></p> <ul style="list-style-type: none"> • A program of appropriate training for operation and maintenance personnel; • Train the trainer style manuals appropriate to the personnel associated with the operation and maintenance of the system; and • If the training information included in the operating guides or suppliers'/manufacturers' manuals does not meet the requirement, then additional information is required; and • Training materials.
Section 11	<p><u>Installation, commissioning & overhauling</u></p> <ul style="list-style-type: none"> • Details of standards and procedures for mounting or erecting, wiring or setting up, and commissioning equipment; • All testing and commissioning certificates and all associated commissioning and test results issued in respect of the Works the system/sub-system and equipment; • System configuration information, including protection settings for electrical equipment; and • Unless otherwise contained in the Technical Maintenance Plans or service schedules, step by step instructions and procedures for complete overhauls, indicating those procedures to be carried out by qualified tradespersons, described under at least the following subheadings: <ul style="list-style-type: none"> - Dismantling; - Cleaning, inspection, repair and adjustment; - Reassembly; and - Final checks and unit running.
Section 12	<p><u>Manufacturer's/Supplier's Operation and Maintenance Manuals, Equipment Warranties and Compliance Certificates</u></p> <ul style="list-style-type: none"> • Manufacturer's operation and maintenance manuals (can be embedded in the Operation and Maintenance Manual or delivered as a separate referenced document); • Relevant warranties and guarantees as required under the Contract for each major item of equipment; and • Compliance certificates as required by specific items of plant, equipment and works and a register in accordance with section 2.9(m) of this Appendix B12; • Warranties must be arranged in a logical sequence and include an index.
Section 13	<p><u>Other Information</u></p> <p>Any relevant information not specifically covered in the previous sections.</p>

Reference	Description
Section 14	<p><u>Document Reference List</u></p> <ul style="list-style-type: none"><li>• A reference list of all documents and drawings referred to in the body of the Operation and Maintenance Manual as well as those not specifically referenced but which are required to complete the documentation related to the asset.<li>• References must be listed in order of type and document number, and provide the title of each document.<li>• Examples of contents are:<ul style="list-style-type: none"><li>- calculations;<li>- commissioning results;<li>- procedures;<li>- quality forms and records;<li>- reference manuals;<li>- software;<li>- technical specifications and reports;



Transport
for NSW

- Sydney Metro City & Southwest

 - Central Station Main Works**

 - Schedule C1

- - Scope of Works and Technical Criteria
 - Appendix B13
 - Advertising

PROJECT	Central Station Main Works	DATE	15 June 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.0
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00000294
FILE NAME	Central Station Main Works (CSM) SWTC App B13		

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1 Overview

- (a) This Appendix B13 describes the requirements for advertising, in relation to the Project Works.
- (b) Advertising types and locations in relation to the Project Works will be specified by the Sydney Metro City & Southwest Advertising Strategy (Advertising Strategy) produced by the Principal.
- (c) The Advertising Strategy will define the guiding principles for placement, types, size, and scale. This strategy will be developed and tested through requirements at each Design Stage.

2 Requirements

2.1 Advertising in operations phase

- (a) In accordance with the Advertising Strategy, the CSM Contractor must:
- (i) demonstrate appropriate provision throughout the design and construction process for the delivery of advertising in the operations phase of the Sydney Metro City & Southwest, including demonstration of:
 - A. spatial provisioning;
 - B. structural integrity;
 - C. lighting integration;
 - D. power and data provision;
 - E. earthing and bonding strategy;
 - F. security monitoring;
 - G. installation access; and
 - H. maintenance access.
 - (ii) allow for the following types of advertising to be delivered:
 - A. free-standing digital totems placed within station environment;
 - B. free-standing digital totems placed within the wider station precinct;
 - C. indoor large-format digital screens that are suspended / wall mounted;
 - D. outdoor large-format digital screens that are bridge-mounted / wall-mounted;
 - E. indoor digital poster cases;
 - F. outdoor LED backlit static lightboxes;
 - G. indoor LED backlit static lightboxes;
 - H. technology-based advertising platforms (e.g. beacons, Wi-Fi etc.); and
 - I. screens integrated into the PSD / PEB.
 - (iii) demonstrate how advertising equipment can be installed, upgraded and removed without impacting on long-term materials performance or the aesthetic of the surrounding fabric;
 - (iv) demonstrate how advertising equipment can be installed, upgraded and removed without impacting on station operations or customer experience;

- (v) ensure that advertising, where provided, is integrated into the station architecture or building elements with the ability to support customer information systems;
 - (vi) ensure that advertising does not conflict with customer signage or wayfinding or impede customer flows;
 - (vii) ensure that advertising is:
 - A. coordinated to achieve unobstructed sightlines and legibility of the signage;
 - B. coordinated and integrated with adjacent architectural finishes;
 - C. coordinated with station spatial planning; and
 - D. integrated and coordinated with adjacent wall cladding.
 - (viii) ensure that any trackside wall signage and advertising is integrated with the surrounding cladding system;
 - (ix) ensure that all services and equipment associated with advertising is concealed; and
 - (x) ensure that advertising is not located on stair treads or risers, seating, Gatelines, flooring, ceiling and in 'slow spaces' or as otherwise advised by the Principal.
- (b) The CSM Contractor must develop an "Advertising Provisioning Plan" in accordance with clause 3.1 below to demonstrate how the CSM Contractor will work with the Principal to deliver the Advertising Strategy.

2.2 Metro Station Minimum Requirements

- (a) The CSM Contractor must make provision for the following at the Metro Station:
 - (i) 4 * large-format digital totems in the paid area of the station, including:
 - A. two located at the southern end; and
 - B. two located northern end;
 - (ii) integrated PSD / PEB advertising of two screens per car.

2.3 Central Station Minimum Requirements

- (a) The CSM Contractor must make provision for the following at Central Station:
 - (i) 10 * free-standing digital totems in the East Concourse, including 2 located either side of each lift;
 - (ii) 1 * indoor large-format digital screens on the mezzanine level of the Eastern Entrance;
 - (iii) 4 * indoor large-format digital screens in the North South Concourse, including:
 - A. one either side of the northern stairs;

- B. one at the southern end;
 - C. one on the western wall;
- (iv) 1 * indoor large-format suspended screen in the Northern Concourse.

3 Process

3.1 Advertising Provisioning Plan

- (a) Within 90 days of the commencement of the Contract award the CSM Contractor must prepare and submit to the Principal's Representative an initial version of the Advertising Provisioning Plan that describes how the CSM Contractor will work with the Principal to deliver the Advertising Strategy, including:
 - (i) demonstrated appreciation of how the application of the Advertising Strategy impacts the Project Works, including the approach to addressing the requirements of clause 2.1(a); and
 - (ii) the identification of, and approach to the management of any inter-relationships between advertising and customer-facing elements across the Project Works, including circulation space, wayfinding and signage, retail and public art.
- (b) The CSM Contractor must submit the final Advertising Provisioning Plan for approval by the Principal's Representative within 30 days of receiving feedback from the Principal's Representative on the initial Advertising Provisioning Plan.
- (c) A revised Advertising Provisioning Plan must be submitted at the conclusion of Design Stage 1 and Design Stage 2 for review and approval by the Principal's Representative in accordance with the Contract.

3.2 Advertising capability

- (a) The CSM Contractor must have a demonstrated advertising capability as a core capability within the team.
- (b) The advertising capability is to be in place within 60 days of the commencement of Contract award.
- (c) Demonstrated capability for the purpose of this Appendix B13 is defined as:
 - (i) a minimum of 5 years demonstrated experience in the co-ordination and installation of advertising projects; and
 - (ii) at least 3 examples from the last 5 years where an advertising solution has been successfully integrated in a mixed use project of significant value, including at least one public transport project.
- (d) The advertising capability is to be used:
 - (i) to interface with the Principal's Representative to facilitate all technical interfaces that will ensure the efficient and smooth installation of the agreed advertising solution; and
 - (ii) as the responsible entity for the CSM Contractor to execute the Advertising Provisioning Plan.

- (e) The advertising capability must be retained to support the CSM Contractor's activities until the date of expiry of the final Defects Correction Period.



Transport
for NSW

- Sydney Metro City & Southwest

 - Central Station Main Works**

 - Schedule C1

- - Scope of Works and Technical Criteria
 - Appendix B14
 - Retail and Commercial

PROJECT	Central Station Main Works	DATE	15 June 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.0
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00000296
FILE NAME	Central Station Main Works (CSM) SWTC App B14		

Appendix B14

Retail and Commercial

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Appendix B14

Retail and Commercial

1 Overview

- (a) This Appendix B14 describes the requirements for retail and commercial opportunities in relation to the Project Works.
- (b) Retail types and locations in relation to the Project Works will be specified by the Sydney Metro City & Southwest Retail Strategy (Retail Strategy).
- (c) The Retail Strategy will define the guiding principles for the placement and types of retail to be delivered. This Strategy will be developed and tested through requirements at each Design Stage.

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Retail and Commercial

2 Requirements

2.1 Retail in Operations Phase

- (a) In accordance with the Retail Strategy, the CSM Contractor must:
- (i) demonstrate appropriate provision throughout the design and construction process for the delivery of retail in the operations phase of the Sydney Metro City & Southwest, including demonstration of:
 - A. spatial provisioning;
 - B. structural integrity;
 - C. lighting integration;
 - D. metered power provision;
 - E. earthing and bonding provision;
 - F. data and telecoms provision;
 - G. metered potable water provision;
 - H. sewage and grease-trap provision;
 - I. security monitoring;
 - J. installation access;
 - K. maintenance access; and
 - L. delivery access.
 - (ii) allow for the following types of retail to be delivered:
 - A. tenancy units;
 - B. retail kiosks; and
 - C. pop-up/promotional retail.
 - (iii) demonstrate how retail facilities can be installed, upgraded and removed without:
 - A. impacting on long-term materials performance or the aesthetic of the surrounding fabric; and
 - B. impacting on station operations or customer experience.
 - (iv) ensure that retail does not conflict with customer signage or wayfinding or impede customer flows;
 - (v) ensure that retail is:

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- A. integrated into the station architecture or building elements;
 - B. coordinated to support intuitive wayfinding;
 - C. coordinated and integrated (where appropriate) with adjacent architectural finishes; and
 - D. coordinated with station spatial planning.
- (vi) ensure that all services and equipment associated with retail is concealed; and
- (vii) ensure that retail is not located in 'fast spaces' as defined by the Principal.
- (b) The CSM Contractor must develop a "Retail Provisioning Plan" in accordance with clause 3.1 to demonstrate how the CSM Contractor will work with the Principal's Representative to deliver the Retail Strategy.

2.2 Central Station Minimum Requirements

- (a) The CSM Contractor must make provision for the following at Central Station:
- (i) 1 * kiosk location in the ESR Concourse opposite the Southern Gateline;
 - (ii) 1 * pop-up/promotional location at the mid-point of the North-South Concourse;
 - (iii) 1 * pop-up/promotional location at the northern end of the North South Concourse;
 - (iv) 1 * kiosk located between the centre escalator and the adjacent void area in the North South Concourse;
 - (v) 1 * kiosk located at the mid-point of the East Concourse; and
 - (vi) 1 * kiosk located at each end of the East Concourse.

2.3 Retail fitout for tenancy units

- (a) The CSM Contractor must provide fitout on a 'shell and core' basis for all retail fitout works as provided for in the Retail Provisioning Report approved by the Principal.
- (b) For tenancy units that provide food, the CSM Contractor must provide inter-tenancy walls that are block work (unfinished, smoothed grout) or cement fibre sheet (taped, set and sealed) to AS 4674-2004.
- (c) The CSM Contractor must use the following occupation loadings for spatial provisioning purposes:
- (i) front of house of 1 person per 3 square metres of net area;
 - (ii) back of house 1 person per 20 square metres of net area; and
 - (iii) area splits must be 50 percent retail and 50 percent back of house.

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- (d) The CSM Contractor must provide each unit, area or zone with enclosures including external access doors for tenant access complete with door furniture and locks and associated party wall construction and service systems including floor, wall and ceiling finishes, service systems, mechanical and electrical requirements.
- (e) The CSM Contractor must meet the following flooring requirements in relation to tenancy units:
 - (i) the structural floor slab must be finished a maximum of 75mm and a minimum of 20mm lower than the final finished floor level (finished smooth grade 2 finish), scabbled smooth and free of adhesives and debris; and
 - (ii) divots in floor to a maximum of 15 mm.
- (f) The CSM Contractor must meet the following air supply requirements in relation to tenancy units:
 - (i) 10 litres per second per person per 10 metres square of area (all areas);
 - (ii) a single duct run (from roof level or to side wall point) of 0.8 by 0.8 metres square for kitchen air supply, with sufficient access room along the run for fire dampers, maintenance and cleaning; and
 - (iii) provision for tenancy air-conditioning/fan units and the installation of the dampers, inline fans, weather cawling and ductwork to the tenancy boundary to open floor plan to service a design heat load capacity of:
 - A. counter service: total of 275 W/m sq. (including lighting and back of house; and
 - B. walk-in: total of 300 W/m sq. (lighting, front of house and back of house).
- (g) The CSM Contractor must seal the supply points with a weather proof cover designed for a 20-year Design Life.
- (h) The CSM Contractor must meet the following air extraction requirements in relation to tenancy units:
 - (i) 10 litres per second per person per 10 metres square of area (all areas); and
 - (ii) a single 'high heat' duct run (to roof level or to side wall exhaust point) of 0.5 by 0.5 metres square for kitchen exhaust, with sufficient access room along the run for fire dampers, maintenance and cleaning.
- (i) The installation of the ductwork, dampers, inline fans and weather cawling will be by others. The CSM Contractor must seal the exhaust points with a weather proof cover designed for a 20-year Design Life.
- (j) The CSM Contractor must meet the following electrical power requirements in relation to tenancy units:
 - (i) metered power sub board (a minimum of 100 Amp three phase), including:

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- A. 50CB;
 - B. smart meter; and
 - C. supply and installation of 36 pole EDB.
- (k) The CSM Contractor must provide fire systems (sprinklers, smoke and heat detector) in accordance with the FEB and be capable of an additional 20 percent expansion (to allow tenancy room changes and partitioning).
- (l) The CSM Contractor must provide emergency lighting and signage to tenancy units.
- (m) The CSM Contractor must provide general tenancy lighting, including temporary lighting of 40 lux at 0.7 metres above floor level.
- (n) The CSM Contractor must provide services connections and lines terminating with the tenancy space for:
- (i) 25mm diameter potable water supply, with meter, check valves and backflow protection devices;
 - (ii) 100mm sanitary/sewage connection, including primary stack venting (to roof level or to side wall exhaust point);
 - (iii) 100mm trade waste connection, including primary stack venting (to roof level or to side wall exhaust point); and
 - (iv) telecommunications lines and terminal panels for a minimum of 5 telephone or internet or cash flow/data connections or alarm/security lines.
- (o) The CSM Contractor must not provide natural gas to tenancy units.
- (p) The CSM Contractor must provide space for a minimum of two 240 litre mobile garbage bins per tenancy unit.
- (q) The CSM Contractor must meet the following ceiling requirements in relation to tenancy units:
- (i) minimum clear ceiling zone of 3.5 metres; and
 - (ii) the structural ceiling slab must be cleaned and sealed.

2.4 Development of retail kiosk solution

- (a) The CSM Contractor must design a retail kiosk solution at locations and of sizes provided for in the Retail Provisioning Report and approved by the Principal.
- (b) The CSM Contractor must provide the following services to retail kiosks:
- (i) 3 phase from below slab, 63AMP including 50CB and smart meter. Supply and installation of 24 pole EDB;
 - (ii) data and telecoms;
 - (iii) lighting to customer waiting areas;

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- (iv) fire prevention and management systems;
 - (v) garbage management solution;
 - (vi) metered potable water; and
 - (vii) sewage and grease-trap.
- (c) The CSM Contractor must design the retail kiosk solution such that it:
- (i) integrates with the overall design concept for the Project Works;
 - (ii) has a minimum design life of 10 years;
 - (iii) provides adequate weather protection for tenants;
 - (iv) can be appropriately secured by the tenants to prevent theft or unauthorised access;
 - (v) is resistant to vandalism and graffiti;
 - (vi) does not attract birds or other animals to nest; and
 - (vii) facilitates passive surveillance of the surrounding area.

2.5 Provisions for pop-up/promotional retail

- (a) The CSM Contractor must make provision for a pop-up/promotional retail solution at locations and of sizes provided for in the Retail Provisioning Report approved by the Principal.
- (b) The CSM Contractor must provide the following services to pop-up/promotional retail locations:
- (i) hard-standing area to accommodate a 3,500kg temporary stand, finished to match the paving of the surrounding plazas;
 - (ii) indicators inlaid into the paving to indicate corners/perimeter of location;
 - (iii) 1 x double GPO, IP67-rated; and
 - (iv) data.
- (c) The services in clause 2.5(b) must be housed by the CSM Contractor within a subfloor service box that is:
- (i) finished to match the surrounding fabric;
 - (ii) watertight and weatherproof;
 - (iii) able to be secured when not in use; and
 - (iv) able to withstand the cleaning regime for the surrounding fabric.

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3 Process

3.1 Retail Provisioning Plan

- (a) Within 90 days of the commencement of the contract, the CSM Contractor must prepare and submit to the Principal's Representative an initial Retail Provisioning Plan that describes how the CSM Contractor will work with the Principal to deliver the Retail Strategy, including:
 - (i) demonstrated appreciation of how the application of the Retail Strategy impacts the Project Works, including approach to addressing the requirements of clause 2.1(a) and clause 2.2; and
 - (ii) the identification of, and approach to the management of any inter-relationships between Retail and other customer-facing elements across the Project Works, including the provision of ticketing and customer information, customer circulation space, wayfinding and signage, advertising and public art.
- (b) The CSM Contractor must submit the final Retail Provisioning Plan for approval by the Principal's Representative within 30 days of receiving feedback from the Principal's Representative on the initial Retail Provisioning Plan.
- (c) A revised Retail Provisioning Plan must be submitted at the conclusion of Design Stage 1 and Design Stage 2 for approval by the Principal's Representative in accordance with the Contract.

3.2 Retail capability

- (a) The CSM Contractor must have a demonstrated retail capability as a core capability within the team.
- (b) The retail capability is to be in place within 60 days of the commencement of the contract.
- (c) Demonstrated capability for the purpose of this Appendix B14 is defined as:
 - (i) a minimum of 5 years demonstrated experience in the co-ordination and installation of retail projects;
 - (ii) at least 3 examples from the last 5 years where a retail solution has been successfully integrated in a mixed use project of significant value, including at least one public transport project; and
 - (iii) approved by the Principal's Representative.
- (d) The retail capability is to be used:

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- (i) to interface with the Principal's Representative to facilitate all technical interfaces that will ensure the efficient and smooth installation of the agreed retail solution; and
 - (ii) as the responsible entity for the CSM Contractor to execute the Retail Provisioning Plan.
- (e) The retail capability must be retained to support the CSM Contractor's Activities until the date of expiry of the final Defects Correction Period.



Transport
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- Sydney Metro City & Southwest

- Central Station Main Works**

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- Scope of Works and Technical Criteria
Appendix B15
Design and Safeguarding Requirements

PROJECT	Central Station Main Works	DATE	15 June 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.0
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00007206
FILE NAME	Central Station Main Works (CSM) SWTC App B15		

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1 Overview

- (a) This Appendix B15 describes the design and construction safeguarding requirements for the Project Works of the following:
 - (i) a West Concourse and Western Entrance; and
 - (ii) Platform 12 and 13/14 extensions.

2 Requirements

2.1 Construction safeguarding requirements

- (a) The CSM Contractor must make provision for the construction safeguarding requirements noted throughout the SWTC plus additional requirements noted in this Appendix B15.
- (b) The CSM Contractor must construct a new west concourse stub tunnel beneath Platform 12/13 a minimum of 2m length. The stub tunnel must safeguard the future construction of the western concourse without interruptions to operations.

2.2 Design Stage 1 design requirements for the western concourse safeguarding

- (a) The CSM Contractor must undertake a Design Stage 1 design for the critical elements of the western connection to ensure safeguard requirements are included in the Design Stage 2 and Design Stage 3 designs.
- (b) The CSM Contractor must undertake pedestrian modelling for the Project Works with the inclusion of the West Concourse and Western Entrance to inform the Design Stage 1 design.
- (c) The pedestrian modelling must be undertaken in accordance with SWTC Appendix B16.
- (d) The CSM Contractor must complete a Design Stage 1 that includes the Western Concourse under platforms 10/11 and platform roads 9,10,11 and 12 for proof of concept of the western concourse with same centreline, MCW and MCH as the Eastern Concourse;
- (e) The CSM Contractor's fire hydrant design in accordance with SWTC B04b.
- (f) The CSM Contractor must complete a HV/LV design during Design Stage 1 to shows any HV/LV cables and cables routes makes spatial provision for a future Western Concourse and Entrance.
- (g) The CSM Contractor must complete a design during Design Stage 1 which includes an extension of any CSRs to include for the Western Concourse.
- (h) The CSM Contractor's FLS strategy must include for the West Concourse and Western Entrance.
- (i) The CSM Contractor must provide an OHW design at Design Stage 1 which ensures no OHW masks need to be relocated when a western concourse is constructed.

2.3 Platform extension safeguarding

- (a) The CSM Contractor must ensure that Platforms 12 and 13/14 can be extended to 209m (from face of buffer stop to end of Platform) to accommodate the operations of the 10-car New Intercity Fleet rollingstock.

- (b) The CSM Contractor must ensure that any permanent Project Works structures above platform level (excluding the platform itself) are not within the minimum platform clearance distances to the future platform extension track alignment provided by the Principal (2177519_STAR_MASTERWITHOPTIONS_Rev4.dgn).
- (c) The CSM Contractor must ensure that the F&LS strategy for the Project Works has allows for the future alignment.
- (d) The CSM Contractor must ensure that station systems and services can be extended without the need to re-cable Platforms 12, and 13/14.
- (e) The CSM Contractor must ensure that new canopies constructed on Platforms 12 and 13/14 can be extended seamlessly to provide adequate weather protection for the future platform alignment.
- (f) The CSM Contractor must ensure that track loadings (in particular the loading on the Metro Station box) are sufficient for the future proposed alignment.

2.4 Design Stage 2 and 3 design safeguarding requirements

- (a) The CSM Contractor must provide Design Stage 2 and Design Stage 3 designs which include the interfaces and interface details of safeguarded elements noted in section 2.2 and 2.3.
- (b) The CSM Contractor must provide Design Stage 2 and Design Stage 3 designs which include the constructability assumptions, construction sequence and construction methodology of safeguarded elements noted in section 2.2 and 2.3.
- (c) The CSM Contractor must provide Design Stage 2 and Design Stage 3 designs which include the capacity of key systems and how the safeguarded elements noted in section 2.2 and 2.3 have been included.

3 Deliverables

- (a) All Design Documentation must clearly show the design and construction safeguarding elements required by the Contract.
- (b) The CSM Contractor must present the safeguarding requirements to key stakeholders and review groups in accordance with the requirements set out in MR-T.

- Sydney Metro City &
Southwest

Central Station Main Works

Schedule C1

- Scope of Works and Technical Criteria
Appendix B16
Pedestrian Modelling Requirements

PROJECT	Sydney Metro City & Southwest	DATE	25 August 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.1
COMPANY	Transport for NSW	FILE NUMBER	
FILE NAME	Central Station Main Works (CSM) SWTC App B16		

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1 Introduction

- (a) This Appendix B16 specifies the requirements for pedestrian modelling which the CSM Contractor must undertake in the development of the design of the Project Works.
- (b) The pedestrian modelling must be undertaken for the following two design years:
 - (i) “Initial Design Year 2026” –the planned year for the start of Sydney Metro City & Southwest train operations; and
 - (ii) “Ultimate Design Year 2056” – the year for which capacity is to be safeguarded to allow for long-term patronage growth.
- (c) In this Appendix B16:
 - (i) “Central Station End State” means Central Station modified to include all the new station infrastructure and permanent adjustments to existing station infrastructure delivered as part of the Project Works (including Metro Station, platforms, concourses, VT and Gatelines);
 - (ii) “Devonshire Street Tunnel East” must be read as a reference to the Chalmers Street Entrance;
 - (iii) “Eddy Avenue East” must be read as a reference to the Northern Entrance;
 - (iv) “Eddy Avenue West” must be read as a reference to the Forecourt Entrance;
 - (v) “Elizabeth Street Entrance & Chalmers Street” “must be read as a reference to the Elizabeth Street Entrance;
 - (vi) “Grand Concourse West” must be read as a reference to the Pitt Street Entrance;
 - (vii) “Henry Deane Plaza” must be read as a reference to the Railway Square Entrance;
 - (viii) “O/D” means origin / destination; and
 - (ix) “Sydney Metro” must be read as a reference to Metro Station.

2 Pedestrian Modelling Requirements

- (a) The CSM Contractor must develop a pedestrian model for the Central Station precinct and must carry out pedestrian modelling as follows:
 - (i) at Design Stage 1 for Central Station End State plus the Western Entrance for the Initial Design Year 2026 and the Ultimate Design Year 2056 based on the forecast customer demand set out in Table 1 and Table 2 in sections and the pedestrian demand distribution set out in Table 3;
 - (ii) at Design Stage 1 for Central Station End State for the Initial Design Year based on the forecast customer demand set out in Table 1 and the pedestrian demand distribution in Table 4; and
 - (iii) at Design Stage 2 and Design Stage 3 for Central Station End State updated to reflect any changes made from the modelling carried out in accordance with section 2(a)(ii) above.
- (b) The pedestrian model must comply with the requirements, and include the assumptions, in section 4.
- (c) Reports presenting all pedestrian modelling results must be included in the Design Documentation for each of the Design Stages.
- (d) The CSM Contractor must carry out sensitivity checks of + 50% on the customer demand distribution for Central Station locations “Grand Concourse West” and “Devonshire Street Tunnel East” set out in Table 4 during pedestrian modelling set out in section 2(a)(ii) above and include the results of the sensitivity checks in the reports presenting pedestrian modelling in the Design Documentation.
- (e) The CSM Contractor must provide the Principal's Representative with advice on when key elements of the Project Works, such as VT, concourses and Gatelines, fall below the level of service requirements set out in section 4.1.3(c), based on the pedestrian modelling undertaken in accordance with section 2(a)(ii) and 2(d) above.

3 Forecast Customer Demand and Distribution

3.1 Forecast Customer Demand

- (a) The Central Station and Metro Station forecast customer demand for the AM Peak Hour in the Initial Design Year 2026 is summarised in Table 1.

Central Station 2026	Suburban	Intercity	Sydney Metro	Exits	Total
Suburban	7,200	300	5,000	18,100	30,600
Intercity	2,800	0	1,600	4,000	8,400
Sydney Metro	2,100	200	0	7,400	9,700
Entries	2,700	300	1,700	0	4,700
Total	14,800	800	8,300	29,500	53,400

Note: Demand has been rounded to the nearest 100

Table 1: Central Station and Metro Station Initial Design Year 2026 AM Peak Hour forecast pedestrian demand.

- (b) The Central Station and Metro Station detailed forecast customer O/D demand matrix for the AM Peak Hour in the Initial Design Year 2026 AM Peak Hour is shown in Attachment A to this Appendix B16.
- (c) The Central Station and Metro Station forecast customer demand for the AM Peak Hour in the Ultimate Design Year 2056 is summarised in Table 2.

Central Station 2056	Suburban	Intercity	Sydney Metro	Exits	Total
Suburban	10,000	500	6,300	24,800	41,600
Intercity	4,000	0	2,000	5,700	11,700
Sydney Metro	2,800	200	0	10,000	13,000
Entries	3,400	500	2,100	0	6,000
Total	20,300	1,200	10,400	40,400	72,400

Note: Demand has been rounded to the nearest 100

Table 2: Central Station and Metro Station Ultimate Design Year 2056 forecast pedestrian demand

- (d) The Central Station and Metro Station detailed forecast customer O/D demand matrix for the AM Peak Hour in the Ultimate Design Year 2056 is shown in Attachment B to this Appendix B16.

3.2 Demand Distribution

3.2.1 Central Station End State plus the Western Entrance

(a) The Ultimate Design Year 2056 AM Peak Hour customer demand distribution for the Central Station End State plus the Western Entrance is shown in Table 3.

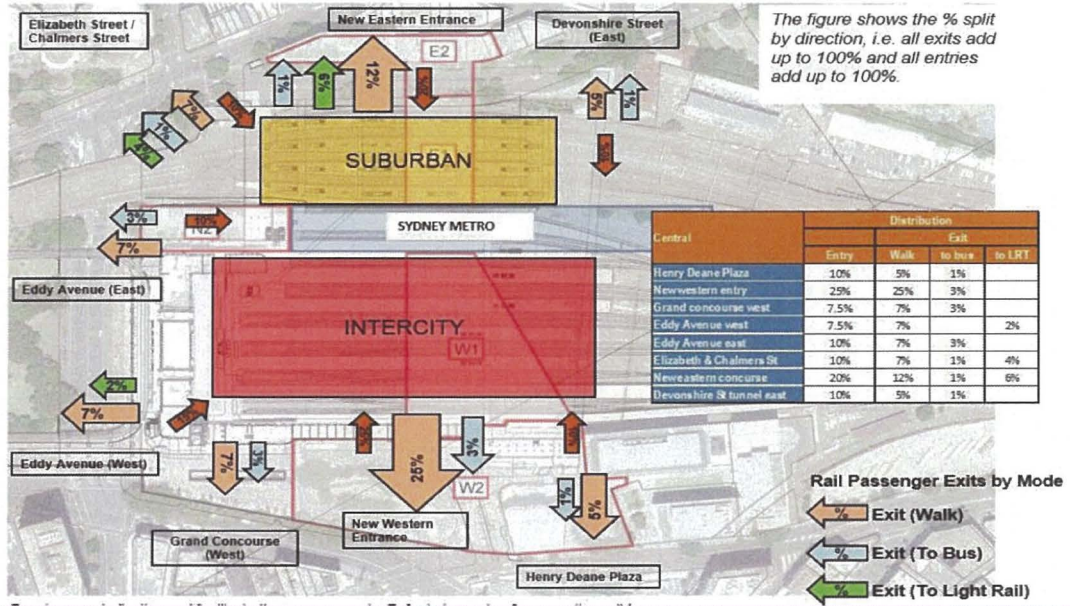


Table 3: Central Station plus Western Entrance year 2056 AM peak hour demand distribution

3.2.2 Central Station End State

(a) The Initial Design Year 2026 AM Peak Hour customer demand distribution for the Central Station End State is shown in Table 4.

Central Station Locations	Distribution			
	Entry	Exit		
		Walk	To Bus	To Light Rail
Henry Deane Plaza	22.5%	5%	1%	
Grand Concourse west	20%	8%	3%	
Eddy Avenue west	7.5%	7%		2%
Eddy Avenue east	10%	7%	3%	
Elizabeth Street Entrance & Chalmers Street	10%	7%	1%	4%
Eastern Entrance	20%	12%	1%	6%
Devonshire Street Tunnel East	10%	29%	4%	

Table 4: Initial Design Year 2026 AM Peak Hour demand distribution for the Central Station End State

4 Inputs and Assumptions

4.1.1 General

- (a) The pedestrian model must include all pedestrian areas within Central Station End State and footpaths surrounding Central Station. The boundaries of the model must include footpaths out to Lee Street (including on the western side of the Henry Deane Plaza subway), Pitt Street, Eddy Avenue and Chalmers Street (including the Chalmers Street Entrance).
- (b) The pedestrian model must allow for a number of non-transport pedestrians accessing the footpaths outside of the Central Station End State.
- (c) The pedestrian model must include 4 different types of customer (each with different walk speed and spatial occupancy requirements), to represent the population including mobility and vision impaired customers, disabled customers, elderly customers, pregnant customers, customers with prams, and customers carrying items such as luggage and surf boards.
- (d) The percentage of persons with reduced mobility (PRM) customers must be 5% for the Intercity Platforms and 2% for the Suburban Platforms.
- (e) The periods of modelling must be the peak one hour during both the AM Peak and PM Peak.
- (f) The Degraded Operation scenario to be used for pedestrian modelling on the island Suburban Platforms must be two consecutive scheduled train arrivals missed on one track (i.e. one side of the island platform). Services resume at the time of the next scheduled train after the two missed services. Upon resumption of services, the follow-on trains arrive at 120 second headways, with no change in passenger load, until the timetable is recovered.

4.1.2 Train Operations

- (a) The CSM Contractor must use the train operations assumptions detailed in Attachment C to this Appendix B16.

4.1.3 Levels of Service (LoS)

- (a) For the purposes of the pedestrian modelling, LoS must be calculated for the average of the peak 15 minutes of the Peak Hours set out in section 4.1.1(e).
- (b) For the purposes of the pedestrian modelling:
 - (i) queuing LoS parameters must be used for platforms and Vertical Transport; and
 - (ii) walkway LoS parameters must be used for concourses.
- (c) The CSM Contractor must demonstrate through pedestrian modelling during the design process that the Project Work and the Central Station End State will achieve the following LoS;

- (i) platforms, walkways and general queueing areas during Normal Operations and Degraded Operations – minimum LoS to be C;
- (ii) stairs during Normal Operations – minimum LoS to be D during the peak minute; and
- (iii) stairs during Degraded Operations – minimum LoS to be D during the peak minute. A lower LOS may be permissible if it can be demonstrated that they will apply for a short duration of time only.

4.1.4 Spatial Area

- (a) Gatelines, unpaid areas and station concourses must have spatial capacity to minimise customer crowding or queuing during Peak Hours.
- (b) Queue lines must not be allowed to block access paths.
- (c) Adequate marshalling areas must be provided where large customer surges could occur including during missed headways and Abnormal Operations.
- (d) The Project Works must be designed such that Central Station End State complies with the following queuing and space criteria during Normal Operations:
 - (i) maximum delay of 60 seconds within a queue for platform level VT;
 - (ii) Platform Clearance time must be not more than 140 seconds for Suburban Platforms;
 - (iii) Platform Clearance time must be not more than 120 seconds for Metro Station platforms;
 - (iv) Platform Clearance time must be not more than 240 seconds for Intercity Platforms;
 - (v) maximum delay of 20 seconds within a queue for a Gateline;
 - (vi) minimum of 0.8m² per person on a platform during Peak Hours, (exclude 0.3m distance from wall for edge effect and 0.3m from PSD);
 - (vii) sufficient capacity so that egress from escalators is kept clear of conflicting cross movements for a distance of at least 8m; and
 - (viii) sufficient capacity to prevent queues forming at transition points between individual elements of pedestrian infrastructure, except those mentioned in sections 4.1.4(d)(i) to 4.1.4(d)(vii).

4.1.5 Vertical Transport

- (a) The following Vertical Transport assumptions must be applied in the pedestrian modelling:
 - (i) the stairways are bi-directional;
 - (ii) where the escalators are located in pairs, one travels up and one travels down;
 - (iii) single escalators connecting platforms and the new concourse areas or the third escalator in a group of three, operate in the peak direction; and

- (iv) an escalator has throughput capacity of 100 people per minute.
- (b) Lifts must not be considered in the modelling due to low numbers of usage.

4.1.6 Platform

- (a) The following platform assumptions must be applied in the pedestrian modelling:
 - (i) customers boarding of the trains is not restricted by the train carrying capacity (passenger loading);
 - (ii) boarding customers would not cross the 'yellow line' to board the train until 10 seconds before the train arrives;
 - (iii) fire stairs and restricted areas for authorised personnel only are considered as non-accessible areas; and
 - (iv) customers are assumed to be uniformly distributed along the entire platform and across each train service.

4.1.7 Concourse

- (a) The following concourse assumptions must be applied in the pedestrian modelling:
 - (i) each gate would have an approximated flowrate of 25 passengers per minute.
- (b) Ticket machine, information service counter and staff rooms must be excluded from the pedestrian model.

Attachment A: Initial Design Year 2026 AM Peak Hour O/D Matrix (with Metro Station demand)

Central Station		4-15	16	17	18	19	20	21	22	23	24	25	NB	SB	Egress (Western)	Egress (Eddy Ave)	Egress (Chalmers)	Egress (Lee St)	Total	Trains per hour (in)	Stopping trains per hour (in)	
Platform	Line	Node	Intercity	Nthn & Nth Shr (to North Shore)	City Cir (clockwise)	Nthn & Wstn (to West/Northern)	Stn & Inn Wst (from City Circle)	City Cir (low)	City Cir (low)	Est Hills (from City Circle)	Airport (to Airport)	Estn Sub & Ilwra (to Bondi Junction)	Estn Sub & Ilwra (to Cronulla)	To North	To South	Egress (Western)	Egress (Eddy Ave)	Egress (Chalmers)	Egress (Lee St)			
4-15	Intercity	115003	0	500	650	25	75	150	325	50	625	200	200	1,300	225	2,150	950	650	275	8,350	12	12
16	Nthn & Nth Shr (to North Shore)	118003	0	0	650	0	25	75	200	25	675	100	125	825	200	425	825	650	1,525	6,325	20	20
17	City Cir (clockwise)	117003	0	1,275	0	0	0	25	100	0	350	25	100	1,275	75	400	750	600	1,425	6,400	20	20
18	Nthn & Wstn (to West/Northern)	118003	25	0	0	0	100	0	0	25	175	0	25	0	75	175	575	450	725	2,350	20	20
19	Stn & Inn Wst (from City Circle)	119003	25	0	0	25	0	0	0	0	50	0	25	0	25	25	150	25	25	375	20	20
20	City Cir (low)	120003	25	450	100	50	0	0	0	25	50	0	675	0	150	325	300	600	2,750	8	8	
21	City Cir (low)	121003	200	875	200	300	150	0	0	0	275	25	1,300	100	225	475	450	1,075	5,650	12	12	
22	Est Hills (from City Circle)	122003	0	0	0	0	0	0	0	0	0	0	0	0	0	75	25	25	125	10	10	
23	Airport (to Airport)	123003	0	0	0	0	0	0	0	0	0	0	0	0	0	75	25	25	125	10	10	
24	Estn Sub & Ilwra (to Bondi Junction)	124003	50	175	0	50	25	0	25	0	25	0	0	400	0	500	1,025	825	1,875	4,975	18	18
25	Estn Sub & Ilwra (to Cronulla)	125003	25	0	0	25	25	0	0	25	125	0	0	25	100	300	300	600	1,550	18	18	
NB	To North		100	250	150	200	75	25	50	0	200	100	25	0	400	800	500	1,400	4,275	20	20	
SB	To South		100	25	25	125	225	0	25	50	475	0	100	0	0	425	1,125	725	2,025	5,450	20	20
	Access (Western)																					
	Access (Eddy Ave)		300	500	100	600	300	0	0	100	400	300	400	1,400	300	0	0	0	0	4,700		
	Access (Chalmers)																					
	Access (Lee St)																					
	Total		850	4,050	1,875	1,400	1,000	275	725	275	3,125	1,050	1,025	7,175	1,025	4,975	7,450	5,525	11,600	53,400		
	Trains per hour (out)		7	20	20	20	20	8	12	10	10	18	18	20	20					Transfers	Entries	Exits
	Stopping trains per hour (out)		7	20	20	20	20	8	12	10	10	18	18	20	20					19,150	4,700	29,550

Attachment B: Ultimate Design Year 2056 AM Peak Hour O/D Matrix (with Metro Station demand)

Platform	Line	4-15	18	17	18	19	20	21	22	23	24	25	NB	SB	Egress (Western)	Egress (Eddy Ave)	Egress (Chalmers)	Egress (Lee St)	Total	Trains per hour (in)	Stopping trains per hour (in)
4-15	Intercity	0	775	975	25	100	200	450	75	850	300	275	1,725	325	3,025	1,325	925	375	11,725	12	12
18	Nthn & Nth Shr (to North Shore)	0	0	850	0	50	100	250	50	800	125	150	900	225	550	1,050	850	1,950	7,900	20	20
17	Gly Cir (clockwise)	0	1,900	0	0	0	50	125	25	450	50	125	1,550	75	525	1,025	850	1,950	8,700	20	20
18	Nthn & Wstn (to West/Northern)	50	0	0	0	125	0	0	25	250	0	25	0	100	250	800	700	1,125	3,450	20	20
19	Stn & Inn Wst (from City Circle)	25	0	0	25	0	0	0	0	50	0	25	0	25	25	225	50	50	500	20	20
20	City Cir (clock)	50	675	150	75	0	0	0	0	25	100	0	925	0	200	450	400	825	3,875	8	8
21	City Cir (anti)	325	1,400	300	425	225	0	0	25	0	450	25	1,800	150	300	675	650	1,550	8,300	12	12
22	Est Hls (from City Circle)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	125	25	25	175	10	12
23	Airport (to Airport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	125	25	25	175	10	8
24	Estn Sub & Illwra (to Bondi Junction)	75	225	0	75	25	0	25	0	0	0	0	425	0	675	1,375	1,125	2,500	6,525	18	18
25	Estn Sub & Illwra (to Cronulla)	25	0	0	50	25	0	0	25	175	0	0	0	25	125	400	375	800	2,025	18	18
NB	To North	125	375	225	250	100	25	75	0	325	150	50	0	0	550	1,100	675	1,900	5,925	20	0
SB	To South	125	25	25	150	275	0	25	50	625	0	100	0	0	550	1,525	975	2,675	7,125	20	0
	Access (Western)	400	700	200	700	400	0	100	100	500	400	400	1,800	400					6,100		
	Access (Eddy Ave)	0	0	0	0	0	0	0	0	0	0	0	0	0					0		
	Access (Chalmers)	0	0	0	0	0	0	0	0	0	0	0	0	0					0		
	Access (Lee St)	0	0	0	0	0	0	0	0	0	0	0	0	0					0		
	Total	1,200	6,075	2,725	1,775	1,325	375	1,050	375	4,050	1,575	1,175	9,125	1,325	6,775	10,200	7,625	15,750	72,500		
	Trains per hour (out)	7	20	20	20	20	8	12	10	10	18	18	20	20					Transfers	Entries	Exits
	Stopping trains per hour (out)	7	20	20	20	20	8	12	10	10	18	18	20	20					26,050	6,100	40,350

Attachment C: Central Station train operation assumptions

Train plan		Train Plan TP9	
Train frequency	Platform	Arrivals	Departures (tph)
		P4	1
	P5	1	0
	P6	1	1
	P7	1	1
	P8	1	1
	P9	1	0
	P10	1	1
	P11	1	0
	P12	1	1
	P13	1	1
	P14	1	0
	P15	1	1
	P16	20	20
	P17	20	20
	P18	20	20
	P19	20	20
	P20	8	8
	P21	12	12
	P22	10	10
	P23	10	10
	P24	18	18
	P25	18	18
	30	20	20
	31	20	20
Train arrival pattern		Headway assumed to be constant across all platforms. Train arrivals simultaneous on P16 and P17, P18 and P19, P22 and P23, and P24 and P25. On P30 and P31 arrivals are offset (train arrivals are staggered at these platforms).	

- **Sydney Metro City &
Southwest**

- Central Station Main Works
Contract Schedules**

- Schedule C1

- **Scope of Works and Technical Criteria
Appendix C01
Metro Station Vertical Transport Specification**

PROJECT	Sydney Metro City & Southwest	DATE	15 June 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.0
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00005125
FILE NAME	Central Station Main Works (CSM) SWTC App C01		

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1 Overview

- (a) This Appendix C01 applies to all lifts and escalators which form part of the Metro Station Works at Central Station.
- (b) Unless the context otherwise requires:
 - (i) terms which have a defined meaning in the General Conditions and SWTC Appendix A01 have the same meaning where used in this Appendix;
 - (ii) any reference to "Specification" is a reference to this Appendix C01; and
 - (iii) any reference to a 'Section' in this Appendix is a reference to a section of this Appendix C01.

2 Performance and Technical Requirements

2.1 Lifts

2.1.1 General

- (a) The lift equipment and installation must conform with the Operator's and CSM Contractor's FLS strategy and the requirements of NFPA130 (2002) – Clause 5.3.5.5 and 5.3.5.7.
- (b) All lifts must:
 - (i) be machine-room-less type;
 - (ii) not open towards Metro Station platform edges;
 - (iii) have fixings and finishes that are demonstrably vandal resistant;
 - (iv) where there are groups of two or more adjacent customer lifts, be controlled by a group controller providing full collective group control;
 - (v) be designed for continuous operation of 24 hours per day, every day, for the Design Life of the equipment;
 - (vi) be designed for a minimum number of motor starts of 240 per hour;
 - (vii) where glass used in the lift car, doors or shaft, use glass of sufficient thickness and laminated/toughened (11.7mm minimum thickness 2 layer bonded) or annealed as appropriate to comply with AS1735.2 Appendix "H" requirements;
 - (viii) have a levelling accuracy of +/- 3.0 mm;
 - (ix) be designed for their rated speed. Lift speeds must be congruent to the travel distance:
 - A. less than 5m at 1.0m/s;
 - B. between 5m and 10m at 1.6m/s;
 - C. between 10 and 15m at 1.75m/s; and
 - D. greater than 15m at 2.0 m/s.
 - (x) be commensurate with the 'Goods Class A' as defined by AS 1735.1 (1999);
 - (xi) have internal dimensions suitable for accommodating an ambulant stretcher;
 - (xii) have a light fitting provided on top of the lift cars. The fitting must be powered by a UPS;
 - (xiii) provide car door locking;

- (xiv) have the capacity to accommodate an elevated working platform, comparable to a JLS 2032ES;
 - (xv) utilise roller guides to the car and counterweight;
 - (xvi) include a mechanical, analogue, motor starts counter;
 - (xvii) include an automatic conservation mode; and
 - (xviii) incorporate facilities for disabled and mobility impaired customers. As a minimum all lifts must be compliant to AS1735.12.
- (c) Lifts that serve customers or other members of the public must:
- (i) be minimum 2025kg, 27 person capacity;
 - (ii) have the lift car wall, door and shaft construction as transparent as far as is reasonably practicable, with minimal obstruction to view from structural and other elements; and
 - (iii) where used to also access Back of House Areas, access control must segregate the entrance to the Back of House Area level from the public.

2.1.2 Ride Comfort, Noise and Vibration

- (a) Lift noise at the lobbies, when measured at 1.5m from the floor and 1m from the door face with doors closed, must not exceed 50dB (A) at any time during the lift cycle.
- (b) Noise level in the lift cars, as measured during any part of the lifts cycle, with the ventilation fans and air conditioning running must not exceed 55 dB(A), excluding the door operation.
- (c) Lift vibrations, as measured during any part of the lifts cycle, must not exceed 0.15mg in any direction.

2.1.3 Lift Shaft Requirements

- (a) The lift shafts for all lifts must:
 - (i) have water sensors in the lift pit. On activation of the water sensors, an alarm will be activated and the lift will automatically 'park' at the top served floor.
 - (ii) include mechanical ventilation in accordance with the SWTC.
 - (iii) have lighting;
 - (iv) use brushed stainless steel panelling for any flushing required by Codes and Standards;
 - (v) use stainless steel mesh panelling for any shaft division screens required by Codes and Standards; and
 - (vi) include fire, heat and smoke detection and fire suppression, with links to the fire system.
- (b) All pit division screens, required by Codes and Standards, must be stainless steel mesh panelling.

- (c) All maintenance panels must be 2mm thick brushed stainless steel, with 3-point lock system, for demonstrable vandal resistance.

2.1.4 Landing Lobbies

- (a) The landing push buttons must be vandal proof "Dewhurst" US 91-15 type (or equivalent approved by the Principal's Representative) with tactile lettering.
- (b) All buttons must be provided with double illumination enabling a low-level (half) illumination in a non-activated state, which intensifies to full illumination after operation of the button. The colour must be approved by the Principal's Representative.
- (c) Indicators must be provided at each landing, which must illuminate an adjustable period before arrival, between 2 and 5 seconds.
- (d) An indicator must be provided at all floors displaying that the lift is out of normal service. The message displayed must be 'OUT OF SERVICE'.

2.1.5 Lift Car Requirements

- (a) All lift cars must have a minimum internal height of 2400mm.
- (b) For 27 person lifts:
 - (i) all lift cars must be a minimum of 1600mm wide;
 - (ii) all lift cars must be a minimum of 2500mm long;
 - (iii) feature lift car and landing door openings must be a minimum of 1400mm wide clear and of the two panel centre opening type;
- (c) All lift doors must be provided with variable voltage variable frequency (VVVF) high-speed heavy-duty door operators, suitable for intensive traffic duty.
- (d) All lift doors must include continuous door safety edge protection.
- (e) Lifts must not contain doors at 90 degrees to each other. Interior lift car lighting must maintain an illumination of not less than 200 lux average horizontal illuminance and 150 lux average vertical illuminance, measured 1.5m above the floor level.
- (f) All lift cars exposed to solar heat loads must incorporate mechanical cooling and mechanical ventilation in accordance with the BCA. The mechanical cooling is to operate when the temperature inside the lift car exceeds 21 degrees Celsius and be of sufficient capacity that the maximum temperature in the lift car interior does not exceed 25 degrees Celsius when the temperature in the lift shaft is 34 degrees Celsius.
- (g) Lift drive systems must use VVVF drives with high efficiency permanent magnet AC motors.
- (h) All lifts drives must be regeneration type; feeding power back into the Metro Station electrical network.
- (i) The lifts must be provided with automatic audible information in the lift cars in accordance with AS1735.12.

- (j) Where two or more lifts are provided at a location, one lift must form a mechanical back-up for the purposes of power supply.
- (k) Lifts must include battery-based uninterruptible power supply facilities to automatically move the lift car to the North South Concourse and open both car and landing doors when there is a loss of main power supply. All lifts, upon reaching their destination and alighting passengers, must shut down until normal mains power is returned.
- (l) Lift must include battery-based uninterruptible power supplies for the alarm sounder, car lighting, remote monitoring system, communication devices and powered ventilation equipment. The following standby times must be adhered to:
 - (i) emergency lighting: 4 hours;
 - (ii) communications system: 2 hours;
 - (iii) ventilation equipment: 2 hours;
 - (iv) car top light fitting: 2 hours; and
 - (v) alarm sounder 2 hours.
- (m) Fault identification must be provided on each lift without the need to access the lift car or lift shaft. Faults must also be communicated to the building management system (BMS).

2.1.6 Interfacing Systems

- (a) Provisions must be made for works by Interface Contractors in accordance with the Interface Schedules, including for:
 - (i) closed circuit television coverage and communications systems; and
 - (ii) a direct telephone link from lift telephones to the Sydney Metro OCC.

2.1.7 Control Features

- (a) All lifts must be provided with fire service operation. A continuous audible signal in the car must sound and a visual signal must be displayed in the car identifying a 'FIRE SERVICE OPERATION' status.
- (b) All lifts must be provided with an independent service control for each lift with a control key switch located in the operating panel in the car.
- (c) Out-of-service key switches must be provided in one of the landing call panels. When the switch is activated:
 - (i) all landing calls must be cancelled;
 - (ii) the 'OUT OF SERVICE' indicator must illuminate on each landing; and
 - (iii) all existing car calls must be answered and no new call will be accepted.

2.1.8 Control and Monitoring

- (a) Lifts must include:

- (i) local control to the respective equipment in accordance with relevant Codes and Standards, the Operator's FLS strategy and CSM Contractor's FLS strategy;
- (ii) all necessary connections and control interfaces to provide alarms and functionality to associated systems including the fire systems, security, communications and hearing assistance;
- (iii) connection with the OCC CCTV system and a functional control interface with the CCS; and
- (iv) provision for alarm and status monitoring by the Metro Station BMS including:
 - A. alarm and stop button activation for all lifts;
 - B. the status of the system operations including direction of travel, system failure, fireman's control; and
 - C. data logging and asset information for the Project's asset information system.

2.1.9 Lift Car Finishes and Indication

- (a) All sills must be hollow stainless steel fabrication.
- (b) All lifts must be provided with digital information screens, to maximise the passengers' comfort. The screens must be a minimum 15 inch high resolution colour monitors.
- (c) All lift cars must have a minimum of two car operating panels of 2mm thick brushed stainless steel, securely fastened with hidden fixings, which must be demonstrably vandal resistant.
- (d) All lift car operating panels must be approved by the Principal's Representative for wayfinding and branding.
- (e) Lift car finishes must be as follows:
 - (i) left-side car wall: framed glass with lower section under handrail to be protected with grating;
 - (ii) right-side car wall: framed glass with lower section under handrail to be protected with grating;
 - (iii) rear-wall (for single entry lift cars): framed glass with lower section under handrail to be protected with grating;
 - (iv) ceiling: brushed stainless steel;
 - (v) skirting: brushed stainless steel;
 - (vi) flooring: stone;
 - (vii) car doors: framed glass;
 - (viii) handrails: brushed stainless steel.
- (f) The car push buttons must be vandal proof "Dewhurst" US 91-15 type (or equivalent approved by the Principal's Representative) with tactile lettering.

- (g) All buttons must be provided with double illumination enabling a low-level (half) illumination in a non-activated state, which intensifies to full illumination after operation of the button. The colour must be approved by the Principal's Representative.
- (h) An indicator must be provided at all floors displaying that the lift is out of normal service. The message displayed will be 'OUT OF SERVICE'.

2.2 Escalators

2.2.1 General

- (a) All escalators must:
 - (i) have a minimum step width of 1000mm;
 - (ii) be the highest duty available commercially;
 - (iii) be capable of a maximum rated escalator speed of 0.75m/s as defined in AS1735.5;
 - (iv) allow variable speed function, with maximum 0.75m/s, a nominal off-peak speed of 0.5m/s and the energy conservation speed of 0.05m/s;
 - (v) have a minimum of four escalator flat steps at the top and bottom landings;
 - (vi) all steps can be aluminium or stainless steel;
 - (vii) be designed for continuous operation of 24 hours per day, every day, for the Design Life of the equipment.
 - (viii) have an angle of inclination no greater than 30 degrees;
 - (ix) have a handrail height of 1000mm;
 - (x) have a step chain internal to truss;
 - (xi) have step chain rollers of a minimum 100mm;
 - (xii) be deemed "public service escalators" for application of AS1735.5. All design and functional recommendations outlined in Annex D (informative) of AS 1735 Part 5, titled "Additional recommendations for public service escalators and public service passenger conveyors" must be applied to escalators regardless of rated speed and vertical rise specifications;
 - (xiii) have hot-dipped galvanised trusses;
 - (xiv) have the anti-fall installed with no gaps between the external face of the escalator and the anti-fall panel;
 - (xv) include automatic slow speed energy conservation mode;
 - (xvi) have the time sequence of speed control adjustable to maximise energy efficiency;
 - (xvii) have the speed change from energy conservation speed to normal operating speed must be achieved prior to customers, walking at a nominal pace of 1.35m/s, reaching the comb plate;

- (xviii) have a radar type passenger detector hidden in the newel.
 - (xix) have double brush type deflector guards provided along the length of travel to protect against entrapment between the skirting panels and the steps;
 - (xx) have step demarcation provided by way of bright yellow lines on both sides and the front edges of each step and by lighting within the step band at each landing;
 - (xxi) not use plastic inserts for demarcation lines;
 - (xxii) include a collection facility for dust and detritus within each escalator truss. The collection facility must also allow for periodic cleaning by specific access provisions;
 - (xxiii) include local operation key switches at the top and bottom newels. All remote controls must become inactive whilst the key is inserted;
 - (xxiv) include fault identification on each escalator without the need to open pit access hatches. Faults must be communicated to the CCS, OCC and fire control room (FCR); and
 - (xxv) include stop buttons at both top and bottom landings. Additional stop buttons must be provided at regular intervals no greater than 10m along the escalator path of travel. Additional stop buttons must have clear, hinged covers with a local audible alarm triggered when the cover is lifted;
- (b) The escalator landings must incorporate hazard warning tactile indicators to comply with AS1428.4. If necessary, the length of landing tread plates must be extended beyond the end of the escalator truss so that tactile indicators fall wholly on the escalator tread plate.
- (c) The escalator cladding below 2.7m from finished floor level must be rigid and impact resistant.
- (d) The escalator decks and steps must meet the Annex J requirements in EN115, as prescribed in DIN 51130:2004.

2.2.2 Guarding

- (a) Where escalators are installed in open void areas with a vertical rise greater than 3m, glass side fall restraint (anti-fall) must be included in the escalator design as an integrated design element, with loads and fixings coordinated with the escalator truss construction. This guard must be of substantial construction so that the top does not deflect more than 10mm.
- (b) The anti-fall must be to a minimum of 1500mm above top of tread.

2.2.3 Lighting

- (a) All escalators must:
- (i) employ LED technology lighting;
 - (ii) be provided with understep lighting;
 - (iii) be provided with skirt lighting, as approved by the Principal's Representative; and

- (iv) be provided with comp plate lighting, as approved by the Principal's Representative.

2.2.4 Indication

- (a) All escalators must be provided with:
 - (i) an LCD display on the escalator decking, for any fault code read out;
 - (ii) illuminated indicators on the decking, showing the operating direction. These indicators will automatically change to reflect any change in direction of the escalator. The indicators must be provided so that they are angled 45 degrees from the horizontal. In addition to the skirting indicators, a stainless steel pedestal arrangement to include additional escalator indicators must be provided; and
 - (iii) automatic audible information on the approach to the escalators.

2.2.5 Finishes

- (a) All escalators must have glass balustrades and black handrails.
- (b) Escalator finishes must be as follows:
 - (i) balustrade decking: brushed stainless steel;
 - (ii) skirting: stainless steel, teflon coated;
 - (iii) comp plate: aluminium; and
 - (iv) machine/pit covers: stainless steel.

2.2.6 Interfacing Systems

- (a) Fire, heat and smoke detection and fire suppression must be provided in escalator pits in accordance with the SWTC;

2.3 Control and Monitoring

- (a) Escalators must include:
 - (i) local control to the respective equipment in accordance with relevant Codes and Standards, the Operator's FLS strategy and CSM Contractor's FLS strategy;
 - (ii) all necessary connections and control interfaces to provide alarms and functionality to the fire systems;
 - (iii) provisions for works by Interface Contractors in accordance with the Interface Schedules, including:
 - A. for all necessary connections and control interfaces to provide alarms and functionality to associated systems within the Project including security, communications and hearing assistance; and
 - B. connection with the OCC CCTV system and a functional control interface with the CCS;
 - (iv) for alarm and status monitoring by the BMS including:

- A. alarm and stop button activation for all lifts; and
 - B. the status of the system operations including direction of travel, system failure, fireman's control; and
- (v) data logging and asset information for the Project asset information system.

2.4 Design Documentation Requirements

- (a) In addition to the Management Requirements the CSM Contractor must provide the following Design Documentation for Vertical Transport at Design Stage 2:
- (i) materials and finishes details including:
 - A. lift car interior;
 - B. flooring;
 - C. hand rails;
 - D. lighting;
 - E. emergency lighting;
 - F. operating panels;
 - G. indication panels;
 - H. non slip treatment escalator steps;
 - I. comb plates;
 - J. escalator hand rails;
 - K. escalator stainless steel; and
 - L. escalator fall protection;
 - (ii) technical specifications;
 - (iii) equipment data sheets;
 - (iv) risk analysis report; and
 - (v) maintenance access and replacement strategy.

3 Testing and Commissioning Requirements

- (a) The lifts and escalators must undergo specific testing and commissioning activities including:
 - (i) lift car interior:
 - A. hidden area and anti-rubbish accumulation test; and
 - B. walls and ceiling panel removal tests;
 - (ii) landing and door strength:
 - A. landing door construction test;
 - B. car door construction test;
 - C. lower door guide test;
 - D. lower door construction test;
 - E. door locking strength;
 - F. horizontal deflection test;
 - G. door frame impact test;
 - H. operating panels and indication panel impact tests; and
 - I. lift walls impact test;
 - (iii) escalators:
 - A. balustrade deflection test;
 - B. balustrade impact test; and
 - C. truss cladding below 2.7m off finished floor impact test.

- # Sydney Metro City & Southwest

- ## Central Station Main Works Contract Schedules

- Schedule C1

- - Scope of Works and Technical Criteria
Appendix C02
Central Station Lift Specification

PROJECT	Sydney Metro City & Southwest	DATE	15 June 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
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1 Introduction

- (a) This Appendix C02 applies to all lift works which form part of the Central Station Works and the Central Walk Works.
- (b) This Appendix C02 describes the performance and technical criteria for the lift works, including for design, construction, installation, testing and commissioning, and hand over.
- (c) This Appendix C02 comprises:
 - (i) Section 1 is an introduction;
 - (ii) Section 2 outlines the minimum Codes and Standards;
 - (iii) Section 3 contains the design process to be applied to integrate the lifts into the design of the building or facility;
 - (iv) Section 4 contains the general, performance and technical requirements;
 - (v) Section 5 contains the required operational and control functionality;
 - (vi) Section 6 contains the interfacing system requirements and aspects of the build quality;
 - (vii) Section 7 contains the general commissioning requirements; and
 - (viii) Attachment 1 contains specific requirements for the lifts.
- (d) Unless the context otherwise requires:
 - (i) terms which have a defined meaning in the General Conditions and SWTC Appendix A01 have the same meaning where used in this Appendix C02;
 - (ii) any reference to "Specification" is a reference to this Appendix C02;
 - (iii) any reference to a 'Section' in this Appendix C02 is a reference to a section of this Specification; and
 - (iv) any reference to a 'Attachment' in this Specification is a reference to an attachment of this Appendix C02.

2 Compliance with Codes and Standards

- (a) The lift works must conform with the requirements of this Specification and all relevant Codes and Standards.
- (b) The minimum Codes and Standards include, as applicable to the equipment specified:
 - (i) AS 1428.2: Design for Access and Mobility; Part Two: Enhanced and Additional Requirements – Buildings and Facilities;
 - (ii) AS 1428.2: sets out requirements for the design of buildings and facilities for access for people with disabilities;
 - (iii) AS 1735: Lifts, Escalators and Moving Walks;
 - (iv) AS 1735.1 sets out the general requirements for Lift installations;
 - (v) AS 1735.2 sets out the requirements for electric passenger and goods lifts;
 - (vi) AS 1735.12 sets out particularly required facilities in lifts for persons with disabilities;
 - (vii) AS 4431. Guidelines for Safe Working on New Lift Installations in New Constructions;
 - (viii) National Construction Code;
 - (ix) AS/NZS 3000: Electrical Installations (known as the Australian/New Zealand Wiring Rules). Wiring requirements for lift installations;
 - (x) AS/NZS 3008: Electrical Installations – Selection of Cables;
 - (xi) Work Health and Safety Act 2011; and
 - (xii) Sydney Trains Engineering Standard – Stations and Buildings - Station Design Standard Requirements.
- (c) In the event of an inconsistency, ambiguity or discrepancy between the requirements of this Specification and Codes and Standards:
 - (i) the CSM Contractor must notify the Principal's Representative and the Independent Certifier; and
 - (ii) the requirement which delivers the greatest level of service or is the highest standard will apply.
- (d) The CSM Contractor must issue to the Principal's Representative and the Independent Certifier certificates of the lift works' compliance with the relevant Codes and Standards and Laws. The CSM Contractor must notify the Principal's Representative and the Independent Certifier of subsequent changes in the relevant Codes and Standards that impact upon this Specification.

3 Design Requirements

3.1 Design Documentation Requirements

- (a) In addition to the Management Requirements the CSM Contractor must provide the following Design Documentation for lifts at:
 - (i) Design Stage 2:
 - A. generic lift design drawings;
 - B. where lifts are to be retrofitted to existing stations or for the replacement of existing lifts, a lift option report in accordance with Section 3.2;
 - (ii) Design Stage 3:
 - A. detailed design drawings, in accordance with Section 3.4; and
 - B. a lift design report in accordance with Section 3.3.

3.2 Lift Option Report

- (a) The lift option report must:
 - (i) confirm whether the lifts available from the respective term contract are suitable for the application;
 - (ii) provide confirmation of the alternative options;
 - (iii) provide an evaluation of the alternative options to include cost, design and maintenance; and
 - (iv) identify a preferred option for approval by the Principal's Representative.

3.3 Lift Design Report

- (a) The lift design report must include:
 - (i) the scope of works;
 - (ii) a list of relevant Codes and Standards;
 - (iii) details of the design criteria, design assumptions and operational parameters used in the lift design;
 - (iv) confirmation of resolution of particular design issues (i.e. Power Supply Conditions);
 - (v) address all design issues as listed in the Table of Contents
 - (vi) confirmation of design co-ordination with the designers of structure, architecture and systems (i.e. confirmation of liaison with Fire Safety Engineer to confirm lift operation in the event of fire alarm in or adjacent to the lift shaft);

- (vii) designer nominated hold and witness points to be included within an inspection and test plan for the lift shaft construction and lift installation and commissioning;
- (viii) compliance sign-off of Designers; and
- (ix) a schedule of Design Documentation.

3.4 Drawings

- (a) The CSM Contractor must provide:
 - (i) general arrangement drawings, in accordance with Section 3.4.2;
 - (ii) builder's work drawings, in accordance with Section 3.4.3;
 - (iii) mechanical drawings, in accordance with Section 3.4.4; and
 - (iv) electrical drawings, in accordance with Section 3.4.5.

3.4.2 General Arrangement Drawings

- (a) The general arrangement drawings must clearly indicate the location and type of all lift well equipment, secondary structure, machinery, brackets and fixings.

3.4.3 Builder's Work Drawings

- (a) The builder's work drawings must:
 - (i) include layout drawings incorporating comprehensive plan drawings of the lift well, machinery spaces, lift entrances and full elevation details;
 - (ii) clearly identify all builder's work including a written schedule of the builder's work required to ensure that necessary allowances can be made accordingly;
 - (iii) include loading requirements for foundations, bases, lifting and supporting structures for plant or equipment, all holes in walls, floors and ceiling elements and machinery spaces as required by this Specification;
 - (iv) clearly identify the heat output generated by any lift equipment to ensure adequate ventilation is provided in machinery spaces as necessary;
 - (v) clearly identify the loading and details of fixings required to any adjacent structure, including the fixing method and sizing;
 - (vi) detail and clearly identify the mounting plates and associated attachment points, including welds, studs and threaded rods attached to the plates;
 - (vii) clearly identify the shaft ventilation filter and thermostatic sensor positioning; and
 - (viii) clearly detail or schedule the electrical supply requirements, providing at least the following information:
 - A. full load running current;
 - B. maximum starting current; and

C. required protective device and capacity.

3.4.4 Mechanical Drawings

- (a) Drawings for all mechanical elements related to the aesthetic finishes (such as car body work, doors and architraves, pushes, indicators, operating panels (car and landing) and mounting plates) must be submitted at each design stage.
- (b) Any drawings for items of plant or equipment submitted for comment must indicate principal dimensions, fixings, connections and all other relevant details.
- (c) Where a manufacturer's original drawings are used, each drawing must be specific to the relevant lift works and all references to optional features, other machines of a range and other such references must be deleted or the original drawings redrawn to comply with this Section.

3.4.5 Electrical Drawings

- (a) All wiring diagrams must indicate clearly that wiring which forms part of, or is connected to, the equipment as delivered.

3.4.6 Coordination of Drawings

- (a) The CSM Contractor must coordinate all drawings prepared by Subcontractors to ensure drawings are compatible, correctly annotated and cross-referenced at all interfaces.

3.5 Design Calculations

- (a) The CSM Contractor must provide, if requested by the Principal's Representative of the Independent Certifier, detailed calculations in accordance with AS 1735 verifying the design deflections and stresses of the selected guide rails.

3.6 Samples

- (a) At Design Stage 2, the CSM Contractor must submit to the Principal's Representative and the Independent Certifier for review in accordance with the Contract, samples based on the drawings and schedules of materials for the following items:
 - (i) car body work, including glass;
 - (ii) cladding;
 - (iii) flooring;
 - (iv) handrails;
 - (v) brackets & fixings;
 - (vi) lighting;
 - (vii) emergency lighting;
 - (viii) car and landing operating panels;
 - (ix) all buttons;

- (x) all indicators;
- (xi) all mounting plates; and
- (xii) braille plates for landings.

4 General, Performance and Technical Requirements

4.1 Scope of Works

- (a) The lift works must comprise all activities necessary to form a complete lift installation and carry out tests, adjustments and commissioning as required giving an effective working installation.
- (b) The CSM Contractor must coordinate and interface the lift works with the work of Interface Contractors and any other works undertaken by the CSM Contractor relevant to the lifts with respect to:
 - (i) dimensional compatibility;
 - (ii) technical interfaces, including power supplies, security, closed circuit television, fire alarm, remote alarm, EWIS and finished floor levels;
 - (iii) programming of sequential operations to interface with other works; and
 - (iv) interdisciplinary co-ordination.
- (c) The CSM Contractor must submit drawings, calculations and any other information necessary to substantiate that the proposals meet the performance requirements of this Contract.

4.2 Design Intent

- (a) In developing the Design Documentation, the following aims must be addressed:
 - (i) universal access (for able bodied and mobility-impaired passengers);
 - (ii) vandal and misuse resistance;
 - (iii) heavy goods, heavy equipment and mobile plant loading;
 - (iv) resistance to railway environmental influences;
 - (v) standardisation with the existing lifts operated and maintained by Sydney Trains;
 - (vi) visual continuity;
 - (vii) passive security;
 - (viii) ease of maintenance and future availability and sourcing of spare parts;
 - (ix) maintainability for the Design Life of the lift;
 - (x) stimulating travel experience; and
 - (xi) minimisation of energy requirements.

- (b) All lift elements must be located to facilitate ease of circulation and clarity of way finding. Equal access is provided through the provision of a lift to serve each change of level.

4.3 Waterproofing

- (a) All lifts must be designed in accordance with the following waterproofing provisions:
 - (i) lift shaft pits must be designed with positive water proofing membranes;
 - (ii) use of chemical additives to the concrete mix (eg Xypex) must not be solely relied upon for waterproofing;
 - (iii) use of precast elements with reliance on sealed/caulked joints for water proofing is prohibited as joints will break down over time;
 - (iv) where water ingress into the lift pit is likely to occur due to natural occurrences, a sump pump and sufficient sump depth must be provided (such as excess water ingress through lift pit construction underground through natural ground);
 - (v) the whole lift shaft structure including the roof needs to be watertight;
 - (vi) all lift canopies must be designed and constructed to prevent water entry to the shaft wall and wetting the lift controller;
 - (vii) all landings must have a slope away from the lift to ensure water does not enter the lift;
 - (viii) all landings must be designed to ensure wind driven rain does not contact the controller, call buttons, doors and landing;
 - (ix) all lift louvers must be storm proof (2 stage) to prevent water ingress from rain and wind driven rain into lift shaft. Detailing on corners of louvres must also prevent water ingress (back flashing may be required.);
 - (x) glazing of the shaft must be waterproof to prevent water ingress and to allow positive air flow when the shaft fan is operating;
 - (xi) wherever possible, paths and platforms must slope away from lift entries. where it cannot be avoided that a path or platform slopes towards the lift, a suitable drain must also be designed and installed before lift commissioning, to ensure water does not enter the lift;
 - (xii) the canopy to the lift shaft must be fitted with sufficient safety hooks (a minimum of two) for harness attachments, to permit access to all points on the canopy; and
 - (xiii) the roof of the lift shaft must be fitted with sufficient safety hooks (a minimum of two) for harness attachments, to permit access to all points on the roof.

4.4 Plant Operating Hours

- (a) The lift plant must be arranged for continuous operation based on a 24 hours a day 7 days a week operation, and must be capable of achieving 240 starts per hour.

4.5 Accessibility

- (a) The lift machinery, ropes, sheaves and other equipment in the machinery spaces must be arranged so as to be accessible to facilitate safe inspection and maintenance. All parts of the lift, lift shaft and lift shaft equipment especially where these are visible from outside the lift shaft or within the lift car must be accessible to facilitate safe and easy cleaning. This is particularly relevant where any glazing is used in the lift shaft or in the lift car.

4.6 Transfer of Mobility Impaired Persons

- (a) All lift elements must be designed to facilitate "Universal Access" for mobility-impaired and people with disabilities, in accordance with AS 1735 Part 12, the Building Code of Australia (BCA) and other relevant Codes and Standards.

4.7 Heavy goods, heavy equipment and mobile plant loading

- (a) In addition to people transportation, the lift works must be designed for transportation of heavy goods, heavy equipment and mobile plant such as elevated work platforms and scissor lifts to the maximum rated load on the load notice.
- (b) Where the door placement is not centred or in cases where the load of the equipment is in an unfavourable position further from the guide rails, the total gross weight must be less than 75% of the maximum rated load.

4.8 Security

- (a) The CSM Contractor must ensure the highest possible levels of security.
- (b) A remote alarm system in accordance with the current system adopted by Sydney Trains must be installed between the lift and the nominated control room at the station as nominated by the Principal's Representative.
- (c) Sufficient glazing to the lift cars and car doors must be used to enable visibility for occupants to see outside, and enable clear lines of sight from outside into the lift. Annealed laminated safety glass must be provided for all glass used, where required.

4.9 Vandal and misuse resistance

- (a) The lifts on the rail network have extremely high exposure resulting in high maintenance costs and breakdown rates due to vandalism and misuse. The CSM Contractor must ensure the highest levels of resistance to vandalism and misuse in order to reduce inconvenience to passengers and delays to rail services. To ensure lifts are maintainable at an acceptable level of reliability and aesthetic condition, all elements of the lift must be designed to improve resistance against vandalism and misuse (especially impact and etching damage).
- (b) Where possible the use of glazing must be avoided. Glass must not be used up to a minimum height at the level of the handrail in the car for all car walls, where 5WL textured stainless steel panels must be used.

4.10 Energy Consumption

- (a) The list works must be provided to deliver a good passenger service whilst incurring minimal environmental impact. Variable speed drives must be provided for the lifts.
- (b) Lift cars and lift shafts must be designed in order to minimise solar gain in both the lift shaft and the lift car. During periods of low usage, the lift cars must park at a non-exposed level in order to minimise solar gain.

4.11 Special considerations

- (a) In undertaking the lift works, the CSM Contractor must make sufficient allowance for the conditions of mass transit (rail station) use, station or facility location, environmental exposure and passenger intensity. Without limitation, the CSM Contractor must ensure that the lift works are able to withstand the following conditions of mass transit rail stations:

- (i) power supply conditions;
- (ii) electrolysis;
- (iii) stray electrical currents;
- (iv) temperature extremes;
- (v) humidity;
- (vi) water ingress into shaft, including due to wind driven rain;
- (vii) environmental exposure;
- (viii) train induced vibration;
- (ix) train generated brake dust; and
- (x) vandal resistance;
- (xi) goods and equipment loading; and
- (xii) plant, mobile plant and EWP loading.

The lift design report must demonstrate that these issues have been addressed.

4.12 Power Supply Conditions

- (a) The permanent power supply specified in the following ASA Standards apply to the installation of the lifts:
 - (i) EP 90 10 00 02 SP Standard Voltage Tolerances;
 - (ii) EP 90 10 00 01 SP Electrical Phase Relationships; and
 - (iii) EP 03 00 00 01 T1 Rectifier Transformer & Rectifier Characteristics.
- (b) The CSM Contractor must confirm within the lift design report the measures undertaken to ensure compliance with AS 3000 Clause 1.9.4 and the standards in Section 4.12(a).

- (c) The lift design report must set out the CSM Contractor's approach during design, manufacture and installation for avoiding issues resulting from any voltage regulation or harmonic issues.

4.13 Standby Battery System

4.13.1 Batteries

- (a) The lift battery must be capable of initiating the lowering or raising of the lift car to the next floor in the event of a mains power failure. The emergency power supply will release the brake. Upon reaching the destination floor and opening the doors the lift must then shut down until normal mains power is returned.
- (b) Standby batteries must be provided for the alarm sounders, car lighting, remote monitoring system, communication devices, car voice annunciation and powered ventilation equipment, allowing for the following standby times in the event of power failure:

Emergency lighting (Car and well)	4 hours continuous illumination
Communication devices	2 hours use
Car ventilation equipment	2 hours use
Alarm sounders	2 hour continuous operation of all sounders

- (c) The alarm sounders must have a dedicated standby battery, independent of any other battery-backed systems, which must support all linked sounders operating continuously for the specified duration.
- (d) Other battery-backed units that share a common battery must be capable of operating for the specified periods, assuming concurrent operation of all supported equipment.
- (e) Communications infrastructure supporting emergency telephony must have a minimum run time that meets or exceeds continuous operation of communication devices in the event of power failure.

4.13.2 Battery Charger

- (a) Automatic battery chargers must be provided, which must be suitable for trickle charging all standby batteries.

4.14 Stray Current Mitigation

- (a) The CSM Contractor must eliminate any occurrences of stray-current leakage from within the lift well and subsequent damage to the overall installation, including lift machinery and all lift well equipment including guide rails and controllers.

4.15 Ride Comfort, Noise and Vibration

4.15.1 Noise Levels on Lift Lobbies

- (a) Lift noise, when measured at 1.5m from the floor and 1m from the door face with the doors closed, must not exceed 50dB(A) at any time during the lift cycle.

4.15.2 Lift Vibration

- (a) Vibration measurements must be taken at the centre of the car, on the floor, in three mutually perpendicular axes corresponding to vertical vibration and lateral quaking. Measurements must be made of vibration levels in each direction over the following cycles:
- (i) one full cycle from the bottom of the station to the top;
 - (ii) one full cycle from the top of the station to the bottom; and
 - (iii) journeys must be measured to identify that the correct speed profiles are being achieved.
- (b) A cycle is defined as the period from when the doors start to close at one level, to when the doors have fully opened at the final level.
- (c) The vibration levels must not exceed the values indicated in the performance table below.

4.15.2.1 Noise Levels in Lift Cars

- (a) Noise levels in the car under acceleration, deceleration and at maximum car velocity in the cycle must not exceed the values indicated in the performance table when measured with any mechanical ventilation devices switched 'OFF'. Readings must also be checked with these devices switched 'ON'.

4.15.2.2 Noise and Vibration Performance Table

- (a) The following table identifies the maximum allowable car noise and vibration performance for differing car speeds.

Lift Speed (m/s)	Maximum Acceleration (m/s ²)	Maximum Jerk (m/s ³)	Max. Noise in car dB(A)
1.0 – 4.0	0.8	1.4	55*

- (b) Horizontal vibration in the frequency range 1—80 Hz (inclusive) must not exceed a maximum (RMS) acceleration level of 0.08 m/s². The above limit applies to any time during a complete cycle, in any 1/3rd-octave band in the frequency range specified.
- (c) Vertical vibration in the frequency range 1-80 Hz (inclusive) must not exceed a maximum (RMS) acceleration level of 0.08 m/s². The above limit applies to any time during a complete cycle, in any 1/3rd octave band in the frequency range specified.
- (d) Vertical vibration during acceleration / deceleration and stop / start periods in the frequency range 1-80 Hz (inclusive) must not exceed a maximum acceleration level (in any 1/3rd octave band) of 0.1m/s².
- (e) These maximum vibration levels apply to lift car speeds up to 4m/s.
- (f) Maximum in-car noise levels should be measured with the lift car air conditioning and ventilation in operation while the car remains at a fixed location.

4.16 Electrical and Wiring Installation

4.16.1 General

- (a) The design of electrical installation must comply with the current edition of AS/NZS 3000 Electrical Installations and AS/NZS 3008 Selection of Cables.
- (b) The electrical supply to the lift works must be in accordance with AS/NZS 3000.

4.16.2 Wiring

- (a) All cables other than travelling cables must be in accordance with AS1735 and AS/NZS 3000.

4.16.3 Steel Conduit and Trunking

- (a) The installation of conduit must be in accordance with AS1735 and AS/NZS 3000.

4.16.4 Machinery Space Lighting and Power

- (a) A single-phase supply, terminating in a single-pole switch fuse located in the machinery space(s) must be provided for each car lighting circuit, taken from the local distribution board.
- (b) Machinery space lighting must incorporate emergency lighting to serve any control panels, drive machines or other serviceable equipment.
- (c) A twin 15 amp switched socket outlet with integral RCD protection must be installed for each lift in the machinery space(s) and in each lift pit, fed from the lift controller.

4.16.5 Lift Well Lighting

- (a) The CSM Contractor must provide permanent lift-well pulse relay controlled lighting positioned at the top of the shaft, the bottom of the shaft, the controller box (landing) and the maintenance box.
- (b) A clearly labelled switch for operating the lift well lighting must be provided in an easily accessible location adjacent to any pit access ladders.
- (c) All well lighting switches must incorporate a neon indicator that operates when the switch is in the off position to facilitate location of the switch in darkness.
- (d) Luminaires must be positioned in accordance with AS1735. Luminaires must be standard emergency lights and must be supplied and installed to the Principal's Representative's approval. In the lift well, the top and bottom luminaire plus every alternate luminaire in the well must have a self-contained emergency battery pack.

4.16.6 Car Lighting

4.16.6.1 General

- (a) Car lighting must be of a suitably robust design to suit a mass transit rail environment and reduce the risk of damage through vandalism or tampering.

4.16.6.2 Car Interiors

- (a) Interior lighting must be by at least four recessed and flush mounted LED luminaires, suitably enclosed, each operated from independent control gear. The

illumination must be not less than 200 lux average horizontal illuminance and 150 lux average vertical illuminance. All lux levels are to be measured at a height 1.5m above the floor level.

- (b) The design of light fittings must include vandal resistant fittings and tamperproof screws, in accordance with Attachment A.

4.16.6.3 Emergency Lighting

- (a) In addition to mains operated lighting, an emergency system must energise automatically to the normal car lighting following the failure of the mains supply and must provide a minimum constant illumination of 50lux for a duration of not less than 3 hours. The emergency lighting must be combined within the luminaires used for the main lighting. Separate emergency lighting luminaires will not be accepted.
- (b) The luminaires for the emergency lighting must be located and rated such that, in addition to providing general illumination of the car, they must provide sufficient illumination to distinguish the car threshold and all communication and control features within the lift car.
- (c) Power for all the emergency lights must be supplied by more than one power supply, configured so that not all of the lights connect to any one supply. Each supply must be on separate circuits to ensure redundancy and that failure of any one supply will not result in total failure of all the lights in the car.

4.16.7 Car Top Lighting

- (a) A low energy LED (or equivalent approved by the Principal's Representative) light fitting incorporating a non-maintained emergency light must be provided on top of the lift car. The fitting must be powered by a standby battery supply. A lead LED light and a bulkhead LED light fixed to the top of car.

4.17 Lift Car Ventilation and Air Conditioning

- (a) All lift cars must include cooled mechanical ventilation to operate when the temperature inside the lift car exceeds 21 degrees Celsius and be of sufficient capacity that the maximum temperature in the lift car interior does not exceed 25 degrees Celsius when the temperature in the lift shaft is 34 degrees Celsius.
- (b) The ventilation must have an air handling capacity to change the volume of air in the lift car in less than 1 min. The mechanical ventilation must include an auxiliary power source to maintain these ventilation requirements for a period of at least 2 hours in the absence of normal power.
- (c) The cooled mechanical ventilation unit must include a label specifying the brand and model of the unit, as well as the general technical specifications of the unit, and the contact details of the manufacturer.

4.18 Lift Shaft Ventilation

4.18.1 Operation

- (a) The shaft fan(s) must be positioned at the bottom of the shaft and capable of providing positive air pressure throughout the shaft. The fan must be connected to the remote monitoring system.

4.18.2 Fan(s)

- (a) The fan(s) must be operated by a two-speed, 3-phase drive controlled by the shaft thermostat with thermal overload protection. The shaft ventilation thermostat must be positioned at the top of lift shaft where the lift electrical equipment is located.

4.18.3 Filter

- (a) The shaft ventilation intake must be filtered and accessible for maintenance without entering the danger zone. The fan filter must be fitted with an industry standard magnahelic gauge for the specific type of fan and connected to a dedicated alarm through the remote monitoring system. This gauge must be visible from inside the lift shaft and contained within the ventilation void.

4.18.4 Louvre

- (a) The shaft ventilation louvre must be 2-stage and storm proof to protect against adverse environmental conditions. The louvre must be hinged, lockable and accessible for maintenance without entering the danger zone. Where louvres are installed in positions accessible to the public, vandal-proof welded mesh screens must be installed. The mesh screens must not impede the louvre door opening mechanism.

4.19 Painting

4.19.1 General

- (a) With the exception of self-finished surfaces and elements otherwise specified, the whole of the equipment must be painted one coat in the factory after full and proper surface preparation, including priming. Any damaged surfaces must be made good on-site.

4.19.2 Special Paint Requirements

- (a) All steelwork provided by the CSM Contractor must be de-rusted, treated with rust inhibitor, primed and painted.
- (b) All cable trunking and conduit must be painted to match adjacent services.

4.20 Guides Rails and Brackets

4.20.1 General

- (a) The lift car and counterweight guides must be jointed and fixed to their brackets so they do not deflect by more than 5.0mm under normal operating conditions.

4.20.2 Fixings

- (a) Mechanical anchor fixing methods must not be used for any structural connections or lift guide brackets which connect the lift rails/structure to the lift shaft. Only chemical anchor fixings must be used due to the dynamic loading produced by the lift.
- (b) The CSM Contractor's structural engineer must detail the chemical anchors selected considering the lift shaft structure and the induced loads. Any variation

away from this requirement must be endorsed by the Principal's Representative. The selection of suitable chemical anchors must be addressed in the lift design report and calculations appended therein.

4.20.3 Guide Rail Construction

- (a) All car and counterweight guides must be machined, undercut tee section, with tongue and groove plated joints and must be provided with steel bases.

4.20.4 Guide Fixing Pitches

- (a) The fixing pitch between guide brackets must be arranged to restrict the designed deflection below the maximum specified. If, due to limitations on the guide fixing pitches caused by construction or structural constraints, this maximum deflection cannot be achieved, suitable guide rail backing must be provided to achieve the deflection criteria accordingly.

4.21 Buffers

- (a) The CSM Contractor must provide all necessary supports, mountings and fixings for the buffers.

4.22 Guarding and Screening

4.22.1 Well Screening Construction

- (a) Unless specified or otherwise approved, well screening must be manufactured from 10 s.w.g. x 25mm steel weld mesh securely welded within a rigid angle frame.
- (b) Screens must not be used to support trunking, conduits or any ancillary lift equipment in the well.

4.22.2 Counterweight Screens

- (a) Counterweight guarding must be provided in accordance with AS1735.2, as appropriate.
- (b) Where the screen conceals buffers with serviceable parts (oil buffers or buffers with switches or other like items) such parts must be easily visible and accessible either through a removable panel or around the screen.

4.22.3 Well Flushing

- (a) Stainless steel, framed panels of minimum 1.2 mm thickness must be provided in accordance with AS1735.1, as appropriate. A ramped apron must be provided below the lowest track or sill.
- (b) All fixings must be countersunk with no projection into the running clearance between the car and landing sills.

4.23 Lift Pits

4.23.1 Emergency Stopping Devices

- (a) Emergency stopping devices must be provided, of a mushroom head design. Toggle or rocker type switches will not be accepted.
- (b) If the stopping device is more than 2000mm above the pit floor, an additional stopping device must be fitted at low level.
- (c) All stopping devices must be clearly and permanently labelled run/stop.
- (d) A minimum of two emergency stopping device must be installed, one at a convenient and accessible location near the bottom of the pit ladder, and the other at a convenient and accessible location next to the top of the pit ladder.

4.23.2 Socket Outlets

- (a) A socket outlet controlled by a local or integral RCD must be provided in each lift pit.

4.23.3 Pit Access Ladders

- (a) A pit ladder must be provided to allow for safe and easy access to each lift pit with handrails extending to a minimum of 1100mm above the pit access level.
- (b) All ladders must preferably be permanently fixed within the lift well in a position that is easily visible and accessible from the pit access level.

4.24 Lift Drives

4.24.1 General

- (a) The control system must provide fully closed loop feedback for speed control by way of an encoder device mounted directly on the high-speed shaft of the drive motor or similar agreed method.

4.24.2 Harmonic Spectrum Data

- (a) The CSM Contractor must provide harmonic spectrum data relating to each phase of the supply to the drive motor:
 - (i) when a lift car is accelerating in either direction with full load, as specified by the Contract;
 - (ii) when a lift car is accelerating in either direction empty; and
 - (iii) during levelling operations.

4.24.3 Lift Motors

- (a) An emergency stopping device must be provided and fixed adjacent to the lift machine.

4.25 Machines

4.25.1 General Provisions

- (a) All components comprising the lift machine and associated supports, together with any diverting pulleys, must be located in the lift well and supported on vibration insulators.

4.25.2 Gearless MRL Machines

- (a) Only VVVF asynchronous squirrel cage type or VVVF permanent magnet synchronous machines must be used.

4.26 Suspension and Compensation Ropes

- (a) All ropes must be delivered to the Site together and must be properly coiled or reeled and adequately protected.
- (b) The suspension rope anchorage devices must permit and indicate equalisation of tension in each rope.
- (c) A data plate must be attached to the car cross head providing details of the suspension rope, its construction, date of installation, lift 'Contract Speed', rated car load and mass of empty car.

4.27 Car Slings

- (a) The lift car must be carried in a steel sling securely fixed together and substantially reinforced and braced to relieve the car enclosure of all strain and to withstand the operation of the safety gear under full-load conditions without any permanent deformation.

4.28 Guide Shoes

4.28.1 General

- (a) All lifts must utilise roller guides to the car and counterweight.
- (b) All guide rollers must be selected to achieve the necessary noise and vibration limits as specified in this Specification.

4.28.2 Roller Guides

- (a) Roller guides must:
 - (i) be so mounted as to provide continuous contact of all wheels with the corresponding rail surfaces under all conditions of loading and operation;
 - (ii) run on dry guide rails; and
 - (iii) be provided to protect the wheels on top of the car and counterweight.
- (b) The car and counterweights are to be statically balanced following fitting of all equipment and finishes prior to final fixing and setting of the roller guides.

4.29 Over Speed Governors and Safety Gears

- (a) Safety gear and over speed governors must be provided and installed in accordance with AS1735.
- (b) The governor tension weight assembly mounted in the lift pit must incorporate a pulley guard to prevent the ingress of objects.

4.30 Counterweights

- (a) A counterweight must be provided as required to optimise power consumption and to provide traction where applicable in accordance with AS1735.

4.31 Car Walls, Floors and Ceilings

- (a) The complete interior finishes and fittings of the lift car including ceiling, walls, door trims, skirting, floor and light fittings must be to selected designs, as detailed in the schedules.
- (b) All car walls below handrail level must be of 5WL textured stainless steel panels. No glazing is to be used for this area.
- (c) All car walls above handrail level must be of 5WL textured stainless steel panels with glazing panel cut-outs. Glazing panels must be fully framed and must not extend to the edges of any wall face. Glazing panels must not be used for any structural purpose.
- (d) The car floor coverings must be of stainless steel checker plate material.

4.31.2 Platform Isolation

- (a) Unless specifically identified in the schedules, the complete platform and car enclosure of each lift must be effectively isolated from the car sling, by resilient rubber pads or suitable anti-vibration pads securely fixed to prevent displacement.

4.31.3 Protective Drapes

- (a) Where protective drapes are required, the CSM Contractor must supply sets of purpose made protective drapes for each lift car.
- (b) The protective drapes must not obscure the load plate, ventilation apertures, the intercom, hands free telephone or the push button and signal panels or any communication or control equipment.
- (c) Where the protective drapes cover glass, the drapes must be stencilled in bold letters "CAUTION - GLASS BEHIND".
- (d) Where protective drapes are not required, suitable facilities must be provided for the attachment of protective drapes only in each lift car. Purpose made protective drapes are not required.

4.32 Lift Car Roof Equipment

4.32.1 Maintenance Control Units

- (a) A maintenance control unit must be provided on the top of the car and must be mounted to eliminate the risk of accidental operation of any controls. In addition to housing an emergency stopping device and door operating controls, a common run button must be provided, which in conjunction with operation of the directional pushes for up and down must provide movement of the lift car under maintenance control.
- (b) All controls on the maintenance unit must be clearly labelled.

4.32.2 Roof Safety Hooks

- (a) The car roof must be fitted with at least two safety hooks, each clearly marked with its safe working load, for the attachment of safety harnesses. Additional hooks must be provided to ensure that a hook is located within 1500mm of any normally accessible point on the car roof.

4.32.3 Guard Rail On Car Top

- (a) Guard rails must be provided on the top of car in accordance with AS1735.1.

4.32.4 Socket Outlet

- (a) A socket outlet controlled by a local or integral RCD must be provided on the car roof.

4.32.5 Emergency Communication Units

- (a) A communication unit must be provided on the lift car, incorporating an emergency call button that must initiate direct communication with a 24 hour attended monitoring service.

4.33 Automatic Horizontal Sliding Doors

4.33.1 Door Operators

- (a) The electric door operators (VVVF or DC PWM) must be of high speed, heavy-duty construction and suitable for intensive traffic duty.
- (b) The opening and closing speed of the door operator must be easily adjusted to suit operating conditions and must be initially set to the times shown in the schedules in Attachment A.
- (c) The interval of time that the doors are in the fully open position must be easily adjustable, to a maximum period of 30 seconds to allow for particular needs of the station.

4.33.2 Passenger Protection System

- (a) A passenger protective device(s) must cause the doors to re-open when an obstruction enters the detection zone and before contact is made with any such obstruction.

- (b) The passenger protective device(s) must be effective from not more than 25mm above the sill and to a height of not less than 1.8m above the sill and must not project beyond the leading edge of the door panel(s).
- (c) The passenger protection device(s) must be mounted on the edge of the doors for ease of access and cleaning.

4.33.3 Door Sills, Guides and Suspension

- (a) Each door must be provided, complete with a top track, running sill and supporting frame as required. Door guide blocks must be easily renewable from the well side of the door panel without the door having to be lifted or removed.

4.33.4 Mechanical Car Door Locking

- (a) It must not be possible to open a car door, except during the pre-opening condition and when the car is within a designated unlocking zone in accordance with AS1735.
- (b) All car doors must be provided with a mechanical car door lock, matched to the door drive and electrical locking equipment.

4.33.5 Landing Door and Door Frames

- (a) Landing doors must be glass and framed with 5WL embossed stainless steel. The surrounding landing structure, including the landing entrance frame trim, must be finished stainless steel.
- (b) Where required, all landing doors, frames and associated items such as sills, tracks and locking devices must comply with the requirements of relevant authorities in respect of fire resistance rating and must be such as to pass a one-hour standard fire test in accordance with relevant Australian Standards.
- (c) Landing door sills must be adequately supported to withstand mobile plant (such as elevated work platforms) up to the maximum load on the load notice in the lift car.
- (d) Each landing level must contain a braille plate detailing the level in a tactile symbol and braille equivalent. The plate must be located on the landing entrance trim.

4.33.6 Car Door

- (a) Glass car doors must be framed in 5WL embossed stainless steel.
- (b) Car door sills must be adequately supported to withstand mobile plant (such as elevated work platforms) up to the maximum load on the load notice in the lift car.

4.34 Controllers

4.34.1 Construction

- (a) The control system must be of the microprocessor type.
- (b) The components and cabinets must be designed and mounted in a manner that facilitates inspection, maintenance, adjustment and replacement of any serviceable parts and in accordance with AS1735 and AS/NZS 3000.
- (c) The control system equipment and associated software must be of non-proprietary type, and must not require the use any special proprietary tools.

4.34.2 Interference

- (a) The arrangement of the electrical equipment must be such that there is no interference with the correct operation of radio, television receivers or other electronic apparatus in Central Station or other buildings in the locality, caused by the normal working of the lift works.
- (b) All lift equipment must be provided within the limitations for electromagnetic emissions and Immunity given in AS/NZS 61000. Suppression components must not be used in any part of the circuit where their failure might cause an unsafe condition.

5 Operational and Control Requirements

5.1 General

- (a) The control features detailed below must be provided in accordance with the scheduled requirements within this Specification.

5.2 Exclusive Service

- (a) Provide independent service control for each lift with a control key switch located in the car operating panel in the car. When operated the independent service switch must:
 - (i) remove that lift from the normal control system so that it responds to and cancels car calls only;
 - (ii) park the car with doors open;
 - (iii) allow car button registration to be made in the normal manner and with respect to further travel of the lift, must set the direction of travel; and
 - (iv) the key switch for the independent service must be limited access type.

5.3 Automatic Re-levelling

- (a) Provision must be made to allow for automatic, accurate re-levelling of the lift car where, after stopping at a floor, loading, unloading or sinkage could cause the car to move out of level with the floor by more than 10mm with the doors open or closed.

5.4 Call Registered Indicator

- (a) Each push button must incorporate an illuminating indication when it has been operated, which must be cancelled when the function has been completed (e.g. door open illuminates until the doors are fully open, a car or landing call button illuminates until the call is answered). This feature is to be provided in conjunction with dual illumination as detailed below.

5.5 Dual Push Button Illumination

- (a) All buttons must be provided with double illumination enabling a white illumination in a non-activated state, and enabling a green illumination in the activated state.

5.6 Car Arrival Gongs

- (a) An adjustable electronic chime must be provided at each floor to give an audible indication when the lift car arrives at the landing in response to a hall call.

- (b) The electronic chime must operate once for the up direction and twice for the down direction and must incorporate an adjustable setting to enable operation between 2 and 5 seconds before the lift arrives at a floor.

5.7 Car Operating Panels

5.7.1 General items

- (a) The location and design of all engraving in the lift car must be approved by the Principal's Representative.
- (b) Car buttons and operating panels together with floor designations must be approved by the Principal's Representative.
- (c) The use of incandescent lamps will not be permitted for push button or signal illumination.

5.7.2 Requirements

- (a) The car operating panels must comply with the requirements in the following table:

Item	Feature	Number required per lift
1	Faceplate Material	2.5mm stainless steel
2	Edges	Square and deburred
3	Finish	Linish No. 4
4	Fixings	Tamperproof "Torx" screws
5	Load Notice	As appropriate
6	Buttons	US91-15 compact round metal having tactile and braille, with black pressed face and white/green illumination and vandal proof.
7	Alarm/Phone button	Must be illuminating
8	Stop buttons	Must be <u>excluded</u>
9	Door close buttons	Must be <u>excluded</u>
10	Surface engraving (main and auxiliary operating panels)	To be as follows: 1. Lift No. – 13mm high and 1 mm thick Gills Sans in black with a luminance factor not less than 0.3 in contract to the background 2. Emergency telephone instructions – 10mm high and 1mm thick Gill Sans filled black 3. Floor engraving - 10mm high and 1mm thick Gill Sans filled black
11	Emergency Telephone	EM-FONE (in car main operating panel only)
12	Auxiliary car operating panel	Panel must include: 1. the lift identification number 2. the destination buttons and destination description initial (eg. P, C) in raised tactile 3. an emergency phone button
13	Car button location	The location of buttons must be between 1050mm and 1200mm from floor level.

5.8 Landing Operating Panels

5.8.1 General items

- (a) The location and design of all engraving in the lift car must be approved by the Principal's Representative.
- (b) Landing buttons and operating panels together with floor designations must be approved by the Principal's Representative. The landing buttons must not be closer than 500mm from any internal corner or fixed obstruction, in accordance with AS1735.12.
- (c) The use of incandescent lamps must not be permitted for push button or signal illumination.
- (d) The landing operating panel must be mounted flush with the landing entranceway frame.

5.8.2 Requirements

- (a) The landing operating panel must comply with the following requirements:

Item	Feature	Number required per lift
1	Faceplate Material	2.5mm stainless steel
2	Edges	Square and deburred
3	Finish	Linish No. 4
4	Fixings	Tamperproof "Torx" screws
5	Buttons	US91-15 compact round metal having tactile and braille, with black pressel face and white/green illumination and vandal proof.
6	Landing button location	The location of buttons must be between 1050mm and 1200mm from floor level.

5.9 Exclusion of Door Close Button

- (a) A door close push button for the purpose of closing the doors when they are fully open must be excluded.

5.10 Door Open Button

- (a) A door open push button must be provided which must remain effective when the lift is standing within a door zone. By pushing the button the doors must re-open if they are closing or closed and remain open for a pre-set period.
- (b) Control or security features must not be arranged to override the operation of the door open button, which might lead to the possibility of trapping passengers within the lift car.

5.11 Car Arrival Indicator

- (a) Indicators must be provided at each landing, which must illuminate an adjustable period before arrival, between 2 and 5 seconds.

5.12 Out of Service Function

5.12.1 Out of Service Key Switch

- (a) Out of Service key switches must be provided at the designated location(s) in the lifts car and at the designated landing(s). When the switch is activated, all landing calls must be cancelled and the Out of Service Indicator must illuminate on each landing. All existing car calls must be answered and no new call must be accepted.
- (b) After all existing car calls have been answered the lift must return to the designated floor and park with the doors closed.

5.12.2 Out of Service Indicator

- (a) An indicator must be provided at all floors indicating that the lift is out of service. Any control feature that prevents normal use of the lift to passengers must automatically activate this indicator.
- (b) This feature must incorporate a battery backed emergency power supply to enable indication even in the event of mains power failure or disconnection.
- (c) The out of service indicator must be an illuminated graphic "OUT OF SERVICE" sign, fitted within the landing call plate.

5.13 Fire Service Operation

- (a) Where required as determined in Part E3 (Lift Installations) of the National Construction Code, an additional key switch must be provided at the 'Main Terminal Floor' (in accordance with the CSM Contractor's fire and life safety strategy) for Fire Service Operation. Fire Service Operation must be operable only by the use of a key that is removable in either the 'OFF' or the 'ON' position.
- (b) A continuous audible signal in the car must sound and a visual signal must be displayed in the car identifying an "FIRE SERVICE OPERATION" status.
- (c) All car calls must then be cancelled and no new ones must be accepted until the car has separated from any group control and travelled to the floor at which the fire service operation call was registered.
- (d) If at the time of registration of the fire service operation call, the lift is travelling away from the destination floor, it must stop at the nearest floor in the direction of travel without opening the car doors and return immediately to the destination floor.
- (e) In the event of the fire detector in the lift shaft being activated, the lift car must complete its current operation and then will not respond to further car calls. It is anticipated that in response to the fire detection event, the next lift operation will be 'Fire Services Operation' under the authority of the Fire and Rescue NSW. This lift operation may be superseded by the lift operation required to comply with the CSM Contractor's fire safety engineering strategy.

5.14 Electronic Passenger Detector

- (a) An electronic passenger detector must be provided effective when the lift is standing at a floor level with the doors open or closing.

- (b) Passenger movement within the detection zones must initiate an adjustable delay in the remaining door open time if the door is open, (initially set to 2 seconds), or must reopen a closing door.

5.15 Emergency Battery Drive (UPS/APS)

- (a) A facility must be provided to move the lift car to a floor when the car has stopped between floors due to a failure of the normal power supply. The emergency operation is performed at low speed and all safety functions must remain operational to prevent an unsafe condition occurring. When the car has reached a floor the doors must be opened.
- (b) The lift must return into normal service automatically following re-instatement of the power supply.
- (c) The emergency battery drive unit must be designed so that it is protected from damage resulting from harmonics and poor quality permanent electrical supply power and characteristic of the rail environment.

5.16 Emergency Manual Operation

- (a) When the lift is being raised or lowered manually an audible and visual signal must be activated when the lift passes through the unlocking zone. The indicator must be easily seen and heard by personnel carrying out such emergency procedures.
- (b) This device must be powered by a battery backed power supply to ensure correct operation in the event of a power failure.
- (c) The manual raising or lowering procedures must be clearly described on a non-fade notice, mounted permanently in a prominent position in the machinery space.
- (d) The marking of suspension ropes is not acceptable for identifying the location of the lift car at a floor level.

5.17 False Car Call Cancel

- (a) Provision must be made to detect the presence of, and cancel false car calls, either by comparison of the number of calls to the load being carried or by the non-operation of an infra-red detection device following a predetermined number of car stops, or a combination of both.

5.18 Motor Start Counter

- (a) A motor starts counter must be provided. The counter must provide data on the number of starts per hour, number of door operations, run-time of the lift. The counter must record information from the time of commissioning of the lift, and must continue to collect data throughout the Design Life of the lift.

5.19 Overload Control

- (a) If the car load exceeds the lift capacity by more than 10% (or a minimum of 75kg) the car must be prevented from starting and the doors must remain open.

- (b) A visual signal must illuminate in the car-operating panel and in addition a buzzer must sound.

5.20 Voice Announcement in Lift Car

- (a) The lifts must be provided with automatic audible information in the lift cars.
- (b) The volume of the announcement must be adjustable between 35dB(A) and 55dB(A). Each time the lift stops in response to a car or landing call, the floor must be orally identified in English. A tone must also sound when the lift arrives at a floor. The announcements must correspond with the destination descriptions on the car operating panels.

5.21 Water Sensor in Pit

- (a) A sensor must be provided in the lift pit, which detects the presence of water.
- (b) When the sensor is activated, a signal must be provided via voltage free contacts, which must enable operation of an alarm. When the sensor is activated the lift must proceed to the top floor, evacuate any passengers then remain there with the door closed. The lift must remain unavailable for passenger use until the lift pit sensor no longer detects water.

5.22 Shaft Fan Sensors

5.22.1 Fan Filter Blocked Sensor

- (a) An industry standard magnahelic gauge must be fitted to the shaft fan to detect the state of the shaft fan filter. The shaft fan controller must indicate a blocked fan filter through this sensor to the lift controller and the remote monitoring system via a relay inside the lift controller.
- (b) The CSM Contractor must provide the sensor and relay, and the associated wiring.

5.22.2 Fan Motor Thermal Overload Sensor

- (a) A sensor must be provided which detects when the shaft fan motor is experiencing a thermal overload due to excessive current draw. The shaft fan controller must indicate a motor thermal overload through this sensor to the lift controller and the remote monitoring system via a relay inside the lift controller.
- (b) The CSM Contractor must provide the sensor and relay and the associated wiring.

6 Interfacing System Requirements

6.1 CCTV Camera in the Car

- (a) The CSM Contractor must install CCTV cabling between the power /controls panels and the lift car to the requirements of the specification included in Appendix C04 to the SWTC and the Interface Schedule.

6.2 Alarms and Communication Systems

6.2.1 Emergency Alarm Devices

- (a) An emergency signal must be provided, which must be powered by a standby battery not used for any other purpose.
- (b) While the alarm button is pressed, the button must illuminate and a reassurance sounder fitted on the lift car must be clearly audible from within the lift car, to indicate that the emergency signal is functioning.
- (c) The alarm system must be capable of being extended to a central alarm panel and a voltage-free contact with suitable terminals must be provided for this purpose in the machinery space.

6.2.2 Hand-set Free Emergency Phone Systems

- (a) The lift manufacturer must provide a 'hand-set free' communication system.
- (b) The hand-set free emergency communication system will be automatically activated following manual push button actuation of the emergency alarm.
- (c) Continuous actuation of the emergency alarm button for a period of greater than 3 seconds must initiate a capability to connect to two remote locations.
- (d) Telephone buttons, speakers and microphones, must be located in the car-operating panel. A suitably descriptive notice as approved by the Principal's Representative must be engraved in the car informing passengers how the 'hands free' telephone is operated. The wording, size and location of the notice must be as per AS1735 - Part 1.
- (e) The CSM Contractor must provide all wiring from the telephone to a connection terminal, including a travelling cable with a termination point in the lift machinery space.

6.3 Remote Alarm and Monitoring System

- (a) The CSM Contractor must provide connection to the remote alarm and monitoring system including:
 - (i) a termination in the controller for an interface to the Sydney Trains' systems via:
 - A. a dedicated I/O board; and/or

- B. a dedicated communication port or connection, indicatively RS 232, RS 485 or RS 422.
- (b) Agreed lift controller data and signals must be allowed to be communicated to the Sydney Trains' systems for purposes including operational monitoring, data logging and provision of remote alarms and alerts.
- (c) Details of the termination to the controller must be submitted as part of the Design Documentation.
- (d) The CSM Contractor must supply and install an ethernet cable (minimum Cat 5e) between the lift controller and a Sydney Train's data / communications room to be specified by the Principal's Representative.

6.4 Communication Junction Box

- (a) The CSM Contractor must provide a communication junction box to house interface connections between the lift and external services including:
 - (i) closed circuit television interface connections;
 - (ii) remote alarm interface connection;
 - (iii) emergency phone interface connection;
 - (iv) remote monitoring interface connection;
 - (v) smoke detector interface connection;
 - (vi) shaft vent fan fault interface connection; and
 - (vii) any other external interface connections.

6.5 Equipment Workmanship

6.5.1 General

- (a) The CSM Contractor must permit the Principal's Representative free access to the Site and any relevant manufacturer's premises during working hours and by agreement for inspection of materials, assemblies, method of manufacture and quality control of the process.
- (b) Unless otherwise described, all materials must conform to the appropriate Australian Standard. The CSM Contractor must furnish the Principal's Representative, upon request, with certificates or letters from the prime material manufacturers and suppliers proving that the materials to be used do in fact conform to such standards and the Contract, and confirming that they have "no objection" to the use of their materials. Such certificates and letters must be incorporated into the operation manuals.
- (c) The CSM Contractor must obtain the total quantity of each material from the same manufacture with proven experience of manufacture of similar materials.
- (d) The CSM Contractor must, upon request, submit a list of all materials proposed which are not specifically described in this Specification.

6.5.2 Fixing Devices

- (a) The CSM Contractor must allow for all necessary fixing devices including secondary support steels, framing, bearers, fillets and all preparation in plugging and screwing or cutting for anchor bolts or for other fixing whatsoever necessary.
- (b) The CSM Contractor must provide for an appropriate combination of all working tolerances in the elements of the lift works, in accordance with the relevant Australian Standard, as well as the design tolerances in the work, and must provide for all necessary adjustments to enable the lifts to be fitted.

6.5.3 Fabrication

- (a) The material used in the fabrication must be of a type to achieve the required performance and appearance.
- (b) Methods used in the fabrication must be selected to achieve the specified appearance and performance. Methods used must be based upon the use of suitable equipment and experienced personnel.
- (c) Method statements must contain control procedures to ensure compliance with the requirements of this Contract.
- (d) Upon request from the Principal's Representative, control samples must be produced to adequately demonstrate the standard of workmanship and finish required. Where appropriate, range samples must be established to assist in quality control procedures.

6.5.4 Accuracy and Compliance

- (a) The CSM Contractor must fabricate and install all assemblies in accordance with the shop component and assembly drawings.
- (b) The CSM Contractor must pre-assemble and carry out as great a proportion of the work as possible within a controlled factory environment.

6.6 Workmanship

- (a) The standard of workmanship for the lift works must be to industry best practice and in accordance with relevant Codes and Standards and Laws, and strictly in accordance with the CSM Contractor's shop drawings.
- (b) Workmanship for all construction and component assemblies must be of the highest standards in every respect. Work must be true to detail with sharp, lean continuous profiles and surfaces straight and free from Defects, dents, marks, cracks, indentations, distortions, waves, scratches or flaws of any nature impairing strength or appearance and fitted with proper joints and intersections and with specified finishes.
- (c) When assembled, any moving parts must move freely without binding.
- (d) All fixings that are visible to lift users must be either countersunk or of a decorative nature unless otherwise approved by the Principal's Representative.
- (e) Junctions of identical elements must be mitred, unless otherwise approved by the Principal's Representative.

6.6.2 Appearance

- (a) The finished work is to be entirely free from loose material, chips, marks or any imperfection visible to the naked eye. Localised "making good" is not acceptable.

6.6.3 Firmness and Solidity

- (a) The whole system must be sturdy, rigid, firm and free of vibration, rattling, squeaking and other noises.

6.7 Materials

6.7.1 Castings, Extrusions or Profiles

- (a) All castings, extrusions or profiles are to be of adequate thickness and strength to meet the specified Design Life, structural and durability requirements and eliminate any risk of distortion in the finished surfaces. The thickness of such elements must be sufficient to ensure their complete rigidity in the lengths required in the final installation.

6.7.2 Sealant

- (a) Any form of sealant must be compatible with the adjacent elements of construction in each particular location. All excess sealant must be properly cleaned from exposed surfaces.
- (b) Installed sealant must provide a smooth continuous surface to the full width of the joint and must be tooled flat. The sealant colour must be approved by the Principal's Representative.
- (c) Sealant installation must be strictly in accordance with the sealant manufacturer's instructions.

6.7.3 Glass

- (a) All glass must be of sufficient thickness and annealed laminated safety glass (11.7mm minimum thickness 2 layer bonded) as appropriate to comply with AS1735.2 Appendix "H" requirements.
- (b) All glass must provide undistorted vision and reflection through clear sections and be free from roller wave.
- (c) The location of any safety markings required on glazed panels must be approved by the Principal's Representative. The markings if concealed by a fixing method must be demonstrated prior to such concealment and supporting documentation must be provided to ensure compliance with all relevant Codes and Standards and Laws can be confirmed.
- (d) All surfaces must be thoroughly cleaned before glazing to ensure that frames and glass are free from dust, moisture, frost, oil, grease or other foreign substances.
- (e) All glass panels are to be fully framed. Setting blocks, corner blocks and spacers must be used as required to properly install the glass and maintain the performance criteria. All necessary protective measures must be taken to prevent mechanical damage of glass including from any damaging splashes or weld spatter.

- (f) All glass must be fully framed on all sides with stainless steel strips, and must have vandal proof fixings.
- (g) All glass used in car and landing doors must have a frosted effect to a height of 1100mm.
- (h) All glass must be easily accessible for cleaning and replacement. Ease of maintenance must be considered in design to allow the replacement of glass during regulation day to day operations without extensive disturbance to passengers.

6.7.4 Security Film on Glass

- (a) Security film must not be used on glass unless where it is required for the reduction of heat load. Where security film is used on glass, this must not be installed on any surface accessible to the public or lift passengers. Film may only be used on the internal shaft facing face of the lift car.
- (b) The security film must comply with the Grade "A" – Impact Component Level of AS/NZS 2208 and relevant fire standards.
- (c) The window film must be installed in full compliance with the manufacturer's recommendations and meet the following minimum manufacturing and performance characteristics:
 - (i) be manufactured using a micro layered manufacturing technique;
 - (ii) be optically transparent, not causing any reflection or refraction;
 - (iii) have an abrasion resistance of <5% in accordance with Standard ASTM D 1044;
 - (iv) meet Grade 'A' compliance with AS/NZ 2208 1996;
 - (v) have tensile strength of at least 200Mpa;
 - (vi) where the security film is replaced on site, the security film must run to the edge of the glass and be held with the glass in the support frame; and
 - (vii) where the reduction of heat load is also a requirement the film must reduce ultraviolet radiation by at least 95%.

6.7.5 Safety Stickers on Glass Doors

- (a) Safety stickers in accordance with Sydney Trains's approved design must be installed on the non-accessible face (internal shaft facing face) of all car doors and landing doors.

7 Commissioning Requirements

7.1 General

- (a) The CSM Contractor must provide all materials necessary to form a complete installation and carry out such tests, adjustments and commissioning as required to give an effective working installation.
- (b) The CSM Contractor must supply all materials, instruments, test equipment, software, any other necessary items required for the performance of all tests required to be undertaken as part of the CSM Contractor's Activities. The CSM Contractor must provide the 1 and 3 phase power supply. The CSM Contractor must provide evidence to the Principal's Representative and the Independent Certifier that the instruments have been recently calibrated.
- (c) Without limiting any part of the Contract, should any test be carried out outside the Sydney Metropolitan Area and testing of equipment and systems not be successful, or inconclusive, the CSM Contractor must pay all associated costs for the Principal's Representative to attend all further retest(s) / reinspection(s) necessary to demonstrate compliance with the Contract.
- (d) The CSM Contractor must test and commission the lift works.

7.1 Inspections and Tests

7.1.1 Factory Test

- (a) The CSM Contractor must undertake the following works tests and inspections, in the manufacturers' premises, as identified in Attachment A:
 - (i) an examination of selected machined parts of the lift before assembly and of electrical component parts to check freedom from latent Defects.

7.1.2 Site Acceptance Tests

- (a) The CSM Contractor must test and examine the whole installation. The CSM Contractor must also carry out tests, to be witnessed by the Principal's Representative and the Independent Certifier, to demonstrate compliance with this Contract and for operational and safety compliance.
- (b) These tests and examinations must comply with the requirements of AS 1735 part 10. The results of the tests must be recorded on a separate test and examination certificate for each lift. The CSM Contractor must provide these certificates to the Principal's Representative and the Independent Certifier.
- (c) In particular, acceptance criteria and hold and witness points must be nominated for the performance requirements set out in Section 4.11 to Section 4.15.

7.1.2.2 Dynamic Tests on Electric Traction Lifts

- (a) Notwithstanding the requirements of AS1735 part 10, the witness tests must include the following specific dynamic tests:

- (i) motor current readings must be taken and recorded in the up and down direction with empty car, balanced load and full load in the car;
 - (ii) downward operating safety gears must be tested under 100% load with the safety gear operated either by over speed or via a test groove provided on the governor for the purposes of verifying the correct operation of the safety gear and over speed assemblies as installed;
 - (iii) manual activation of the governor must satisfy the requirements of this Specification;
 - (iv) upward over speed control equipment must be tested with an empty lift car travelling upward in an over speed condition or via a test groove on an over speed governor if provided;
 - (v) car buffers must be tested by running the lift car carrying 100% rated load, at "Contract Speed" (as per Attachment A0) onto the buffers; and
 - (vi) counterweight buffers must be tested by driving the empty car upward so that the counterweight strikes the buffers at Contract Speed.
- (b) The CSM Contractor must provide a lift shaft capable of withstanding all loads imposed by the lift, including dynamic tests. The CSM Contractor is responsible for damage to equipment or property occurring from these tests and must subsequently carry out all necessary remedial works at its own expense.

7.1.2.3 Functional Tests

- (a) The operational functions of all lifts must be witnessed by the Principal's Representative and the Independent Certifier, including:
- (i) all push buttons, indicators and sounders, gongs and other like items;
 - (ii) all key switches and functions controlled thereby;
 - (iii) special control features such as fire alarm recall, emergency recall switches, out of service switches and other such features;
 - (iv) in the case of there being two or more lifts operating under a group control arrangement, this facility, together with any other special traffic handling features, must be demonstrated;
 - (v) smoke parking of the lift in the event of a smoke alarm;
 - (vi) emergency evacuation function in the event of mains electrical power loss; and
 - (vii) lift shaft mechanical ventilation.

7.1.3 Test Certificates

- (a) At the request of the Principal's Representative or and the Independent Certifier, the CSM Contractor must make available copies of any manufacturers' test and type test certificates.

7.1.4 Testing Personnel and Equipment

- (a) All testing and commissioning must be carried out by suitably qualified testing personnel, experienced in such work and using suitable instruments.
- (b) All instruments and test equipment must be calibrated in accordance with the CSM Contractor's quality assurance procedures and at the request of the Principal's Representative or the Independent Certifier, the CSM Contractor must make available copies of any calibration certificates for test equipment used during commissioning.

7.1.5 Putting Into Service

- (a) The CSM Contractor must successfully complete the commissioning of the lift works and rectify any Defects identified during commissioning to the satisfaction of the Principal's Representative and the Independent Certifier, prior to putting the lift(s) into service.
- (b) Prior to any lift being put into service, in accordance with the Work Health and Safety Act 2011 and Work Health and Safety Regulation 2011, the CSM Contractor must clean the machinery spaces, lift wells and cars of all debris and leave the complete installation in the state of cleanliness expected of a new product.
- (c) The lift works when completed must not be used prior to issue of a declaration of conformity in accordance with the Work Health and Safety Act 2011, the Work Health and Safety Regulation 2011 and registration with WorkCover NSW.
- (d) The CSM Contractor must provide operation instructions and manuals to the requirements of the Principal's Representative.

7.2 Operating and Maintenance Manual

- (a) The CSM Contractor must provide operating and maintenance manuals, shop drawings, electrical wiring diagrams and all relevant asset references and technical data to the Principal's Representative and the Independent Certifier.

7.3 Hazard and Risk Assessment (AEA National Code of Practice)

- (a) The CSM Contractor is required to provide a hazard and risk assessment for lifts addressing all applicable items in the AEA National Code of Practice to the Principal's Representative and the Independent Certifier.

7.4 Maintenance Spares

- (a) The CSM Contractor must provide sufficient spares for each lift type to minimise downtime associated with common faults, and no less than the number specified in the following table:

Item	Description	Number required per lift type
1	Landing door RH	2
2	Landing door LH	2

Item	Description	Number required per lift type
3	Car doors RH	2
4	Car doors LH	2
5	Car glass panels	4
6	Car buttons	6
7	Landing buttons	2
8	Door operator	2
9	Door protection devices	4
10	Car lighting	15
11	UPS/APS emergency backup system (complete unit)	1
12	Car and landing indicators	2
13	Voice annunciator system	2
14	FST controller board	1
15	Inverter	1
16	Brake chopper unit	1
17	Motor encoder	1
18	Shaft position encoder	1

Attachment A - Schedules

Attachment A1.1 - Schedule of Lift Details

Description	Details	Notes
Lift type	Passenger/goods machine-room-less (MRL)	Machine room less (MRL) Class A as defined by AS 1735
Lift car capacity	2025 kg (27 passenger minimum)	
Internal car width	1600 mm	
Internal car depth	2500 mm	
Internal ceiling height	2300 mm (minimum)	
Landing/car door opening width	1400 mm (minimum)	
Mass of applied lift car finishes	(dependent on selection of materials) kg	CSM Contractor must confirm mass of applied car finishes (refer to schedules and drawings)
Rated speed	1.0 or 1.6m/s	Rated speed must be 1.0m/s where the lift services less than five stops and 1.6m/s where the lift services five or more stops
Travel	as per SWTC	
Total number of stops	as per SWTC	
Number of landing entrances	as per SWTC	
Power / drive system	Gearless VVVF	
Motor starts per hour	240 +	
Control system	Directional Collective	
Levelling accuracy	+/- 3.0 mm	
3 phase mains supply voltage	415 Volts	AS/NZS 3000, Clause 1.8.2 (c)
Single phase supply voltage	240 Volts	+ 10% - 6% (in accordance with AS 60038)
Counterweight safety gear required (Y/N)	Yes	
Ventilation fan required	Yes	Thermostatic control
Climate control required, air conditioning	Yes	Thermostatic control
Low use functionality	Yes	During periods of sustained inactivity and, after a predetermined time of no lift movement, the lift car must automatically park at lowest level served.
Work tests and inspection required	Yes	

Attachment A1.2 - Schedule of Lift Traffic Handling and Performance Data

Function	Performance	Comments
Minimum door opening time	1.5 Seconds	Adjustable
Minimum door closing time	2.5 Seconds	Adjustable
Landing call dwell time	6-8 Seconds	Adjustable
Main lobby dwell time	8.0 Seconds	Adjustable
Car call dwell time	6-8 Seconds	Adjustable

Attachment A1.3 - Schedule of Control Features

Feature	Required Y/N	Notes
Advance door opening	No	
Attendant service	No	
Audible information feature	Yes	
Automatic car ventilation operation	Yes	Key operated from main car operating panel.
Automatic re-levelling	Yes	
Station life support system recall	No	
Call registered indicator	Yes	
Dual push button illumination	Yes	White (non-activated state), Green (activated state)
Car arrival gongs	Yes	
Landing lanterns	Yes	
"Car Arrival" indicator	Yes	
"Car Approaching" indicator	No	
"Lift In Use" indicator	No	
"Out Of Service" indicator	Yes	
Car calls backwards	No	
CCTV camera in the car	Yes	
Convention feature	No	
Door close button	No	Must be excluded.
Door open button	Yes	
Door opening with extended hold time	No	
Door open sounder	No	
Earthquake operation	No	
Electronic passenger detector	Yes	
Emergency battery drive	Yes	
Emergency power drive	No	
Emergency recall operation	Yes	
Evacuation control	No	
False car call cancel	Yes	
Fire service control	Yes	
Integrated access control	No	
Ladder contact	Yes	
Motor start counter	Yes	

Feature	Required Y/N	Notes
Out of service switch	Yes	
Overload control	Yes	
Priority service in car	Yes	
Security access control	No	
Car voice annunciation	Yes	
Induction loop system	No	
Water sensor in pit	Yes	
Child protection system	No	
Break glass detector	No	

Additional notes and special requirements: Nil.

Attachment A1.4 - Schedule of Lighting

Component	Fitting Type	Glass Type	Material	Light Colour	Special Requirements
Lift car lighting	LED downlights (recessed with glass diffuser)	Opal	Glass / stainless steel 304	4000K	Vandal resistant

*Lux levels: 200 lux horizontal and 150 lux vertical illuminance required 1.5m above the car floor

Attachment A1.5 - Schedule of Car Finishes

Component	Material	Finish	Pattern	Colour	Protection to Finishes
Full mock up of lift car required	No				
Lift car suspended ceiling	Detail design drawing required setting out lift ceiling specification and co-ordination				
Lift car left side wall (upper)	5WL textured stainless steel 304 panel with framed glass cut-out		5WL textured stainless steel		
Lift car left side wall (lower)	5WL textured stainless steel 304 panel		5WL textured stainless steel		
Lift car right side wall (upper)	5WL textured stainless steel 304 panel with framed glass cut-out		5WL textured stainless steel		
Lift car right side wall (lower)	5WL textured stainless steel 304 panel		5WL textured stainless steel		
Lift car rear wall (top)	5WL textured stainless steel 304 panel with framed glass cut-out		5WL textured stainless steel		
Lift car rear wall (lower)	5WL textured stainless steel 304 panel		5WL textured stainless steel		
Lift car flooring	Stainless steel 304 checker-plate				Tread plate
Lift car door(s)	Framed full length glass				Privacy film – floor to 1100mm
Skirting	Stainless steel 304	Satin finished			
Lift car sill	Heavy duty				
Landing entrance architraves	Stainless steel	Satin finished			
Landing entrance transom panels	Framed glass				
Landing doors	Framed full length glass				Privacy film – floor to 1100mm
Landing sills	Heavy duty – full width support angle				

Component	Material	Finish	Pattern	Colour	Protection to Finishes
Car operating panel(s) x 2	Stainless steel 304	Satin			
Car push buttons	US91-15 compact round metal having tactile and braille, with black pressel face and white/green illumination and vandal proof.		Round		Vandal resistant.
Car position indicators	Colour LCD screens				Vandal resistant
Car position indicator plates	Stainless steel 304	Satin			Vandal resistant
Key switches in car	Manufacturer's standard				Vandal resistant
Landing push buttons	US91-15 compact round metal having tactile and braille, with black pressel face and white/green illumination and vandal proof.		Round		Vandal resistant.
Landing push button plates	Stainless steel 304	Satin			Vandal resistant
Landing lantern plates	Stainless steel 304	Satin			Vandal resistant
Lift Well Flushing	Stainless steel 304	Satin			
Well dividing screens	N/A				
Counterweight screens	To this Specification			Safety yellow	
Car roof handrails	To this Specification			Safety yellow	

Attachment A1.6 - Schedule of Car and Landing Equipment

The colour and finish to equipment must be manufacturers standard unless indicated otherwise in the schedule below.

Equipment	Colour	Finish	Comments
Car doors – panels	Framed full length glass	Matte	
Car doors – top track assembly	Black	Matte	
Car door toe guard	Black	Matte	
Lift car platform	Black	Matte	
Car sling	Black	Matte	
Car pulleys	Safety yellow	Matte	
Car roof balustrades	Safety yellow	Matte	
Landing doors – panels	Framed full length glass	Matte	
Landing doors – top track assembly	Black	Matte	
Landing fascia panels/toe guards	Black	Matte	

Attachment A1.7 - Schedule of Machine Equipment

Equipment	Colour	Finish	Comments
Lift machine			Manufacturer's standard
Lift lowering device			Manufacturer's standard
Traction & diverter sheaves	Safety yellow	Matte	
Machinery guards			Manufacturer's standard
Over speed governor guard			Manufacturer's standard
Control panels			Manufacturer's standard
Machine & liftwell trunking / conduit	Black	Matte	To match shaft primary structural steels

Additional notes and special requirements: Nil

Attachment A1.8 - Schedule of Lift Shaft Equipment

Equipment	Colour	Finish	Comments
Counterweight screen	Safety yellow		
Pit ladder	Galvansed	Matte	Galvanised steel. To match primary structural steels
Sole plates / buffers stands	Galvanised.		Galvanised steel.
Pit sump cover	Galvanised		Galvanised steel.
Counterweight frame and weights	Safety yellow		
Counterweight pulley	Safety yellow		
Guide rails	Black	Matte	
Guide brackets	Black	Matte	To match primary structural steels
Well dividing steels	N/A		
Well dividing screens	N/A		
Overhead and secondary steelwork	Black	Matte	To match primary structural steels
Guide footing and buffer stools	Black	Matte	To match primary structural steels
Buffers			Manufacturer's standard
Rope compensation units	N/A		
Governor tension frame			Manufacturer's standard
Lift pit	Black	Matte	To match primary structural steels
Lift well	Black	Matte	To match primary structural steels
Well brackets	Black	Matte	To match primary structural steels
Lift car brackets	Black	Matte	To match primary structural steels

Additional notes and special requirements: Nil



Transport
for NSW

- # Sydney Metro City & Southwest

- ## Central Station Main Works Contract Schedules

- Schedule C1

- - Scope of Works and Technical Criteria
Appendix C03
Central Station Escalator Specification

PROJECT	Sydney Metro City & Southwest	DATE	15 June 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.0
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1 Introduction

- (a) This Appendix C03 applies to all escalator works which form part of the Central Station Works and Central Walk Works.
- (b) This Appendix C03 specifies the performance and technical criteria for the escalator works, including for the design, fabrication, installation, testing, commissioning and handover.
- (c) This Appendix C03 comprises:
 - (i) Section 1 is an introduction;
 - (ii) Section 2 outlines the minimum Codes and Standards;
 - (iii) Section 3 contains the design requirements;
 - (iv) Section 4 contains the general, performance and technical requirements; and
 - (v) Section 5 contains the mandatory inspection and testing to be carried out during construction, commissioning and bringing into service, the acceptance testing to confirm that the escalator works meet the performance and technical requirements and other general commissioning requirements.
- (d) Unless the context otherwise requires:
 - (i) terms which have a defined meaning in the General Conditions and SWTC Appendix A01 have the same meaning where used in this Appendix C03;
 - (ii) any reference to "Specification" is a reference to this Appendix C03; and
 - (iii) any reference to a 'Section' in this Appendix is a reference to a section of this Appendix C03.

2 Compliance with Codes and Standards

- (a) The escalator works must conform with the requirements of this Specification and all relevant Codes and Standards.
- (b) The minimum Codes and Standards must include, as applicable to the equipment specified:
 - (i) AS 1428.2: Design for Access and Mobility; Part Two: Enhanced and Additional Requirements – Buildings and Facilities;
 - (ii) AS 1428.2: sets out requirements for the design of buildings and facilities for access for people with disabilities;
 - (iii) AS 1428.4: Warning tactiles should be applied to the cover plates at the top and bottom of the escalators;
 - (iv) AS 1735: Lifts, Escalators and Moving Walks;
 - (v) AS 1735.1 sets out the general requirements for vertical transportation installations;
 - (vi) AS 1735.5 (EN115) sets out the basic requirements for escalators;
 - (vii) AS 1735.10 sets out required test procedures;
 - (viii) Building Code of Australia (BCA);
 - (ix) AS/NZS 3000: Electrical Installations (known as the Australian/New Zealand Wiring Rules);
 - (x) AS/NZS 3008: Electrical Installations – Selection of Cables;
 - (xi) Work Health and Safety Act 2011;
 - (xii) RailCorp Fire and life safety standard guidelines;
 - (xiii) RailCorp Engineering Standards – Stations and Buildings – Station Design Standard Requirements Station Functional Requirements; and
 - (xiv) Disability standards for Accessible Public Transport – 2002;
- (c) In the event of an inconsistency, ambiguity or discrepancy between the requirements of this Specification and Codes and Standards:
 - (i) the CSM Contractor must notify the Principal's Representative and the Independent Certifier; and
 - (ii) the requirement which delivers the greatest level of service or is the highest standard will apply.
- (d) The CSM Contractor must issue to the Principal's Representative and the Independent Certifier certificates of compliance with the relevant Codes and Standards and Laws. The CSM Contractor must notify the Principal's

Representative and the Independent Certifier of subsequent changes in the relevant Codes and Standards that impact upon the requirements of this Specification.

3 Design Requirements

3.1 Drawings

3.1.1 Overview

- (a) The CSM Contractor must produce the following drawings at each Design Stage:
- (i) general arrangement drawings, in accordance with Section 3.1.2;
 - (ii) builders work (including any permanent lifting points), equipment delivery and removal drawings, in accordance with Section 3.1.3; and
 - (iii) mechanical drawings, in accordance with Section 3.1.4; and
 - (iv) electrical drawings, in accordance with Section 3.1.5.

3.1.2 General Arrangement Drawings

- (a) The general arrangement drawings must clearly indicate the location and type of all escalator pit equipment, secondary structure, machinery, brackets and fixings.

3.1.3 Builder's Work Drawings

- (a) The builder's work drawings must:
- (i) include layout drawings, incorporating comprehensive plan drawings of the upper and lower escalator pits, escalator supports, and full elevation details.;
 - (ii) clearly identify all builder's work including a written schedule of the builder's work required to ensure that necessary allowances can be made accordingly;
 - (iii) include loading requirements for foundations, bases, lifting and supporting structures for plant or equipment, all holes in walls, floors and ceiling elements and machinery spaces as required by this Specification;
 - (iv) clearly identify the loading and details of fixings required to any adjacent; and
 - (v) clearly detail or schedule the electrical supply requirements, providing at least the following information:
 - A. full load running current;
 - B. maximum starting current; and
 - C. required protective device, capacity and settings.

3.1.4 Mechanical Drawings

- (a) Drawings for all mechanical elements related to the aesthetic finishes (such as balustrades, indicators and mounting plates) must be submitted at each Design Stage.

- (b) All mechanical drawings for items of plant or equipment must indicate principal dimensions, fixings, connections and all other relevant details.
- (c) Where a manufacturer's original drawings are used, they must be specific to the relevant escalator works and all references to optional features, other machines of a range and other such references must be deleted or the original drawings redrawn to comply with this Section.

3.1.5 Electrical Drawings

- (a) All wiring diagrams must indicate clearly that wiring which forms part of, or is connected to, the equipment as delivered.

3.1.6 Coordination of Drawings

- (a) The CSM Contractor must coordinate all drawings prepared by Subcontractors to ensure drawings are compatible, correctly annotated and cross-referenced at all interfaces.

3.2 Samples

- (a) At Design Stage 2, the CSM Contractor must submit to the Principal's Representative and the Independent Certifier for review in accordance with the Contract, samples based on the drawings and schedules of materials and finishes for the following items:
 - (i) balustrade;
 - (ii) step (part only);
 - (iii) handrails;
 - (iv) finish materials;
 - (v) push buttons (emergency stops and other such items);
 - (vi) key switches;
 - (vii) glazing;
 - (viii) tactile ground surface indicator;
 - (ix) skirt deflector brush.

4 General, Performance and Technical Requirements

4.1 Scope of Works

4.1.1 General

- (a) The CSM Contractor must undertake the detailed design, fabrication, delivery, installation, testing and making ready for operation of the escalators.
- (b) The CSM Contractor must coordinate and interface the escalator works with the work of Interface Contractors and any other works undertaken by the CSM Contractor relevant to the escalators with respect to:
 - (i) dimensional compatibility;
 - (ii) technical interfaces, including power supplies, security, closed circuit television, fire alarm, EWIS and finished floor levels;
 - (iii) programming of sequential operations to interface with other works; and
 - (iv) interdisciplinary co-ordination.

4.1.2 Design - General Requirements

- (a) Escalators must be of compact type (all equipment fully enclosed within the escalator truss), designed for heavy-duty outdoors-public systems suitable to operate in the local environment. All machinery and control equipment must not be located within the escalator step band.
- (b) Escalators must be reliable, must require low level of maintenance and have the Design Life specified in section 4.2 of the SWTC.
- (c) Escalators must be of the reversible type, capable of operating in either direction.

4.1.3 Design Intent

- (a) In developing the Design Documentation, the following aims must be considered:
 - (i) vandalism and misuse resistance;
 - (ii) resistance to railway environmental influences;
 - (iii) standardisation with existing escalators operated and maintained by Sydney Trains;
 - (iv) visual continuity;
 - (v) ease of maintenance and future availability and sourcing of spare parts;
 - (vi) maintainability for the design life of the escalator;
 - (vii) stimulating travel experience; and
 - (viii) minimisation of energy requirements.

- (b) All escalator elements must be located to facilitate ease of circulation and clarity of way finding.

4.1.4 Transfer of Mobility-Impaired Persons

- (a) All escalator elements must be designed to facilitate “universal access” for mobility-impaired people and people with disabilities, in accordance with the Building Code of Australia and any other relevant Codes and Standards.

4.1.5 Step Demarcation and Combs

- (a) A total of 3 edges of each step tread must be provided with replaceable plastic demarcation inserts finished in safety yellow, resistant to wear, mechanical damage and dislodgement.
- (b) The 2 side edges of each step tread must be provided with replaceable plastic demarcation inserts finished in safety yellow, resistant to wear, mechanical damage and dislodgement.
- (c) The edge adjacent to the projecting edge of each step tread must be provided with replaceable plastic demarcation inserts finished in safety yellow, resistant to wear, mechanical damage and dislodgement.
- (d) Step combs must be finished in safety yellow and be resistant to wear;
- (e) Comb lighting must be provided;

4.1.6 Operational Requirements

- (a) The escalators hours of operation must be considered as 24 hours per day, 7 days per week, 52 weeks of the year, with the following characteristics:

Type of load	Application	Duration/Frequency
Peak load	100% of brake test load (1450 N/step)	0.5hrs every 3hrs
Average load	40% of brake test load	Between load peaks

- (b) The following moving parts must be calculated or tested to demonstrate compliance with the operating characteristics of Section 4.1.6(a):
 - (i) bearings,
 - (ii) step chains;
 - (iii) handrail drive;
 - (iv) drive machine;
 - (v) tension carriage;
 - (vi) lubrication system; and
 - (vii) braking systems.

4.1.7 Time between Major Repairs

- (a) Escalators must be designed to achieve the specified Design Life, and a minimum of 100,000 operational hours between major repairs under all conditions imposed by the railway environment.

4.1.8 General Characteristics

- (a) Escalators must comply with the following characteristics:

1	Inclination (slope)	30 degrees
2	Rises (indicative)	4m - 18m
3	Step width (nominal)	1000 mm
4	Minimum step depth	380 mm
5	Maximum step height	210 mm (To comply with AS1735 Clause 8.1.1 requirements for use as emergency exit when out of service)
6	Minimum clear height above step	2300 mm
7	Maximum speed	0.65 m/s (lower rise escalators may be designed for lower nominal speeds than the maximum speeds)
8	Number of flat steps at both landings	4 (where feasible)
9	Horizontal movement of the steps from the comb plate at both landings	1600 mm (where feasible)
10	Transition radius of curvature	Between the range of 1.5m and 2.6m, depending on the Site application and in compliance with AS1735 Part 5
11	Safety factor for step (minimum)	8 with a minimum load of 1450 N/step and in compliance with AS1735 Part 5

12	Safety factor for step chain	8 over ultimate tensile stress
13	Maximum noise level	60 dB measured at 1.5 m above or at side around the escalator

4.1.9 Drainage of Escalator Pits

- (a) Provision must be made in all indoor and outdoor escalator pits and the machinery spaces, for water, oil, and other liquids to drain into a sump at the lowest point of the pit. The sump must be connected to a main drainage system. Liquids in the pit may be contaminated and consideration must be made in the design to address the requirements of Law and the Contract, including any treatment required to the sum drainage prior to discharge. A float switch must be provided to automatically stop operation of the escalators in case the water level exceeds a predetermined adjustable level.
- (b) Escalators must be designed to address:
 - (i) that escalators may be subject to ground water with high mineral content and a marine environment; and
 - (ii) the effects of dirt and dust.

4.1.10 Space and Safety Requirements for Escalator Machine Rooms and Pits

- (a) The drive machine, controller and related equipment must not be located within the step band.
- (b) For both in-the-truss and remote machine room designs, there must be no obstructions (such as supporting posts for the upper support beam, partitions, or piping) preventing easy access to the drive machine and controller.
- (c) This area must be reserved for the installation of motors, drives, and controllers of various sizes and placements. There must be an adequate clear workspace and passageway on at least three sides of the machine or two sides where walls interfere. The layout of cables, wiring and services in escalator pits and spaces will be such that it allows free and safe access to equipment.
- (d) Each machine controller must be mounted with an adequate clear workspace in front of the controller. Where workspace for the control equipment is tight, the equipment must be easily movable and positively secured with fixed mechanical aids, and eliminate any manual handling risks.
- (e) Escalator machine pits must be provided with movable floorplates over the full area of the pit. Floorplates must be removable by one person without the use of special equipment.

4.1.11 Truss Trays

- (a) Truss trays must be provided at the landings, and for the entire length and width of the trusses to collect dust, debris, lubricants and any moisture or water entering into the escalator. They must be fully sealed and of watertight construction to prevent oil leaking below the truss, and be sloped for proper drainage.
- (b) Any accumulation of oils, lubricants and contaminated liquids must be contained to prevent discharge into the water drainage system or external to the escalator. The system must be design to provide clear access for the purpose of cleaning the trays and catch basins.

4.1.12 Service life of Components

- (a) All components must be designed to maximise their service life and require minimum maintenance effort under heavy duty public service, and harsh environmental conditions. The service life of components under conditions of continuous operation must be documented and provided to the Principal's Representative and the Independent Certifier. Components must be designed to support the Design Life of the escalator.

4.1.13 Energy Efficiency Measures

- (a) Escalators must be supplied with "energy efficiency" provisions. The CSM Contractor must include in the Design Documentation details of proposed energy conservation measures, such as continuous operation where the monitoring system has to adapt the energy consumption to the actual passenger traffic load, automatic interrupted operation at non-peak hours.

4.1.14 Design for Ease of Maintenance

- (a) All routine maintenance will be carried out on-site.
- (b) Maintenance must not require access from the external sides of the truss.
- (c) Escalators must be designed to allow ease of access for inspection and maintenance with minimal need to remove surrounding equipment.
- (d) The drive machine, controller and related equipment must not be located within the escalator step band, as this restricts ease of access for inspection, maintenance, repair and replacement or parts.
- (e) As the accumulation of materials (grease, oil, dust, paper) represents a fire risk, cleaning of the truss trays must be possible and easily accessible.

4.1.15 Pit Barriers

- (a) Removable barriers must be provided for placement at each end of an escalator to guard the pit opening when the floorplates are removed.

4.1.16 Operating Controls

4.1.16.1 Normal Operation (Key Switches)

- (a) Escalators must have key-operated switches at each end at the upper and lower landings.

- (b) Each key switch must provide starting and direction selection, and must be clearly and permanently labelled to indicate these features.
- (c) The key switch must have up and down direction positions, and a centre position. The key must be removable only in the centre position.

4.1.16.2 Emergency Stop Button

- (a) Manually operated emergency stop buttons must be provided in conspicuous and easily accessible positions at or near to the landings of escalators.
- (b) The stop buttons must have covers, which when lifted must operate a local audible buzzer as a preventative measure against misuse.
- (c) For escalators with rises above 12m additional stop buttons must be provided along the incline.

4.1.16.3 Traffic Flow Lights

- (a) Traffic flow lights must be provided to indicate the running direction of the escalator.

4.1.17 Use of Lubricants

- (a) Non-flammable lubricants must be used on all escalator components requiring lubrication including to all chains. All materials used for components that may come in contact with non-flammable lubricants must be designed for compatibility.

4.2 Structural Elements

4.2.1 Truss

- (a) The truss must be made of welded steel profiles. The sides of the structure must be of framework design (lattice type).
- (b) As a minimum, chords, truss posts, support angles, and diagonals must meet the strength standards of steel ST 52-3, cold or hot formed and steel ST 37-2.
- (c) Each truss structure must be designed and constructed so as to carry safely the dead load of the escalator (including escalator equipment, drive machine, controller, truss-covering) including any additional loads (external cladding, fall over side protection) attached to the truss, plus the passenger load. The maximum deflection measured between the unloaded bare truss position and the under full load truss position of the complete installed escalator, must not exceed the 1/1000 of the distance between supports.
- (d) Prior to welding, profiles must be sandblasted. After the welding the truss must be hot-dip galvanised in accordance with DIN 50976, with a coating thickness of between 50 and 85 µm.
- (e) The CSM Contractor must consider Site-based installation difficulties requiring the truss to be broken down into sections, which can be reassembled on Site with bolted spliced joints.
- (f) There must be provision to enable the installation of escalator sprinkler protection systems.

4.2.2 Supports

- (a) The number and structure of supports must be properly designed in order to:
 - (i) ensure a maximum deflection of the truss of less than 1/1000 of distance between supports;
 - (ii) prevent the direct structure-borne noise to be transmitted to the building;
 - (iii) comply with anti-seismic regulation; and
 - (iv) to undertake the thermal expansion of the truss.
- (b) To avoid unnecessary obstructions along the circulation path below the escalator, clear span escalator trusses are preferred where the rise is less than 8 metres.
- (c) The truss must bear on the supporting steel or concrete beams with shim packs with vibration dampening pads of resilient material.

4.2.3 Steps

- (a) Steps must be of one-piece robust design, made of die-cast aluminium in accordance with the relevant Codes and Standards, and must be corrosion resistant.
- (b) Steps must be in compliance with the load test requirements of AS 1735.
- (c) Tread width/depth: 1000mm/minimum 380 mm.
- (d) Both the tread surface and riser face must be fitted with longitudinal grooves.
- (e) Step rollers must have lifetime lubricated sealed ball or roller bearings and must be rated for severe, heavy duty service. Step roller bearings must have an L10 rating of 100,000hrs.
- (f) Provision must be made in the escalator design to allow quick and easy step removal at one or both of the landings, and must permit removal without disturbing balustrades.
- (g) Escalators must be designed to allow quick and easy alignment of steps during installation.
- (h) The step fixing (to the step chains/axles and step wheels) must be designed such that the transfer of the driving forces to the step, exerts minimal forces on the step.
- (i) Steps must not be used as a means to maintain step chains in the correct tracking gauge.
- (j) Steps must have demarcation as specified in Section 4.1.5.

4.2.4 Track System

- (a) The tracks must continuously support the escalator step and chain wheels. The tracks must be designed for ease of renewal and provide smooth running surfaces. All joints in tracks, where possible, must be diagonal across the width of the running track surface.
- (b) Preference must be given to designs where the chain wheel track is adjustable in the neighbourhood of the top and bottom sprocket, in such a way that the chain

may lie tangential to the sprocket pitch line on both the upper and lower sides of the sprockets.

- (c) A guard must be provided around the sprockets at each landing to retain a chain and step system in the event of chain breakage.
- (d) Auxiliary tracks must be provided at both landings, which must be designed so as to support the steps through the comb in the event of failure of a step wheel.

4.2.5 Comb, Comb Plates, Floor Plates

- (a) The entire assembly must be wear-resisting, noncorrosive and anti-slip.
- (b) Combs must be sectional and screwed to the comb plates allowing quick and easy removal and replacement. They must be in safety yellow colour and resistant to wear. Combs must have such a design that upon trapping of foreign bodies either their teeth deflect and remain in mesh with the grooves of the steps, or they break.
- (c) The comb plate must be of robust design, supporting heavy passenger loading without any part of the assembly touching the steps. Provisions for lateral and vertical fine adjustments must be provided to allow the cleats of the step treads to pass between the comb teeth with minimum clearances.
- (d) Horizontal guides must be provided at each landing to assist in ensuring that the steps enter the comb plate safely.
- (e) Floor plates must be easily removable to allow step removal without dismantling any part of the balustrade.

4.2.6 Step Chain, Step Wheels

- (a) The two main step chains must be roller-type, of heat treated steel construction supported at intervals by linkage wheels. The chain must incorporate links, pins, bushes and rollers, and be supplied in precision matched lengths. Outboard rollers must only be used on escalators with rise greater than 9.4m.
- (b) The step chain must be of water-proof and lubrication free type.
- (c) The tracking gauge of the step chains must be maintained by axles between the step chains. Steps must not be used as a means to maintain tracking gauge.
- (d) A means to prevent steps from coming into physical contact with one another, and to prevent chains from sagging or buckling must be provided.
- (e) A means to maintain constant distance between the step axles by way of an automatic tensioning device to maintain tension and compensate for wear must be provided. Step chains must be constructed to permit removal of segments as may be required for replacement (at a minimum of every six-axle section).
- (f) Rollers must be constructed of suitable material, with diameter sufficient to provide reliability, maintainability, smoothness of motion and to operate within the noise level requirements. The wheels, hubs and bearings must have an L10 rating of 100,000hrs.
- (g) A test certificate confirming the tensile breaking load of the assembled step chain must be provided from an approved test authority.

- (h) Means must be provided to allow the step chain to be shortened by one step when the tension carriage reaches its outer limit of travel.
- (i) A shielding device must be provided to protect the chain, track guides and rollers against water, dirt and debris.

4.2.7 Motor

- (a) The motor must be variable speed drive, 3-phase AC induction motor, voltage 400 V \pm 10 %, frequency 50 Hz \pm 2 %.
- (b) Thermal overload devices must be fitted within the motor windings.
- (c) The motors must be totally enclosed with external cooling fins.
- (d) The motor protection class must be equivalent to IP55 insulation group F.
- (e) The motor must be mounted by a method, which guarantees accurate alignment following removal for repairs.
- (f) Driving motors and motor switchgear must provide a smooth start.
- (g) The motor must be so designed to be energy efficient in its operation.
- (h) The motor must be designed to withstand a minimum of 60 starts per hour.

4.2.8 Controller

- (a) The controller must consist of a dust and waterproof metal cabinet containing all switchgear necessary for the control of the escalator and must be an IP55 rated enclosure.
- (b) The controller must enable either rated or maintenance speeds to be selected, and must be connected to the power switchboard. The controller must be designed to withstand 60 starts per hour.
- (c) All escalators must be free from systems that must be periodically programmed by the manufacturer. All installed runnable and diagnostic software required to operate the escalator must be supplied under the Contract. A duplicate copy of all site-specific software must also be supplied by the CSM Contractor in a format able to be plugged in on-site by a competent escalator technician.
- (d) Where workspace for the control equipment is tight, the equipment must be easily movable and positively secured with fixed mechanical aids, and eliminate any manual handling risks.
- (e) Inspection controls must be provided to permit operation during maintenance or repair or inspection by means of portable and manually operated control devices. For this purpose, two inspection outlets (one at each landing) for the connection of the flexible cable of the portable control device must be provided. The length of the cable must be at least 3.0m. Inspection outlets must be located in such a way that any point of the escalator can be reached with the cable.

4.2.9 Balustrade and Finishes

- (a) Balustrade and panelling must be of stainless steel construction. The finish must be finished stainless steel with any variation subject to quotation.

- (b) The design of balustrades and finishes must be robust and make allowance for forces imposed in a public service environment. The newel stand in particular must be rigidly supported.
- (c) Interior panels where applicable must be easily removable to allow access to the handrail, safety devices and other equipment within the balustrade and truss.
- (d) All gaps between the balustrade and wall finishes must be suitably covered to prevent access into the gap.
- (e) All panels must be fitted with anti-drumming material on the reverse side to minimise noise levels generated by the escalator machinery.
- (f) Glass balustrades must not be used.
- (g) Balustrade panels must be constructed where practical in equal lengths for interchangeability.
- (h) Panels must be sized so that no more than two people are required to remove a panel, and without the aid of special handling equipment.
- (i) All exposed panel fasteners must be by flush fitting tamper resistant screws. Friction and clip fastening methods must not be used.

4.2.10 Skirting

- (a) Skirting panels fixed adjacent to the moving surface must be fabricated from smooth rigid materials and braced to prevent permanent deformation during passenger transit. They must be finished satin stainless steel with an anti-friction material.
- (b) The skirting must not yield more than 4mm under a single force of 1500N acting at the most unfavourable point (point of maximum deflection) at right angles to the surface (over an area of 25 cm²). All efforts to reduce the possibility of trapping between the skirting and the steps must be employed.
- (c) Panels must have smooth and flush fitting joints and flush fitting fasteners must be used.

4.2.11 Skirt Brush Guards (Deflector Guards)

- (a) Skirt brush guards must be fitted to escalators at the point between the steps and balustrade skirting, in accordance with AS 1735 part 5.
- (b) The brush guard must be designed (splayed) to prevent a user's / passenger's foot being trapped beneath it and must also prevent the trapping of small-wheeled trolleys, baggage or strollers. The brush material must be fire resistant and non-toxic when burned. The end terminations of the skirt guard at each landing must have purpose designed end caps positioned to eject a user's / passenger's foot or baggage and pushchairs from beneath the guard and terminating before the comb-step intersection.

4.2.12 Key Switches

- (a) Suitable metal enclosures must be provided at the newel ends of the balustrade, at both upper and lower landings, to house each key switch having three separate positions. There must be clearly marked up and down direction positions, and a

centre position. The key must be removable only in the centre position. The key switches must have barrels which require the use of a key nominated by the Principal's Representative.

4.2.13 Handrail System

- (a) The handrails must receive their motion from the main escalator drive through direct gearing and drive shaft or drive chains so that the handrail and steps operate at the same speed in each direction of travel.
- (b) The newel sheaves must be provided at the upper and lower landings and must be designed with nominally half wrap of the handrails around each sheave.
- (c) Where pinch and pressure belt drive systems are used, these must be designed for heavy duty loading and to be vandalism and misuse resistant.
- (d) Sheave and roller systems must be designed and positioned so that lubricant cannot reach the surface of the handrail.

4.3 Braking Systems

4.3.1 Operational Brake

- (a) The escalator drive mechanism must be fitted with electro-magnetically released brake. The brake force must be generated by guided compression springs. The brake must be capable of being set to provide smooth consistent braking and must cause the escalator to stop and remain stopped under all conditions of load and speed. The brake must be capable of being fitted with a manually operated device to allow hand winding.
- (b) A monitor must be provided, and if the brake lining becomes insufficient for safe usage, restart of the escalator must be prevented. The output from this monitor must be made available for the remote monitoring.
- (c) A monitor must be provided to detect mechanical engagement of the brake with motor for the purpose of stopping the escalator to prevent the motor continuing to run through the brake.
- (d) The brake coil must be insulated to Class F.
- (e) The brake must comply with stopping distances as described in AS1735 Part 5 Clause 12.4.4.

4.3.2 Auxiliary Brake

- (a) All escalators must have an auxiliary brake.
- (b) The auxiliary brake must become effective in either of the following conditions:
 - (i) before the speed reaches a value 1.4 times the rated speed; or
 - (ii) by the time the steps change from the present direction of motion.
- (c) The auxiliary brake's operation must positively open the control circuit.

4.4 Safety Features

- (a) Escalators must be designed so that there is no risk of injuries to the user/passenger. Splits, linings, and crossings must exclude any possibility of clothing getting caught or stuck.
- (b) Escalators must include the following operational safety measures and the status of these must be made available to the remote monitoring:
 - (i) pit stop switch;
 - (ii) handrail entry devices - 2 at each landing;
 - (iii) step upthrust device ;
 - (iv) step level (step sag) device;
 - (v) handrail speed monitoring device;
 - (vi) broken handrail device;
 - (vii) missing step device;
 - (viii) comb impact device – at both sides of each comb;
 - (ix) broken step chain device - 1 per chain;
 - (x) skirt obstruction switch;
 - (xi) tension carriage switch;
 - (xii) key switch, at both landings;
 - (xiii) drive machine with:
 - A. operational brake;
 - B. non-reversal device;
 - C. motor thermic device, protection against overheating;
 - D. over speed governor; and
 - E. control device for brake lifting operation;
 - (xiv) main circuit breaker;
 - (xv) isolation switches at both landings;
 - (xvi) inspection socket at each landing and a portable inspection control device;
 - (xvii) asymmetric relay activated in case of non - symmetrical main current supply; and
 - (xviii) auxiliary brake on main drive shaft.
- (c) Escalators must include the following passenger safety measures and the status of these must be made available to the remote monitoring:
 - (i) passenger emergency stop button at both landings and alarm;
 - (ii) step and comb demarcation;

- (iii) safety signs;
- (iv) skirt brush (deflector) guards;
- (v) transition radius of curvature (refer Section 4.1.8);
- (vi) number of flat steps at both landings = 4; and
- (vii) traffic flow lights at both landings.

4.5 Fault Indication

- (a) Fault indicators must be provided on the balustrade decking for the purpose of status indication, and display of codes for fault finding purposes.

4.6 Remote Alarm and Monitoring System

- (a) The CSM Contractor must provide integration to a remote alarm and monitoring system for the purposes of alerting staff to an escalator failure. This integration must meet the following requirements:
 - (i) have network connectivity for the transfer of data into the Sydney Train's systems via a CAT6A cable from the escalator to the station office network connection point;
 - (ii) have the ability to interrogate the status of the lift (e.g. "out of service", "Up operation");
 - (iii) at 24 hour manned stations, the status of the escalator must be accessible to controlling staff via audible and visual alerts;
 - (iv) at unmanned and partially manned (that is, not 24 hour manned) stations, the status of the escalator must be accessible at the "controlling station", a location nominated by the Principal's Representative, to controlling staff via audible and visual alerts;
 - (v) be able to provide a list of system parameters to enable reliability analysis; and
 - (vi) all required system parameter values must be available to the external software when a request for information is made.
- (b) The wiring or communication between the escalator and the remote alarm panel must be provided by the CSM Contractor.

4.7 Tests and Inspections at Manufacturers' Premises

- (a) The CSM Contractor must undertake the following works tests and inspections, in the manufacturers' premises:
 - (i) an examination of selected machined parts of the escalator before assembly and of electrical component parts to check freedom from all Defects.

4.8 Maintenance Spares

- (a) The CSM Contractor must provide sufficient spares for each escalator type to minimise downtime associated with common faults.

4.9 Equipment Workmanship

4.9.1 General

- (a) The CSM Contractor must permit the Principal's Representative and the Independent Certifier free access to the Site and any relevant manufacturer's premises during working hours and by agreement for inspection of materials, assemblies, method of manufacture and quality control of the process.
- (b) Unless otherwise described, all materials must conform to the appropriate Australian Standard. The CSM Contractor must furnish the Principal's Representative and the Independent Certifier, upon request, with certificates or letters from the prime material manufacturers and suppliers proving that the materials to be used do in fact conform to such standards and the Contract, and confirming that they have "no objection" to the use of their materials. Such certificates and letters must be incorporated into the operation manuals.
- (c) The CSM Contractor must obtain the total quantity of each material from the same manufacture with proven experience of manufacture of similar materials.
- (d) The CSM Contractor must, upon request, submit a list of all materials proposed which are not specifically described in this Specification.

4.9.2 Fixing Devices

- (a) The CSM Contractor must allow for all necessary fixing devices including secondary support steels, framing, bearers, fillets and all preparation in plugging and screwing or cutting for anchor bolts or for any other fixing whatsoever necessary.
- (b) The CSM Contractor must provide for an appropriate combination of all working tolerances in the elements of the escalator works as well as the design tolerances in the work, and must provide for all necessary adjustments to enable the escalators to be fitted.

4.9.3 Fabrication

- (a) The material used in the fabrication must be of a type to achieve the required performance and appearance.
- (b) Methods used in the fabrication must be selected to achieve the specified appearance and performance. Methods used must be based upon the use of suitable equipment and experienced personnel.
- (c) Method statements must contain control procedures to ensure compliance with the requirements of this Contract.
- (d) Control samples must be produced to adequately demonstrate the standard of workmanship and finish required. Where appropriate, range samples must be established to assist in quality control procedures.

4.9.4 Accuracy and Compliance

- (a) The CSM Contractor must pre-assemble and carry out as great a proportion of the work as possible within a controlled factory environment.

4.9.5 Workmanship

- (a) The standard of workmanship for all element of the escalator works must be to industry best practice and in accordance with relevant Codes and Standards and Laws, and strictly in accordance with the CSM Contractor's shop drawings.
- (b) Workmanship for all construction and component assemblies must be of the highest standards in every respect. Work must be true to detail with sharp, lean continuous profiles and surfaces straight and free from Defects, dents, marks, cracks, indentations, distortions, waves, scratches or flaws of any nature impairing strength or appearance and fitted with proper joints and intersections and with specified finishes.
- (c) When assembled, any moving parts must move freely without binding.
- (d) All fixings that are visible to escalator users must be either countersunk or of a decorative nature.
- (e) Junctions of identical elements must be mitred.

4.9.6 Appearance

- (a) The finished work is to be entirely free from loose material, chips, marks or any imperfection visible to the naked eye. Localised "making good" is not acceptable.

4.9.7 Firmness and Solidity

- (a) The whole system must be sturdy, rigid, firm and free of vibration, rattling, squeaking and other noises.

4.10 Materials

4.10.1 Castings, Extrusions or Profiles

- (a) All castings, extrusions or profiles are to be of adequate thickness and strength to meet the structural requirements and eliminate any risk of distortion in the finished surfaces. The thickness of such elements must be sufficient to ensure their complete rigidity in the lengths required in the final installation.

4.10.2 Sealant

- (a) Any form of sealant must be compatible with the adjacent elements of construction in each particular location. All excess sealant must be properly cleaned from exposed surfaces.
- (b) Installed sealant must provide a smooth continuous surface to the full width of the joint and must be tooled flat. The sealant colour must be approved by the Principal's Representative.

4.10.3 Painting

4.10.3.1 General

- (a) With the exception of self-finished surfaces and elements otherwise specified, the whole of the equipment must be painted one coat in the factory after full and proper surface preparation, including priming. Any damaged surfaces must be made good on-Site to the satisfaction of the Independent Certifier.
- (b) All steelwork must be de-rusted, treated with rust inhibitor or galvanized, primed and painted.

4.10.3.2 Waterproofing

- (a) All escalators must be designed and constructed so that any ingress of water does not adversely affect operation. In addition, all truss, trays and cladding must be fully sealed and watertight.

5 Commissioning Requirements

5.1 Inspection, testing and commissioning requirements

5.1.1 General

- (a) Testing and commissioning must be undertaken.
- (b) The CSM Contractor must supply all materials, instruments, test equipment, software, power supply and any other necessary items required for the performance of all tests required to be undertaken as part of the escalator works. The CSM Contractor must provide evidence to the Principal's Representative and the Independent Certifier that the instruments have been recently calibrated.
- (c) Without limiting any part of this Contract, should any test be carried out outside the Sydney metropolitan area and testing of equipment and systems be unsuccessful or inconclusive, the CSM Contractor must pay all associated costs for the Principal's Representative to attend all further retest(s) and/or reinspection(s) necessary to demonstrate compliance with the Contract.
- (d) The CSM Contractor must successfully complete the commissioning of the escalator works and rectify any Defects identified during commissioning to the satisfaction of the Independent Certifier, prior to putting the escalator(s) into service.
- (e) Prior to any escalator being put into service, in accordance with the Work Health and Safety Act 2011, the CSM Contractor must leave the complete installation in the state of cleanliness expected of a new product.
- (f) The escalator works when completed must not be used prior to issue of a declaration of conformity in accordance with the Work Health and Safety Act 2011 and registration with WorkCover NSW.

5.1.2 Commissioning Tests on Site

5.1.2.1 Witness Tests

- (a) The CSM Contractor must test and examine the whole of the escalator works. The CSM Contractor must also carry out tests to be witnessed by the Principal's Representative and the Independent Certifier, to demonstrate compliance with this Contract.
- (b) These tests and examinations must generally comply with the requirements of AS 1735 parts 5 and 10. The results of the tests must be recorded on a separate test and examination certificate for each escalator. The CSM Contractor must provide these certificates to the Principal's Representative and the Independent Certifier.

5.1.2.2 Dynamic Tests on Escalators

- (a) Notwithstanding the requirements of AS1735 parts 5 and 10, the witness tests must include the following specific dynamic tests:
 - (i) demonstrate the operation of the operational and auxiliary brakes under full load at full speed conditions in both directions;

- (ii) motor current readings must be taken and recorded in the up and down direction under no load, full load conditions; and
 - (iii) manual activation of the governor must satisfy the requirements of this Specification.
- (b) The CSM Contractor must carry out all necessary remedial works repair all damage to equipment or property occurring from these tests.

5.1.2.3 Functional Tests

- (a) The operational functions of all escalators must be demonstrated to the Principal's Representative and the Independent Certifier, including demonstration of the operation of:
- (i) all safety features describe in Section 4.4;
 - (ii) all push buttons, indicators and sounders, gongs and other like items;
 - (iii) all key switches and functions controlled thereby; and
 - (iv) special control features such as fire alarm, emergency switches, out of service switches and other such features.

5.1.2.4 Test Certificates

- (a) The CSM Contractor must make available copies of any manufacturers' test and type test certificates to the Principal's Representative and the Independent Certifier.

5.1.2.5 Testing Personnel and Equipment

- (a) All testing and commissioning must be carried out by suitably qualified testing personnel, experienced in such work and using suitable instruments.
- (b) All instruments and test equipment must be calibrated in accordance with the CSM Contractor's quality assurance procedures. The CSM Contractor must make available copies of any calibration certificates for test equipment used during commissioning to the Principal's Representative and the Independent Certifier.

5.2 Operating and Maintenance Manual

- (a) The CSM Contractor must provide operating and maintenance manuals, shop drawings, electrical wiring diagrams, all relevant asset references and technical data to the Principal's Representative and the Independent Certifier.

5.3 Hazard and Risk Assessment (AEA National Code of Practice)

- (a) The CSM Contractor must submit to the Principal's Representative and the Independent Certifier a hazard and risk assessment for the escalators, addressing all items in the AEA National Code of Practice.

- Sydney Metro City & Southwest

 - Central Station Main Works**

 - Schedule C1

- Scope of Works and Technical Criteria
Appendix C04
Indra Specification

PROJECT	Sydney Metro City & Southwest	DATE	07 June 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	8.0
COMPANY	Transport for NSW	FILE NUMBER	[SM1700003330]
FILE NAME	CSM SWTC App C04 - Indra Specification		

Contents

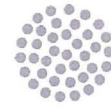
1	Indra Specification	1
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1 Indra Specification

- (a) The Indra Specification is included at Attachment 1 to this Appendix C4.

Attachment 1



indra

IAD-WIS-10-001 WORK INSTRUCTION

STANDARD DIGITAL CABLING AND CONTAINMENT WORK INSTRUCTION FOR SYDNEY TRAINS

Version: No 5

Date: 15/04/2016

Page: 1/ 31

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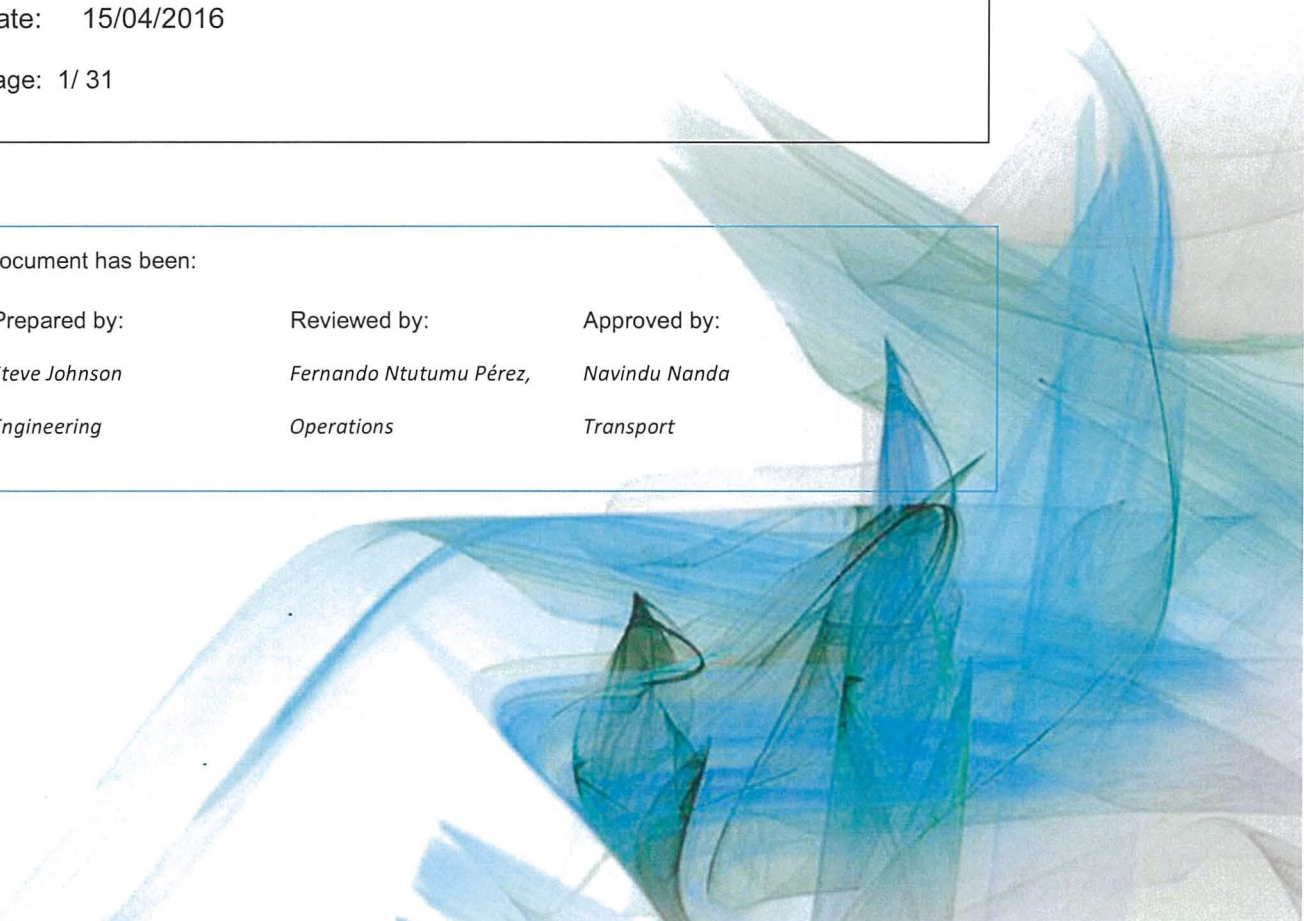
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1 PURPOSE

This specification covers the minimum requirements for the installation of Security Systems performed on behalf of Indra Australia Pty Ltd.

This specification, where applicable shall be deemed to be used in conjunction with the latest editions and revisions of the Australian Standards and local Statutory Rules and Regulations affecting these types of installations.

This specification is for the sole use of Indra's staff and Indra's subcontractors in performing rail associated work.

2 SCOPE

This specification is intended to detail specific requirements of materials and methods of installation to meet Indra's standards.

Every project is further specified by the project installation manual and the customer's specification. Where these conflict with the requirements of this specification, the Indra Project Manager will provide an order of precedence of documentation. It shall be the sub-contractor's responsibility to be conversant with and comply with the specifying documentation.

3 DEFINITIONS AND ABBREVIATIONS

Refer to ANNEX A

4 FLOWCHART AND RELATED PROCESS

Not Applicable

5 INSTALLATION OF CABLES AND WIRING

5.1 Installation Requirements

All cable routes shall be designed to be as unobtrusive as possible, both to reduce visual impact on surroundings and to avoid drawing attention to the presence of copper or fibre cable .

5.2 Cable Installation

The main cable route shall generally be installed on one side of the track and shall cross the track the least possible number of times. Local cable routes shall be installed as required.

All electrical wiring shall conform to current SAA wiring rules. There shall be no exposed wiring. All plugs and sockets shall be of the outdoor environmental type.

Care has to be taken that the physical separation of high and low-current cables is maintained. This issue is covered in detail under chapter 3.2.4.4(R&M Installation and Testing Guideline).

Local conditions may require that greater clearances than listed here be used.

A minimum clearance of 130 mm must be maintained between data cables and lamp mountings such as neon, incandescent and discharge lamps (e.g. mercury-vapour lamps).

UTP-systems intended to support 1G Base-T require significantly greater clearances than considered by AS/NZS 14763.2, to leave a min of 300mm between 1GBase-T data cables and power cables.

Cables shall be laid neatly in heavy-duty containment and parallel in trenches. Special care must be taken at bends or corners in the cable route and at entries into buildings to prevent the interlocking or bunching of cables.

All cable harnesses and looms shall be supported and laced in such a manner so as not to cause stress on any conductors.

Cables shall be installed in continuous lengths without breakage or connections within the cable route.

Care will be taken when routing cables in under floor system, not to pinch the cables to avoid probable damage to the cables.

Avoid coiling excess cable as it can cause return loss reflections which shall lead to a fail during acceptance testing.

The cables may not be unrolled over the sides of the reel flanges (This risks twisting the cables). The geometry of the symmetrical pairs is noticeably changed).

Care must be taken to prevent the ingress of moisture in to the ends of cable during installation to maintain the properties of the cable and ensure compliance at time of testing

All attempts shall be made to pump out any duct routes that are found to be water logged prior to installation to ensure product longevity.

Correct tools and pulling sock's to be used to ensure the proper pulling force when unrolling the cable.

Vertical installations strain relief is recommended at least every 600 mm. Avoid cable bundling or limit the quantity of cables bundled together to reduce the occurrence of alien crosstalk and cable stress when moving or bending, and to make sure the specified bending radii is not exceeded

All manufactures cable preparation and module termination procedures are to be followed refer to 4.2 ANNEX E R&M Installation and Testing Guideline.

Installers must follow the proper and professional installation considering at minimum the following list and any other higher procedures:

- Adequate personnel must be present at site to pull the installation cables.
- Before routing the cables, edges of openings and pipes must be rounded off, to avoid damaging the jacket when the cables are later routed and fastened.
- Cable ducts or conduits must be used when passing through walls.

- When installing the cable, the bending radius may not be less than that specified by the cable manufacturer. The same applies after the cable has been installed.
- To avoid accidental cable damage, the cables should be installed directly from the cable reels along the cable routes and should not be laid out along the floor.
- Ensure that adequate tools for cable unrolling, lay down and/or pulling as well as pulleys for corners are available and personnel instructed on their usage.
- Any sign of stress or kinks in the cable sheath insulation or conductors must be avoided (e.g. caused by improper fastening or by the weight of crossed installation cables).
- The radius of the channel route must be selected so that the specified minimum bending radius is maintained when changing direction.
- Metallic ducts or raceways must be properly connected and bonded to ground.
- Do not bundle cables (especially U/UTP) together. If this is not possible/ practical then limit the number of cables bundled together.
- Cables tie guns or similar tools may not be used when fastening data cables, nor may they be used when fastening cable ties to provide connection module strain relief.
- No pressure may be exerted on the cables because of improper tying from using quick cable installers or cable ties. The basic principle is that the geometry of the cable jacket must not change.
- Cable channels must be closed after work has been completed (raised floors, wall ducts, etc.) to avoid dirt and damage which could influence the transmission properties of the installed cables.
- Data cables are sensitive to direct sources of heat: hot air blowers or gas burners used for installing shrink tubing must not be used in the vicinity of data cables.
- If chemicals are used to facilitate cable pulling, be sure they are compatible with the cables Sheath material.
- This is also applicable to any chemical (mostly spray type) used for other types of cables that may accidentally get in contact with data cables.

All Cables shall be installed in compliance to ANNEX E R&M Installation and Testing Guideline.

5.3 Cable Schedules, Testing, Sign Off and Handover

Cable schedules shall be provided by Indra for all cabling. After the cable installation and labelling has been completed, the sub-contractor shall provide verification that all cable runs are satisfactory for use and are as shown on the schedules by carrying out and updating the Indra cable schedules, the following minimum checks.

1. All CAT6A and Fibre Optic cable will be handed over to Indra from the installer at the time that Indra arrive onsite and terminate both ends. Up until this point the cable remains the ownership of the installer. The handover process will include witness testing and documentation from both parties to ensure the installed cables meet manufactures and industry standards.
2. A continuity check using an Ohm meter of all cores of all types of cables from the panel end in switchboards\comms room to the field devices end. Results will be presented to Indra in the form of a witness test and documentation (Note: Do not Megger electronic equipment.)
3. TDR Checks on co-axial cables.
4. A valid calibration test for all equipment used (typically once per year). A certification (pdf) to be submitted along with testing sheets.
5. Check that cores are free from spurious voltages, especially AC voltages.
6. Ensure the bend radius of all cabling does not exceed manufacturers' recommendations. Referring to ANNEX E R&M Installation and Testing Guidelines.
7. Cleanliness and environmental conditions must be maintained to the highest of standards especially when installing connectors as they are very sensitive to dirt.

5.4 Cable and Wire Identification

Cables shall be identified by suitable cable markers approved by the Indra Project Manager unless specified elsewhere. Where a new cable marker is to be used, a sample of the cable marker shall be provided to Indra for approval prior to its use.

These marking systems will be correctly sized for the installed cable to ensure the label is always legible, visible and secure, i.e. cannot slip.

All cables will be labelled at both ends with either the terminal descriptions into which they are terminated or identically with the description provided by Indra on the cable schedule. The cable markers shall be mechanically printed. Hand written cable markers will not be acceptable.

5.5 Cabling and Containment Specification

No containment less than twenty-five (25) millimetres nominal size shall be used, and containments shall be sized to allow ease of cable installation and replacement. Allowance shall be made for thermal expansions of rigid PVC containment. Any installed containment must have 25% spare capacity as a minimum. Power and communications cabling is to be segregated as per the relevant Australian Standard.

Orange containment shall be used for power cables only. White containment shall be used for CCTV cabling. Power and communications cabling is to be segregated as per the relevant Australian Standard.

Any conductive containment travelling between structures (e.g. two separate awnings, a platform and a bridge, etc) shall have a least two (2) isolation gaps at a distance of greater than two metres (2000mm) apart.

Any conductive containment fixed to railing and travelling within two metres of an OHW Structure shall have at least two isolation points at least two metres (2000mm) either side of the OHW Structure.

All isolation points shall be at least 50mm wide and of a material that offers suitable mechanical and environmental protection.



Any containment installation must consider the cable bending rule for the cable's contained in addition to the containment its-self.

Specific Cabling and Containment specifications vary depending on the location and type of site. They are broken down into site specific requirements as follows:

- **Above Ground Station\Car Park Cabling and Containment**
- **In-Ground Cabling and Containment**
- **Under Ground Station Cabling and Containment**

In-Ground is defined as: in trench in ground; or contained in underground pit and pipe system

Above-Ground is defined as: not In-Ground

5.5.1 Above Ground Station\Car Park Cabling and Containment

There are two different environments in the case of an above ground station or car park that require different cable types.

All containment accessible to the public up to three (3) metres in height shall be in steel, elsewhere containment may be PVC. Steel shrouds are not allowed to be used for this purpose. Junction boxes made of steel shall be used where readily accessible. All containment at or below three (3) metres in height shall be securely fixed with double sided saddles using security fixings (i.e. security screws or pop rivet).

Steel flexible containment of 300mm in length shall be used where cables enter the camera housings if cables cannot be concealed in the camera support. No other flex containment shall be used on any other part of the installation unless otherwise approved by the Indra Site Supervisor.

Where two (2) or more steel containments are run side by side or run parallel on any surface they shall be spaced at such a distance to allow one of the containments to be dismantled without affecting the remainder.

All containment shall be securely installed to prevent vandalism. Double sided saddles with a maximum of 500mm centres shall be the minimum requirement. Joints between steel and PVC containment are not permitted at visible locations. All containment must be sealed to prevent the ingress of water.

Each length of containment shall be fitted with a sturdy draw wire, securely anchored and appropriately identified at each end to permit cables to be pulled through. Sufficient draw in boxes will be installed to enable rewiring of the containment if required. All lids will be secured using security fixings (i.e. security screws or pop rivet).

Flexible Containment

Cables, where rigid containment is not suitable, shall be protected by flexible containment for the final part of their run from the duct or rigid containment to field mounted equipment, the containment being secured by the correct thread size connector at each end. Under no circumstances is the instrument or equipment to carry any mechanical load or stress. Flexible containment runs shall not exceed 500mm (0.5) metre in length unless otherwise specified. Containment is to be protected or installed in such a way as to be safe from mechanical damage in addition to being vandal resistant, therefore flexible steel encased containment shall be utilised.

Rigid Containment

All saddles, where used, shall be spaced at intervals not exceeding 500mm over the length of the containment run, and otherwise complying with AS3000. Saddles shall be fitted to within 10cm from Junction Boxes, elbows, bends etc. This applies to all incoming and leaving containments. Double saddles shall be used unless otherwise approved by the Indra Project Manager, and shall be fixed using appropriately sized security screws or similar.

Containment entering cabinets and other equipment shall finish completely flush with the lock nut or screwed inlet provided, or be fitted with an approved thermo plastic bush. PVC containment joins must be secured using the appropriate glue. The threaded part of steel containment terminating in enclosures shall not go past the leading nut.

Containment terminating at a cable tray or ladder, if approved, shall be securely attached to the tray or ladder using a "U" bolt, saddle or other approved method, and shall be bushed. The method of installation shall not cause the cable to be strained or bent tighter than its minimum bending radius.

All containment shall be free from burrs, sharp edges and internal flaws which may cause damage to cables. Any abrasions to galvanised surfaces of containments shall be painted with anti-corrosive paint.

For containment and ducting sizing refer to Appendix B

5.5.2 Cable Specifications for all cables above ground



5.5.2.1 All IP cameras maximum cable run from switch location 100 metres (including Patch cables)

Item	Specifications
Cat.6A, U/FTP R&M Cable R795897	ISO/IEC 11801 ed. 2.2; IEC 61156-5 2nd ed.; EN 50173-1; EN 50288-x-1; Fire rating: IEC 60332-1; IEC 60754-2; IEC 61034; Cable class : Installation Cable Category : Cat.6A ISO Cu cable shielding : U/FTP Number of fibres / conductors : 8 Stranding : 4P Cable jacket material : LSZH Cable jacket characteristics : cable, metal-free , zero-halogen, flame-retardant Cable protection : no protection Cable overall diameter : nominal value Ø 7.1 - 7.6 mm Fibre / conductor diameter : AWG23 Color code RAL : 6018 Color : Green

Table 1: All IP cameras maximum cable run from switch location 100 metre

5.5.2.2 19" Closed Cable Management

Item	Specifications
19" Closed Cable Management R&M Cable R795791	Diamentions (2RU), 75mm recessed Color: Black

Table 2: 19" Closed Cable Manager

5.5.2.3 Fibre Single Mode Cable (6 Fibres)



Item	Specifications
Fibre Single Mode Cable (6 Fibres)	Standardisation: ISO/IEC 60794-1-2 E11, IEC 60794-1-2 E3, IEC 60794-1-2 F1, IEC 60332-1, IEC 60332-3C, IEC 61034, IEC 60754-2, ISO/IEC 11801:2002, ITU-T G.652.D, IEC 60793-2-50:2004, B 1.3, IEC 60794-1-2 E1
R&M Cable R304145	Cable class: Loose Tube Cable design: I/A-DQ(ZN=B)H Fibre class: OS2 Number of fibres / conductors: 6 Cable jacket material: LSZH Cable jacket characteristics: cable, water-tight Cable jacket characteristics: cable, metal-free Cable jacket characteristics: zero-halogen Cable protection: rodent protection Cable overall diameter:6.5 mm Conductor type: loose tube, gel-filled Fibre / conductor diameter:E9/125µm Fibre type: Single mode (SM) Color: green

Table 3: Fibre Single Mode Cable (6 Fibres)

5.5.2.4 Fibre Single mode Cable (12 Fibre)

Item	Specifications
Fibre Single mode Cable (12 Fibres)	Standardisation: ISO/IEC 60794-1-2 E11, IEC 60794-1-2 E3, IEC 60794-1-2 F1, IEC 60332-1, IEC 60332-3C, IEC 61034, IEC 60754-2, ISO/IEC 11801:2002, ITU-T G.652.D, IEC 60793-2-50:2004, B 1.3, IEC 60794-1-2 E1
R&M Cable R304147	Cable class: Loose Tube Cable design: I/A-DQ(ZN=B)H Fibre class: OS2 Number of fibres / conductors: 12 Cable jacket material: LSZH Cable jacket characteristics: cable, water-tight Cable jacket characteristics: cable, metal-free Cable jacket characteristics: zero-halogen Cable protection: rodent protection Cable overall diameter:6.5 mm Conductor type: loose tube, gel-filled Fibre / conductor diameter:E9/125µm Fibre type: Single mode (SM) Color: green

Table 4: Fibre Single Mode cable (12 Fibres)

5.5.2.5 Fibre Single Mode Cable (24 Fibres)

Item	Specifications
Fibre Single mode Cable (24 Fibres) R&M Cable R304148	Standardisation: ISO/IEC 60794-1-2 E11, IEC 60794-1-2 E3, IEC 60794-1-2 F1, IEC 60332-1, IEC 60332-3C, IEC 61034, IEC 60754-2, ISO/IEC 11801:2002, ITU-T G.652.D, IEC 60793-2-50:2004, B 1.3, IEC 60794-1-2 E1 Cable class: Loose Tube Cable design: I/A-DQ(ZN=B)H Fibre class: OS2 Number of fibres / conductors: 24 Cable jacket material: LSZH Cable jacket characteristics: cable, Cable jacket characteristics: cable, metal-free Cable jacket characteristics: zero-halogen Cable protection: rodent protection Cable overall diameter: 7 mm Conductor type: loose tube, gel-filled Fibre / conductor diameter: E9/125µm Fibre type: Single mode (SM) Color: green

Table 5: Fibre Single mode Cable (24 Fibres)

5.5.2.6 Help point units maximum cable run from Switch location up to 100 metres

Item	Specifications
Ethernet	Cat.6A, U/FTP. R&M Cable R795897
Power	2-18 AWG stranded bare copper pairs with polyolefin insulation, PVC jacket with ripcord 5341UE Multi-Conductor
Signal Tamper	2-22 AWG stranded bare copper pairs with polyolefin insulation, PVC jacket with ripcord E.g. Belden 5541UE or equivalent.

Table 6: Help point units maximum cable run from Switch location up to 100 metres

5.5.3 In-Ground Cabling and Containment

All containment shall be arranged in fixed format for the full length of the platform or paved area and shall be supported so that backfilling will not disturb the format.

Stabilised sand shall be placed around the containments and compacted to hold them securely in position. The compacted sand shall cover the containments by at least 50mm. There shall be no depression evident as a result of trenching, nor shall there be a trip hazard resulting from the trenching.

Where pedestrian traffic is involved the depth of the containment from the top of the trench to the top of the highest layer of containment shall be not less than 300mm.

Where motor vehicles can run over the surface the containment shall be buried not less than 600mm.

In rock or to avoid obstructions the depth of containment cover can be reduced to 300mm in vehicular areas provided the containment is covered with 150mm reinforced concrete, minimum reinforcement shall be two layers of F62 mesh.

Cable pits for cable pulling purposes shall be provided in platforms at not greater than 35 metre intervals and constructed in accordance with Appendix B. All pits are to be sealed and lockable.

For containment and ducting sizing refer to Appendix B.

5.5.4 In-Ground Cable Specifications

For cable specification refers to 5.5.2 and refers to 5.5.4.1/ 5.5.4.2 for Data, the help point power and signal cables.

5.5.4.1 In-Ground cable run from switch location maximum 100 metres (including Patch cables)

Item	Specifications
Cat.6 U/UTP R&M Cable R795901	CAT6 Outdoor UTP, water blocked, UV resistant, PE Jacket, E.g. R&M R795901

Table 7: All IP cameras maximum cable run from switch location 100 metres

5.5.4.2 Help point units maximum cable run from Switch location up to 100 metres

Item	Specifications
Ethernet	CAT6 Outdoor UTP, waterblocked, UV resistant, PE Jacket, E.g. R&M R795901
Power	1 pair 18AWG (7x26) TC conductors (coloured appropriately for identification), double insulated, PVC jacket, water blocking material under jacket, 10 year manufacturer's warranty. E.g. Belden 5300U1 or equivalent.
Signal Tamper	2 pair 22 AWG (7x30) TC conductors, 1 pair shielded, 1 pair unshielded, PVC jacket, water blocking material under jacket, 10 year manufacturer's warranty. E.g. Belden 5502G1 or equivalent.

Table 8: Help point units maximum cable run from Switch location up to 100 metres

5.5.5 Under Ground Stations Cabling and Containment

All cables and containment run in an underground station environment, as classified by Sydney Trains, shall be halogen free.

All cables and containment run into rooms/cabinets/enclosures containing Fire Management Systems (FMS) must be flame retardant to IEC 60332-2 (EN 50265-2-2).

No containment less than twenty-five (25) millimetres nominal size shall be used, and containments shall be sized to allow ease of cable installation and replacement. Allowance shall be made for thermal expansions of rigid Halogen Free containment. Any installed containment must have 25% spare capacity as a minimum. Power and communications cabling is to be segregated as per the relevant Australian Standard.

All containment accessible to the public up to 3 metres in height shall be in steel, elsewhere containment may be Halogen Free. Steel shrouds are not allowed to be used for this purpose. Junction boxes made of steel shall be used where readily accessible. All containment at or below 3 metres in height shall be securely fixed with double sided saddles using secure fixings (i.e. security screws or pop rivet).

Steel flexible containment of 300mm in length shall be used where cables enter the camera housings if cables cannot be concealed in the camera support. No other flex containment shall be used on any other part of the installation unless otherwise approved by the Indra Project Manager.

Where two (2) or more steel containments are run side by side or run parallel on any surface they shall be spaced at such a distance to allow one of the containments to be dismantled without affecting the remainder.

All containment shall be securely installed to prevent vandalism. Double sided saddles with a maximum of 500mm centres shall be the minimum requirement. Joints between steel and Halogen Free containment are not permitted at visible locations. All containment must be sealed to prevent the ingress of water.

Each length of containment shall be fitted with a suitable draw-wire (such as Jetline, rope, etc...), securely anchored at each end to permit cables to be pulled through. Cabling is not to be used as a draw-wire.

Cables, where rigid containment is not suitable, shall be protected by flexible containment for the final part of their run from the duct or rigid containment to field mounted equipment, the containment being secured by the correct thread size connector at each end. Under no circumstances is the instrument or equipment to carry any mechanical load or stress. Flexible containment runs shall not exceed 500mm (0.5) metre in length unless otherwise specified. Containment is to be protected or installed in such a way as to be safe from mechanical damage.

All saddles, where used, shall be spaced at intervals not exceeding 500mm over the length of the containment run, and otherwise complying with AS3000. Saddles shall be fitted to within 10cm from Junction Boxes, elbows, bends etc. This applies to all incoming and leaving containments. Double saddles shall be used unless otherwise

approved by the Indra Project Manager, and shall be fixed using appropriately sized security screws or similar.

Containment entering cabinets and other equipment shall finish completely flush with the lock nut or screwed inlet provided, or be fitted with an approved thermo plastic bush. Halogen Free containment joins must be secured using the appropriate glue. The threaded part of steel containment terminating in enclosures shall not go past the leading nut.

Containment terminating at a cable tray or ladder, if approved, shall be securely attached to the tray or ladder using a "U" bolt, saddle or other approved method, and shall be bushed. The method of installation shall not cause the cable to be strained or bent tighter than its minimum bending radius.

All containment shall be free from burrs, sharp edges and internal flaws which may cause damage to cables. Any abrasions to galvanised surfaces of containments shall be painted with anti-corrosive paint.

For containment and ducting sizing refer to Appendix A.

5.5.6 Underground Station Cable Specifications

For cable specification refers to 5.5.2 and refers to 5.5.6.1 for the help point power and signal cables.

5.5.6.1 Help point units maximum cable run from Switch location up to 100 metres

Item	Specifications
Ethernet	Cat.6A, U/FTP. R&M Cable R795897
Power	Figure eight 18 AWG 19x29 E.g. Belden 8471NH or equivalent.
Signal Tamper	22 AWG, 7/0.25 X 2 copper conductors, 4.3mm to 4.95mm OD. E.g. Belden 8761NH or equivalent.

Table 9: Help point units maximum cable run from Switch location up to 100 metres

All cables run in an underground environment, as classified by TfNSW, shall be Low Smoke and Halogen Free (LSZH).

All cables run into rooms / cabinets / enclosures containing fire management systems (FMS) must be flame retardant to IEC 60332-2 (EN 50265-2-2).

All cables selected for underground use must meet the specifications of the previously specified cable, in both physical and electrical performance. Cable that does not meet the requirements, but which may be considered suitable, must be submitted to Indra for approval prior to installation.

Care has to be taken that the physical separation of high and low-voltage cables is maintained. This issue is covered in detail under chapter 3.2.4.4(R&M Installation and Testing Guideline) clearances between copper data and power cables.

This is for guidance. For specific cabling requirements, refer to cable schedule for the particular site.

All cable installed in underground stations must meet the following minimum cable specifications.



5.5.7 Rigid Containment

All saddles, where used, shall be spaced at intervals not exceeding 500mm over the length of the containment run, and otherwise complying with AS3000. Saddles shall be fitted to within 10cm from Junction Boxes, elbows, bends etc. This applies to all incoming and leaving containments. Double saddles shall be used unless otherwise approved by the Indra Project Manager, and shall be fixed using appropriately sized security screws or similar.

Containment entering cabinets and other equipment shall finish completely flush with the lock nut or screwed inlet provided, or be fitted with an approved thermo plastic bush. PVC containment joins must be secured using the appropriate glue. The threaded part of steel containment terminating in enclosures shall not go past the leading nut.

Containment terminating at a cable tray or ladder, if approved, shall be securely attached to the tray or ladder using a "U" bolt, saddle or other approved method, and shall be bushed. The method of installation shall not cause the cable to be strained or bent tighter than its minimum bending radius.

All containment shall be free from burrs, sharp edges and internal flaws which may cause damage to cables. Any abrasions to galvanised surfaces of containments shall be painted with anti-corrosive paint.

5.5.8 Cable Trays

Cable trays are to be used in ceiling voids unless otherwise specified or where access does not permit. Cable trays are to be sized to accept the required number of cables with 25% spare capacity. Cable trays rising from the ground or floor in all locations other than electrical risers and switch rooms shall have covers to a height of 1.5 metres, readily removable by one (1) person. Cables are to be secured to the cable tray at minimum 300mm intervals. Cable trays shall be used with proprietary bends and tees. All cable trays shall be adequately supported. Minimum supports shall be 1.5m apart and galvanised. Where different services are installed onto the same cable tray, relevant standards are to be adhered to regarding segregation requirements.

5.5.9 Cable Duct

Extruded PVC grey, open slotted duct from either "Legrand", "Aussie Duct" or NHP or approved equivalent shall be used within control panels and field cabinets. All major cable runs are to be in approved, steel ducting sized to accept the required number of cables with 25% spare capacity. Ducting shall be used with its proprietary bends, tees and other fittings. All ducting shall be adequately supported. Minimum supports shall be 1.5 metres apart.

5.5.10 Saddles and Support Brackets

Saddles and Support Brackets shall be entirely suitable for the type of containment and locations in which they are to be used. PVC accessories shall not be used with steel containment.

5.5.11 Fittings and Junction Boxes

Fittings shall be suitable for use with the type of containment or pipe they are to connect with. All steel fittings shall be galvanised. Screw types and fixings shall be uniform throughout the installation.

Junction boxes shall be used where two or more cables have been run in a common containment boxes used with galvanised containment shall be cast galvanised and fitted with heavy duty lids. In the case of multiple terminal points an approved sheet steel terminal box shall be installed. Junction and terminal boxes shall only be installed in positions acceptable for maintenance and these positions shall be approved by the Indra Project Manager prior to installation.

No more than two bends and two 45 degree sets or equivalent shall be installed between cable draw-in points.

6 INSTALLATION OF EQUIPMENT

6.1 Camera Monitoring Poles

6.1.1 Height

As required to provide the cameras nominated field of view but with a minimum height of four (4) metres unless otherwise specified..

6.1.2 Construction

Camera poles to four (4) metres are to be heavy duty galvanised steel hollow hexagonal or round section. Poles to be installed in accordance with the pole manufacturers' recommendations.

Camera poles above four (4) metres are to be heavy duty galvanised hexagonal steel hollow section. Poles to be installed in accordance with the pole manufacturers' recommendations. See-saw type camera poles are to be used unless otherwise specified.

All apertures drilled or cut into the poles after delivery shall be treated against corrosion.

Camera cables shall be installed inside the pole and inside steel flexible containment no longer than 500mm from the point of exit to the camera housing.

6.1.3 Shared Services Poles

Where it is deemed necessary to mount CCTV Cameras on to Lighting Poles, the Lighting Poles must be manufactured in accordance to specification for CCTV Poles noted in this document. In addition to this all other criteria for mounting of cameras must be adhered to.

Where the CCTV Camera is to be mounted above a height of four (4) metres, a "drop-down" (or see-saw) type pole is to be utilised and is to be constructed to a minimum to meet all requirements as laid out in this document. All poles are to be installed into a location ensuring ease of access for serviceability.

All relevant standards for cabling must be adhered to including the use mechanical segregation for all CCTV Cabling within the lighting pole.

6.1.4 Wind Loading

The wind loading applicable to the pole(s) shall meet the relevant Australian Standards.

Poles that are supplied and installed need to be able to withstand a constant wind of eight (8) m/s gusting to sixteen (16) m/s the displacement produced at the top of the pole is no greater than 20mm.

6.1.5 Installation

All camera poles installed shall be vertically aligned and positioned in accordance with the directions of the Indra Project Manager. Concrete plinths shall be finished off with a 45 degree chamfer, and any bolts or securing fixings installed so as not to present a trip hazard.

Mid-hinged (See-Saw) pole should be installed with enough clearance distance for the required lowering operation. For the standard GMSRC-MH4LC 4 metre pole this is measured at 2.2 metres clearance from any surrounding objects in the direction of lowering.

7 REFERENCE DOCUMENTATION

The latest version of the following documents will be used as a reference in the application of this procedure:

Title	Document Number
Data Control and Management	IAD-PRO-13-001
Security Standard - Stations	RSS-001 V1.01
Minimum Security Requirements and Design Criteria for Stations	RSS-200 V 1.0
Security Technical Note	TN-S 13/01
Installation requirements for customer cabling	ACIF S009: 2013
Engineering Drawing Handbook (IEAust)	HB 7-1993
Technical drawing - General principles	AS 1100.101: 1992
Identification of the Contents of Piping, Conduits and Ducts	AS 1345: 1995
Lightning protection	AS/NZS 1768:2007
Intruder Alarm Systems (All applicable current parts and amendments)	AS 2201
Degrees of protection provided by enclosures (IP Code)	AS 60529: 2004
Conduits and fittings for electrical installations (All current parts and amendments).	AS/NZS 2053
Electrical installations (known as the SAA Wiring rules).	AS/NZS 3000: 2007
Electromagnetic compatibility (EMC) - Generic standards - Immunity for residential, commercial and light-industrial environments	AS/NZS 61000.6.1: 2006

Information technology - Security techniques - Information security management systems – Requirements	AS/NZS ISO/IEC 27001:2006
Information technology - Security techniques - Code of practice for information security management	AS/NZS ISO/IEC 27002:2006
Quality management systems – Requirements	AS/NZS ISO 9001:2008
Tests on electric and optical fibre cables under fire conditions - Part2-2: Test for vertical flame propagation for a single small insulated wire or cable - Procedure for diffusion flame	IEC 60332-2-2 Ed. 1.0
Information technology - Generic cabling for customer premises (ISO/IEC 11801:2011, MOD)	AS/NZS 3080:2013
Closed circuit television (CCTV) - Management and operation	AS 4806.1-2006
Earth potential rise - Protection of telecommunications network users, personnel and plant - Code of practice	AS/NZS 3835.1:2006
Earth potential rise - Protection of telecommunications network users, personnel and plant - Application guide	AS/NZS 3835.2:2006
Structural design actions - Wind actions	AS/NZS 1170.2:2011

Table 10 REFERENCE DOCUMENTATION

8 VERSION CONTROL

Date	Version	Reason for change
23.09.2015	No.1	First release
16.11.2015	No.2	Segregate Analogue and Digital specifications
17.02.2016	No.3	Removal of cable termination references
29.03.2016	No.4	Heading of 5.5.2 changed to above ground
15.04.2016	No.5	Replace Fiber with Fibre

Table 11 VERSION CONTROL

9 FORMS

The applicable forms for this procedure are set out in the following table.

Code	Title	Version
11075000000000TP01	ITP Station Inspection and Test Plan	01

Table 12 Forms

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ANNEX A ACRONYMS, ABBREVIATIONS AND DEFINITIONS



A-1 LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition	Description
AWG	American Wire Gauge	Common unit of measure of diameter of wire conductors
BC	Bare Copper	Copper-only conductors, to distinguish from copper coated steel.
BOM	Bill of Material	Equipment Listing for the Works
CCTV	Closed Circuit Television	The system pertaining to video imaging.
CSR	Construction Status Report	A schedule of work showing allocated resources
LSZH	Low Smoke, Zero Halogen	Emits only low levels of smoke and no Halogen when burned according to specific standards.
MEN	Multiple Earth Neutral	Earthing method used in Australia whereby the Protective Earth and Neutral are electrically connected.
NOEW	Notification of Electrical Works	
OHW	Overhead Wiring	1500 Vdc overhead supply used to power rail cars.
OTDR	Optical Time Domain Reflectometer	Electronic tool used to test fibre optic cable.
PVC	Polyvinyl Chloride	Type of plastic used for electrical insulation.
QA	Quality Assurance	Quality Assurance system such as ISO 9001
TC	Tinned Copper	Copper-only conductor with a thin coating of solder
TDR	Time-Domain Reflectometer	Electronic tool used to characterize and locate faults in metallic cables.

Table 13 LIST OF ACRONYMS AND ABBREVIATIONS

A-2 LIST OF DEFINITIONS



The following definitions shall apply throughout this specification and associated Product Installation specifications except where the context clearly indicates otherwise

Term	Definition
Approved	"Approved" or "approved means" or "approval" shall mean approved by or having the approval of the Project Manager for Indra or their appointed representative.
Company's Representative	"Company's Representative" shall mean the Project Manager for Indra or their appointed representative.
Customer Specification	"Customer Specification" are the documents and drawings provided by Indra customer as defined by the Indra purchase order.
Plant	"Plant" refers to items of equipment that do not constitute part of the installation, but are required for the purpose of installation e.g. tools, ladders, mechanical hoist and scaffolding and the like.
Security Fixing	"Security Fixing" is specifically a fixing with a Security Tamper Torx Head (with center pin).
Sub-contractor	"Sub-contractor" shall mean any company or employee of any company that has entered into a contract with Indra for the purpose of carrying out work on behalf of Indra.

Table 14 LIST OF DEFINITIONS

ANNEX B CONTAINMENT AND DUCTING

Containment and Ducting		Comments
Protection from corrosion		All above ground containment, ducting and fixings must be protected from corrosion. In areas close to the sea, containment and duct must be hot dip galvanised
Containment size		Minimum size of 25mm containment is permitted and preference is given to Unistrut and duct in lieu of containment sizes above 32mm. Written approval from the Indra Project Manager is required to use above ground containment greater than 32mm in diameter.
Maximum number of cameras (Fixed, PTZ or Help Points) for containment sizes		
25mm containment	1 camera / HP	Double sided saddles (at maximum 500mm centres) with security screws (Torx) below 3mtrs or where prone to vandalism
32mm containment	3 cameras / HP	
50mm containment	6 cameras / HP	
63mm containment	10 cameras / HP	
Maximum number of cameras for Unistrut and Duct		
41mm x 41mm Unistrut	5 cameras	Fixed every 2 metres by screws or brooker rod. Unistrut is to have U section cover, when installed below 3 metres or where prone to vandalism. The U section is to be secured by stainless straps or ties every 1200mm. Clip on PVC Unistrut lid is suitable for installation above 3 metres or where it's not prone to vandalism.
50mm x 50mm duct	7 cameras	Fixed every 1200mm by screws or brooker rod. Where fixings are greater than 1200mm, Unistrut or additional support maybe required. Duct lid is to be secured by security screws (Torx) or pop riveted when installed below 3 metres or where prone to vandalism.
75mm x 75mm duct	15 cameras	Fixed every 1200mm by screws or brooker rod. Duct lid is to be secured by security screws or pop riveted when installed below 3 metres or where prone to vandalism.
100mm x 100mm duct	40 cameras	Fixed every 1200mm by screws or brooker rod. Duct lid is to be secured by security screws or pop riveted when installed below 3 metres or where prone to vandalism.
Shared services		No other service is to share the CCTV and Help point containment and ducting except with written approval from the Indra Project Manager.
PVC containment		Light duty PVC containment is permitted where installed above 3 metres and where vandalism is not likely. All joins must be securely glued.
Containment saddles		PVC containment must be saddled @ 500mm centres maximum with double sided saddles and suitable fasteners.
Containment colour		All PVC containments must be white in colour (telecommunications) for CCTV cables.
Exposed metal		Exposed thread and cut edges shall be free from grease and cutting compound and protected with galvanised paint.
Sharp edges		All containments and duct must be free from sharp edges, both internally and externally
Workmanship		All containment and duct work is to be installed in an acceptable tradesman like manner. Containments are to be neatly dressed and bent around obstacles. Wherever possible duct and containment should follow the structure and in the most unobtrusive way possible.
Draw line		All containments shall have installed a continuous draw line through the containment secured at both ends of the run.
Junction boxes		Junction boxes and drawing points are to be installed no greater than 8 metres apart, or no more than two 90 degree bends apart whichever is the lesser. Junction boxes or access point must be provided where the containment enters a structure or building.
Fasteners and Fixings		Plastic, nylon or fibre rawl plugs or nail in plugs are not to be used for fixing in to masonry or concrete. Aluminium rawl plugs, loxins and Dynabolts are suitable. Stainless or galvanised screws are to be used in all locations
Containment bends and elbows		Wide radius bends should be used wherever possible to provide ease of cable installation. Use of elbows and sharp bends should be minimised and where unavoidable, a junction box or drawing point must be provided.
Flexible containment		Flexible containment is not to be used except where approved in writing by the Indra Site Supervisor

Table 15 Containment and Ducting

Underground Containments and pits	Comments
Pits	To be installed no greater than 35 metres apart or where the containment run changes direction.
Pit type	ACO Cablemate brand pits (Type 52 or 63) with galvanised checker plate lid with locking screw shall be used.
Pit sealing	Containment entries to pits are to be sealed from water ingress.
Pit finished height	Pits shall be installed so the top of the pit cover is level with the surrounding surface and doesn't present a trip hazard.
Containment identification	All underground containments (excluding ULX) shall be installed in accordance with AS3000 and shall have suitable warning tape installed in the trench at the nominated height above the containment. (the warning tape shall be 'Telecommunication Cable')
Containment colour	All underground PVC containments must be white in colour (telecommunications)
Exposed PVC containment	No part of PVC underground containment is to be exposed. Where exposed, it must be covered by steel containment, a steel shroud or a concrete plinth.

Table 2 Underground Containments and pits

Under Line Crossings (ULX)	Comments
ULX depth	All ULX containments must be installed 2.1 metres below the top of the lowest running rail and must be installed in accordance with the Sydney Trains standards
ULX approval	Approval must be received from the relevant Sydney Trains area Engineer prior to commencement.
ULX containments	Minimum size for ULX containment is 50mm and a spare 50mm containment must be run. Both to have draw lines installed.
ULX warning posts	ULX warning post is to be installed at the location of the ULX on both sides of the rail corridor.
Cables crossing Earth Boundry	Where earthing cabling crosses over the Earth Boundry, the external walls of the building shall be deemed as the earthing boundry.

Table 16 Underground Line Crossings (ULX)

Device	Minimum number of fibre connections required
UPS (network)	2
4 channel video camera card	1
8 channel camera alarm card	1
RS485 Card	2

Table 17 Minimum number of fibre connections required per Device

Note: 1 x 12 Core cable shall be required for up to 16 cameras. A further 3 cores for every 8 cameras shall be required thereafter.

ANNEX C UNDERGROUND (and deemed to be underground) STATIONS

List of Underground Stations
Redfern (ESR platforms and underground passages)
Central (ESR platforms and underground passages)
Town Hall
Wynyard
North Sydney
Circular Quay
St. James
Museum
Martin Place
Kings Cross
Edgecliff
Bondi Junction
Hurstville
Kogarah
Olympic Park
Epping (ECPRL Link Platforms and underground passages)
Chatswood (ECPRL Link Platforms and underground passages)
Delhi Road
Macquarie Park
Macquarie University

Table 18 List of Underground Stations

List of Stations out of the current scope
Green Square Mascot
Domestic Airport
International Airport
Green Square Mascot

Table 19 List of Stations out of the current scope

ANNEX D CONTRACTOR INSTALLATION QA REPORT

Station:

Date:

Contractor Check List Item	N/A	Pass	Fail
Cable Containment System			
Containment runs are not obtrusive			
Containment saddled adequately every 500 mm- min			
Containments sealed against water ingress			
Containment under platform coping edge, does not extend beyond edge			
No flexible between rigid containment			
Protective caps on Unistrut lid secured			
Galvanised containments below 3 meters			
Threads complete into joining glands and junction box			
Exposed threads are protected			
No trip hazards from containment runs			
No sharp edges on containment / brackets			
Unistrut / duct and covers complete and secured against vandalism			
Installation is vandal resistant			
Security fasteners used on containments and brackets			
No PVC to steel containment joints visible			
Chemical anchors used in concrete			
Unistrut / ducting held in 3 places every 2m max			
Fasteners include washers and locknuts			
Halogen free cables used in underground installations			
No metallic containments present inside station buildings			
Any containment entering huts or buildings is coloured white for CCTV.			
White containments used for CCTV cables			
Pits installed level to ground and not a trip hazard			
Pit lid is secured and lockable			
Camera Pole Installation			
Camera pole height 4 meter Minimum			
Camera pole drill holes cold galvanised			
Drill holes plugged			
Camera pole vertically aligned			
Concrete plinth finished with a 45 degree chamfer.			
Station Condition After Install Work			
No damage to plaster or brick work			
No damage to corbels on brick work			
No damage to sealing around containments			
No building alterations			
No heritage damage			
No Galv spray on brick work			
All refuse and waste removed			
No equipment damage			
Station Master has no complaints or damage to report			

Site inspected by:

A duly authorised representative of:

(Contractor)

Signature: _____

Designation:
Contact Number:

On this the _____ Day of _____ 20

Documentation accepted on behalf of Indra

Signature: _____

Name:

Designation:

Contact Number:

On this the _____ Day of _____ 20

ANNEX E R&M Installation and Testing Guideline

ANNEX F ITP Station Inspection and Test Plan

- **Sydney Metro City &
Southwest**

- Central Station Main Works
Contract Schedules**

- Schedule C1

- **Scope of Works and Technical Criteria
Appendix C06
SYAB Asset Maintenance and Operations
Strategy**

PROJECT	Sydney Metro City & Southwest	DATE	20 February 2018
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.1
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00005122
FILE NAME	Central Station Main Works (CSM) SWTC App C06		

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1 Overview

- (a) The SYAB Asset Maintenance and Operation Strategy is included in this Appendix C06 at Attachment 1.

Attachment 1

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Laing O'Rourke

Sydney Yard Access Bridge

Asset Maintenance and Operations Strategy

NWRLSRT-GHD-SYY-00-REP-000010Rev B

June 2017

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1. Introduction

1.1 Background

- (a) The SYAB is a new permanent road bridge that will provide a connection from Regent Street into the Sydney Yard. In particular, the SYAB will extend from Regent Street over the Mortuary Station line and intercity tracks into the Sydney Yard.
- (b) The users of the SYAB will include:
 - (i) the contractors responsible for the construction of the Sydney Metro City & Southwest works at Central Station;
 - (ii) the contractors responsible for other construction activities at Central Station;
 - (iii) the operator and maintainer of Sydney Metro; and
 - (iv) Sydney Trains and NSW Trains for the purpose of maintenance activities and periodic major projects in and around Sydney Yard.

1.2 Overall Philosophy

Operation, maintenance and servicing of the facilities are carried out to ensure the safety, integrity, condition and operating functions of the infrastructure.

In addition, maintenance minimises the risk of crime, ensures pedestrian, staff and construction worker safety and provides visible amenity and cleanliness to enhance the visual appeal of the Central Station precinct.

The provision of new maintenance access road bridge and entry area is unlikely to lead to major changes to existing maintenance procedures, or changes in existing operating and maintenance manuals, as there are numerous overbridge entries, within the Sydney Trains network.

However it is still important to document the maintenance requirements for each new overbridge entry, to ascertain the increased operation and maintenance requirements, especially for any new requirements that may not currently exist in the Sydney Trains systems

1.3 Document Purpose

This Asset Maintenance and Operations Strategy (AMOS) was formulated to:

- Support the provision of facilities that are inviting and safe for staff/construction workers to use and which are easy to operate and be maintained by the owner.¹
- Avoid any requirement for isolation, closure, possession or the like in order to carry out operations and maintenance activities.²
- Identify and advise any necessary changes or increases to the current operations and maintenance requirements and regimes.³
- Facilitate the completion of an Asset Maintenance Plan, to be developed by the Operator and Maintainer as per Transport for NSW's Transport Asset Maintenance Planning Standard (TN 042: 2015).

The information provided in this Strategy relates to new assets created as part of Transport for New South Wales's Sydney Yard Access Project and is to be incorporated into and reviewed in conjunction with the existing Operations and Maintenance Plan/Strategy for Central Station.

1
2
3

1.4 Scope

This report is applicable to new Bridge assets only, as listed in Table 2. It excludes rail and overhead wiring and associated assets. Relocated assets are to be managed as per the existing Plan/Strategy.

1.5 Bridge location, description and access

A description of SYAB is provided in Table 1.

Table 1 – SYAB Characteristics

Ref	Item	Description
1	Bridge Name	Sydney Yard Access Bridge
2	Service Level Category	'Non Pedestrian Maintenance access type bridge
3	Bridge Location	Located on Regent St near to Central Station, Chippendale, Sydney, NSW

1.5.1 SYAB new works Description

The 2017 works resulted in the creation of new assets as listed in Table 2.

Table 2 –New Assets (2017)

Ref	Asset Group	Asset	Description
1.	Structures		
2.		Bridge	Deck, Girders, Pier columns
3.		Reinforced Earthen Embankment	Northern end of SYAB lands on an Earthen Embankment
4.	Safety & Security Enhancing Facilities	Signage	Located on all new external footpaths, ramps and steps.
5.		Communications and Security system	CCTV systems, control systems and alarm systems, etc,
6.		Active vehicle arrestor	Active vehicle blocker to minimize pedestrian hazard from runaway truck exiting SYAB
7.		Readers - Electronic Access (EAC)	Between Bridge and Regent st area
8.	Services & Systems	Rail Friction Stop Buffer	New friction stop buffer in Sydney yard
9.		LV system	New padmount transformer, distribution boards, switchboard outlets and associated conduits,
10		Lighting	Barrier Lighting on bridge, regent st area, underbridge and emergency lighting,
11			

12		Earthing and Bonding	existing earthing and bonding network for new bridge
13	Landscaping	Trees	Landscaping of Regent St area
14		Shrub and ground cover	Landscaping of Regent St Area

1.5.2 Site Access and Limitations

Site access is provided via Regent Street.

Signage should be erected giving appropriate notice of proposed closure or access restrictions for maintenance activities, including changes to circulation.

1.5.3 Site Plans

A site plan for the new bridge, is provided in Figure 1 for Sydney Yard Access Bridge

This plan will be updated as the project delivery continues.

2. Key Maintenance Areas

The key maintenance areas at Sydney Yard Access Bridge are:

SYAB Bearing inspection and replacement.

Minor and Major repainting of steelwork.

Regent St Entry: Cleaning and maintaining the cleanliness of the entry area.

Signage: Repair and replacement of damaged signage such as wayfinding signs.

Communications: Maintenance and repair of communication equipment.

Lighting: Maintenance and repair of faulty lights on the Regent St area and bridge.

Pavements: Maintenance of ramps, stairs and pavement surfaces to ensure optimum design life and avoidance of trip or slip hazards for commuters.

Security Cameras: Maintenance and repair of security cameras to ensure effective operation and coverage.

Water Services: Maintenance cold water system pipework, accessories and to ensure that water supply is provided to relevant standards.

Pavement/Bridge Drainage: Maintenance of bridge drainage and downpipes and Regent st drainage to enable effective stormwater drainage.

The Bridge Expansion joints are Granor AC-AR gland type joints that need to be cleared of debris periodically.

3. Maintenance Requirements

Maintenance tasks can be classified as one of the following:

- Periodic
- Reliability/performance based maintenance
- Repair (Failure)

The majority of electrical, mechanical, hydraulic and fire system elements are proprietary equipment and the maintenance regime should be as per the manufacturers' recommendations.

3.1 Periodic Maintenance Activities

Periodic Tasks include:

- Cleaning
- Landscape maintenance (Regent St only)
- Checking of lights, cleaning of dirty luminaires
- Checking of signage
- Checking CCTV coverage
- Checking of fencing/gates
- Cleaning vertical safety screens
- Cleaning Regent Entry area and bridge of spillage
- Bridge Bearing inspection.
- Bridge screening post support flashing will require touch up painting in line with bridge painting specification.

3.2 Reliability / Performance Based Maintenance

Reliability / performance tasks include:

- Replacement of light bulbs
- Cleaning of pavement, drains & pits
- Security camera maintenance
- Communications maintenance
- Gate maintenance

3.3 Repair (Failure)

- Pavements
- Lighting fittings
- Other items as required.

4. Safety Management

Maintenance works should only be carried out for minor activities when temporary barricades should be erected to protect commuters from maintenance plant.

No activity should be undertaken that could endanger the safety of commuters or workers without protective measures being put in place.

Where passengers and/or staff will be impacted by maintenance works, appropriate and adequate notification of maintenance works and its effect on access must be given.

All operational and maintenance activities are to be carried out in accordance with Sydney Trains safety requirements.

5. Asset Operations Plan

The Asset Operations Plans for applicable elements are provided in the table below. These should be incorporated into the existing asset operations plans.

The following table broadly details the way that the new bridge and forecourt is to operate, as well as what to expect when these assets fail.

Table 3 – Asset Operations Plan

Element No.	Element Name	Function	Description	Normal Operation	Emergency Operation
1	Bridge and Regent St Entry Lighting	To provide lighting of all bridge and regent st entry	All new lighting utilise LED technology.	PE sensor on with manual override	Emergency lighting is provided in the event of the failure through the back up power supply.
3	CCTV	To provide real-time images to monitor situations, and allow review of onsite incidents and security intrusions	Cameras have been provided to monitor selected target areas in and around the Bridge.	Record CCTV footage of selected target areas in and around the bridge. These images would be stored automatically for a set period of time before being overwritten.	CCTV footage provides real-time images to monitor emergency situations. Following visual assessment, staff monitoring the situation can either take appropriate action or contact relevant emergency authorities. CCTV is connected to UPS to maintain function during loss of power.
4	Readers – Electronic Access Gates (EAC)	To maintain security on the Bridge and Sydney Yard	Card readers are provided on the bridge Regent st approach for secure access entering and egressing the bridge.	The readers do not require intervention on a daily basis, barring monitoring whether the facilities are functional.	Fail open in an emergency.

6. Asset Maintenance Schedule

The Asset Maintenance Schedule is provided in the table below. This section should be merged into the existing asset management schedule for the central station, rather than having multiple sub documents from individual programs and projects.

Other than cleaning activities which should be carried out on a weekly basis, most of the maintenance activities will be needed only at 1-5 year intervals. However, maintenance staff should be encouraged to regularly inspect the Regent st and bridge deck and environs for any sign of deterioration, correct operation of lights and equipment, possible trip hazards, vandalism etc.

Sydney Trains safety procedures are to be complied with at all times.

6.1 Structural - Maintenance and Monitoring Requirements⁴

Component s	Locations	Material	Maintenance Regime	Anticipated Timing
Regent st area pavement				
Slab	Ground Atmospheric	Cast in-situ concrete	Visual Inspection and repair crack where necessary.	Routine inspection every 5 years.
Concrete Footing Beam	Buried	Cast in-situ concrete	Footings are buried underground. Inspection is limited. The design is expected to provide the desired service life.	Inspection is limited.
Bridge Elements				
Deck	Atmospheric	Precast concrete and Cast in-situ topping	Visual Inspection and repair crack where necessary.	Routine inspection every 5 years.
Girders	Atmospheric	Precast concrete/ Steel	Visual Inspection and repair crack where necessary.	Routine inspection every 5 years.
Piers	Atmospheric	Cast in-situ concrete	Visual Inspection and repair crack where necessary.	Routine inspection every 5 years.

Mechanical Elements

Elements are mainly proprietary materials and maintenance regime would be manufacturers' recommendations. Instructions on the design drawings should also be followed. If elements are not covered by manufacturer's recommendations, then undertake two yearly inspection and maintenance.

Electrical Elements

Elements are mainly proprietary materials and maintenance regime would be manufacturers' recommendations. Instructions on the design drawings should also be followed. If elements are not covered by manufacturer's recommendations, then undertake two yearly inspection and maintenance.

6.2 Bridge

Component	Objective	Fault/Defect Description	Cause	Failure Effect	Impact			Task Description	Frequency	Tools & Equipment	Competencies	Responsibility	Safety Management	Comments
					Safe	Envi	Oper							
Pavements (AC, concrete)	Asphaltic concrete (bituminous) and concrete surfaces	Pot-holing, cracking or rutting	Poor construction Water ingress	Poor walking surface	Y	N	Y	Check pavement integrity	3 yearly	Compactor, brooms, saws, jack hammer	Maintenance crew	Regular inspection by asset maintenance staff	Barricades, PPE, SWMS	Asset maintenance staff to regularly check pavement surface for any signs of deterioration.
Pavements (concrete paving)	Paved surfaces	Uneven surface, trip hazard	Poor construction Water ingress Subgrade failure	Poor walking surface	Y	N	Y	Check pavement integrity	3 yearly	Compactor, brooms	Maintenance crew	Regular inspection by asset maintenance staff	Barricades, PPE, SWMS	Asset maintenance staff to regularly check pavement surface for any signs of deterioration.
Vertical Screens	Maintain appearance of surfaces	Finishes worn, marked, deteriorated or vandalised (graffiti etc)	General wear and tear Vandalism	Visual eyesore for commuters	N	N	N	Visual inspection and assessment Cleaning of elevated sections of glazing to be undertaken using Elevated Work Platform and/or Bosun's chair following risk assessment	3 years or as required	Dictated by required repair	Dictated by required repair	Asset maintenance staff	PPE and MSDS as required. Appropriate risk assessment to be undertaken including working at height	Asset maintenance staff to regularly check wall and glass surfaces for any signs of deterioration.
Signage	Replace damaged or missing signs	Missing or damaged signs	Vandalism Theft Wind	Poor signage Poor passenger experience	Y	N	Y	Check and replace or re-erect as necessary	3 years or as required	PPE, working at heights equipment	Maintenance crew	Asset maintenance staff	PPE Working at heights	Asset maintenance staff to regularly check signage
Fixtures and Fittings	Replace damaged or missing fixtures and fittings	Missing or damaged fixtures and fittings	General wear and tear Vandalism	Poor amenity	N	N	N	Check and replace or re-erect as necessary	3 years or as required	PPE	Maintenance crew	Asset maintenance staff	PPE	Station staff to regularly check fixtures and fittings
Card Readers (EAC)	Provide clean and functioning amenities	Finishes marked or damaged	General wear and tear Vandalism	Poor amenity Failure to provide facilities	Y	Y	Y	Inspection Wipe down/clean surfaces Report machine failures	Weekly or as required	Gloves, cloth, cleaning solvent, PPE	Presentation staff	maintenance staff	PPE, MSDS	

6.3 Safety & Security Enhancing Facilities

Component	Objective	Fault/Defect Description	Cause	Failure Effect	Impact			Task Description	Frequency	Tools & Equipment	Competencies / Accreditation	Responsibility	Safety Management	Comments
					Safety	Environment	Operation							
CCTV	Security camera operation	Non-operation or poor direction	Electrical or equipment failure	No CCTV security coverage	Y	N	Y	Check CCTV operation	As per existing security system	As necessary if equipment failure is noted	CCTV Technician	Inspection by Indra specialist contractor to Sydney Trains	Sydney Trains electrical safety procedures	Asset maintenance staff should regularly monitor operation of CCTV to ensure that it is operational and that coverage is effective.
Fencing and safety barriers	Condition assessment	Cracking, deformation, corrosion and scaling	General wear and tear Inadequate corrosion protection	Reduced integrity	Y	N	N	Visual inspection of all fencing and barriers	3 yearly	PPE	Maintenance crew	Asset maintenance staff	PPE	

6.4 Services & Systems

Component	Objective	Fault/Defect Description	Cause	Failure Effect	Impact			Task Description	Frequency	Tools & Equipment	Competencies / Accreditation	Responsibility	Safety Management	Comments
					Safety	Environment	Operation							
Stormwater system	Clean out pits and drains	Blockages, silt and rubbish build up	Rubbish, leaves, paper, silt	Pit, channel or pipe overflow	Y	Y	Y	Clean out channels and gully pits of debris/silt build up	As per existing stormwater system	Gloves, PPE, broom etc	Specialist operator Confined space accreditation as required	Specialist operator	Barricades, PPE, SWMS Specialist equipment	Arrangements to be made with council for pumping out equipment.
Hydraulic Services	Condition assessment	System failure	Pipe failure	Flooding	Y	Y	Y	Inspection and testing	As per existing hydraulic system	PPE, Dictated by required repair	Asset maintenance staff	Building Technician	PPE Specialist equipment	
Communications	Condition assessment	System failure	Electronic or equipment fault	Inability to communicate	Y	Y	Y	Inspection and testing	As per existing Comms system	PPE, Dictated by required repair	Asset maintenance staff Comms specialist	Building Technician	PPE Specialist equipment	
Security	Condition assessment	System failure	Electronic or equipment fault	Staff and passenger security compromised	Y	Y	Y	Inspection and testing	As per existing security system	PPE, Dictated by required repair	Asset maintenance staff Security system specialist	Building Technician	PPE Specialist equipment	
Electrical LV	Condition assessment	System failure	Electronic or equipment fault	Power failure	Y	Y	Y	Inspection and testing	As per existing Electrical LV system	PPE, Dictated by required repair	Asset maintenance staff Electrician	Building Technician	PPE Specialist equipment	
Electrical Switchboards (DBs and ISMSB)	Condition assessment	System failure	Electronic or equipment fault	Power failure	Y	Y	Y	As per AS2467	As per AS2467	PPE, Dictated by required repair	Electrician	Electrician	PPE Specialist equipment	
Earthing and Bonding	Condition assessment	System failure	Circuit breakage	Electric shock	Y	N	Y	Inspection and testing	As per existing earthing and bonding	PPE, Dictated by required repair	Asset maintenance staff Electrician	Building Technician	PPE Specialist equipment	
Lighting	Station lighting	Light failure	Globe failure	Poor or no lighting	Y	N	Y	Check lights are operating Clean light and surrounds	Annual cleaning Globes to be replaced as necessary or every 6 years.	PPE, Dictated by required repair	Licensed electrician to replace globes	Regular inspection by Asset maintenance Staff	PPE Specialist equipment	Asset maintenance staff to regularly check that lights are working and are coming on between sunset and sunrise.

6.5 Landscaping (Regent st area)

Component	Objective	Fault/Defect Description	Cause	Failure Effect	Impact			Task Description	Frequency	Tools & Equipment	Competencies / Accreditation	Responsibility	Safety Management	Comments
					Safety	Environment	Operation							
Trees, shrubs and groundcover	Maintain healthy plantings	Dead foliage	Plant death Weather conditions	Poor amenity Falling branches	Y	Y	N	Inspection Removal of dead foliage Referral to arborist as required	5 yearly	Gardening equipment, PPE, working at heights equipment	Maintenance crew Arborist Tree lopping specialist	Maintenance crew	PPE Working at heights SWMS	
Groundcovers and grasses	Maintain healthy plantings	Dead foliage	Plant death Weather conditions	Poor amenity Falling branches	Y	Y	N	Inspection Removal of dead foliage Referral to arborist as required	5 yearly	Gardening equipment, PPE, working at heights equipment	Maintenance crew Arborist Tree lopping specialist	Maintenance crew	PPE Working at heights SWMS	

6.6 Review and Update

Maintenance and operational requirements are to be updated in accordance with Asset Management planning.

GHD

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	K Brady	J Lovely		R Waddell		
B	K Brady	J Lovely		R Waddell		

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- **Sydney Metro City & Southwest**

 - Central Station Main Works
Contract Schedules**

 - Schedule C1

- **Scope of Works and Technical Criteria
Appendix C07
Construction Pedestrian Modelling
Specification**

PROJECT	Sydney Metro City & Southwest	DATE	25 August 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.1
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00028168
FILE NAME	Central Station Main Works (CSM) SWTC App C07		

Contents

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2.2	Construction OD Matrices	4

1 Overview

- (a) This Appendix C07 applies to all Construction Impact Pedestrian Modelling.
- (b) Unless the context otherwise requires, terms which have a defined meaning in the General Conditions and the SWTC (including SWTC Appendix A01) have the same meaning where used in this Appendix C07.

2 Performance and Technical Requirements

2.1 2018 Train Plan

- (a) Table 1 and Table 2 list the train arrival and departure information in the AM Peak Hour and PM Peak Hour respectively.

Table 1 AM Peak Hour train service

	Platform	Arrival	Departure
Interstate / Regional	Platform 1 - 3	N/A	N/A
Intercity and Country	Platform 4 - 15	12	7
Suburban	Platform 16	20	20
	Platform 17	20	20
	Platform 18	20	20
	Platform 19	20	20
	Platform 20	8	8
	Platform 21	12	12
	Platform 22	12	12
	Platform 23	8	8
	Platform 24	18	18
	Platform 25	18	18

Table 2 PM Peak Hour train service

	Platform	Arrival	Departure
Interstate/ Regional	Platform 1 - 3	N/A	N/A
Intercity and Country	Platform 4 - 15	7	12
Suburban	Platform 16	20	20
	Platform 17	20	20
	Platform 18	20	20
	Platform 19	20	20
	Platform 20	12	12
	Platform 21	8	8
	Platform 22	8	8
	Platform 23	12	12
	Platform 24	18	18
	Platform 25	18	18

2.2 Construction OD Matrices

(a) Table 3 and Table 4 have the origin-destination movements in the AM and PM Peak Hours respectively.

Table 3 2026 AM Peak Hour OD matrix

Platform		4-15	16	17	18	19	20	21	22	23	24	25	Exit 1	Exit 2	Exit 3	Exit 4	Exit 5	Exit 6	Exit 7	Exit 8L	Total
		Sydney Terminal	Nthn & Nth Shr (to North Shore)	City Cir (clockwise)	Nthn & Wstrn (to West/Northern)	Sth & Inn Wst (from City Circle)	City Cir (ccw)	City Cir (ccw)	Est Hills (from City Circle)	Airport (to Airport)	Estn Sub & Ilwrra (to Bondi Junction)	Estn Sub & Ilwrra (to Cronulla)	Western Forecourt	Pitt St	Eddy Ave	Elizabeth St	Eastern Stairs	Chalmers St	Lee St	CBD & SE Light Rail	
4-15	Sydney Terminal	0	827	991	30	109	249	516	65	725	310	249	913	619	1,645	583	148	523	509	426	9,436
16	Nthn & Nth Shr (to North Shore)	2	0	705	0	58	91	222	24	672	104	138	381	353	604	370	95	497	563	247	5,126
17	City Cir (clockwise)	40	2,686	0	41	9	45	130	8	498	60	107	332	436	969	727	186	866	949	386	8,475
18	Nthn & Wstrn (to West/Northern)	41	0	0	6	245	1	7	84	483	58	54	337	365	648	563	144	711	772	306	4,823
19	Sth & Inn Wst (from City Circle)	36	0	0	34	1	0	0	11	50	5	22	21	32	57	72	19	93	97	34	583
20	City Cir (ccw)	49	834	63	33	0	0	0	0	102	52	7	121	160	357	258	66	321	351	141	2,914
21	City Cir (ccw)	253	2,061	266	372	191	0	0	41	0	292	35	204	250	517	388	100	507	550	217	6,245
22	Est Hills (from City Circle)	15	11	0	12	2	0	0	0	0	3	11	9	13	22	27	7	40	41	14	227
23	Airport (to Airport)	10	7	0	10	1	0	0	0	0	1	8	6	9	14	18	5	27	27	9	153
24	Estn Sub & Ilwrra (to Bondi Junction)	66	418	16	70	21	3	32	0	9	0	0	242	360	699	832	273	912	976	371	5,297
25	Estn Sub & Ilwrra (to Cronulla)	31	11	0	37	25	0	0	20	136	0	1	32	81	133	238	78	364	364	111	1,663
Exit 1	Western Forecourt	24	65	11	42	26	2	5	10	30	14	34									261
Exit 2	Pitt St (Light Rail)	29	95	15	55	36	3	6	13	35	22	38									348
Exit 3	Eddy Ave	156	65	10	44	31	2	4	11	27	15	25									391
Exit 4	Elizabeth St	56	182	25	90	72	4	9	21	47	37	51									595
Exit 5	Eastern Stairs	10	36	5	17	14	1	2	4	9	8	11									118
Exit 6	Chalmers St	54	314	51	137	86	8	17	28	75	90	83									944
Exit 7	Lee St	59	372	59	174	114	10	20	38	98	100	108									1,151
Exit 8L	CBD & SE Light Rail	95	277	43	137	93	7	15	31	79	70	86									934
Total boarding passengers		1,026	8,262	2,260	1,341	1,136	427	984	408	3,076	1,241	1,071	2,598	2,677	5,665	4,075	1,118	4,859	5,198	2,262	49,684

Table 4 2026 PM Peak Hour OD matrix

Platform		4-15	16	17	18	19	20	21	22	23	24	25	Exit 1	Exit 2	Exit 3	Exit 4	Exit 5	Exit 6	Exit 7	Exit 8L	Total	
		Sydney Terminal	Nthn & Nth Shr (to North Shore)	City Cir (clockwise)	Nthn & Wstn (to West/Northern)	Sth & Inn Wst (from City Circle)	City Cir (ccw)	City Cir (ccw)	Est Hills (from City Circle)	Airport (to Airport)	Estn Sub & Ilwrra (to Bondi Junction)	Estn Sub & Ilwrra (to Cronulla)	Western Forecourt	Pitt St	Eddy Ave	Elizabeth St	Eastern Stairs	Chalmers St	Lee St	CBD & SE Light Rail		
4-15	Sydney Terminal	0	36	31	2	35	14	9	43	222	27	58	71	48	373	47	6	41	45	69	1,177	
16	Nthn & Nth Shr (to North Shore)	26	5	29	0	36	10	9	29	327	33	61	128	84	183	137	18	135	224	100	1,575	
17	City Cir (clockwise)	96	215	1	51	8	1	1	0	168	22	18	70	49	131	104	14	95	154	68	1,268	
18	Nthn & Wstn (to West/Northern)	726	0	0	0	559	10	7	732	1,809	9	366	190	133	258	320	42	368	526	202	6,257	
19	Sth & Inn Wst (from City Circle)	869	0	0	136	0	0	0	55	234	0	14	31	21	33	44	6	64	87	31	1,626	
20	City Cir (ccw)	57	74	9	21	7	0	0	0	36	18	0	23	16	44	34	5	31	51	22	448	
21	City Cir (ccw)	637	424	44	590	437	0	0	89	0	119	8	60	42	113	74	10	88	137	58	2,929	
22	Est Hills (from City Circle)	219	1	0	80	39	0	0	0	0	0	3	6	4	7	6	1	11	15	5	397	
23	Airport (to Airport)	453	6	0	195	114	0	0	0	0	0	28	12	8	15	13	2	22	30	11	908	
24	Estn Sub & Ilwrra (to Bondi Junction)	219	47	19	121	94	10	7	6	31	1	0	60	41	76	103	21	111	161	63	1,191	
25	Estn Sub & Ilwrra (to Cronulla)	272	51	4	91	53	3	1	45	256	0	0	26	22	35	64	13	138	168	51	1,294	
Exit 1	Western Forecourt	616	222	16	256	228	8	5	81	144	36	178										1,789
Exit 2	Pitt St (Light Rail)	684	329	29	334	380	14	9	138	235	79	327										2,558
Exit 3	Eddy Ave	945	353	33	326	544	13	9	201	316	98	449										3,288
Exit 4	Elizabeth St	477	451	54	299	579	18	12	192	255	156	524										3,018
Exit 5	Eastern Stairs	163	155	19	101	198	6	4	67	91	73	261										1,138
Exit 6	Chalmers St	269	379	47	273	470	20	13	181	281	177	494										2,605
Exit 7	Lee St	501	731	90	531	907	38	25	348	540	336	947										4,994
Exit 8L	CBD & SE Light Rail	309	221	24	179	279	10	7	102	157	81	268										1,637
Total boarding passengers		7,537	3,700	453	3,586	4,967	175	118	2,311	5,102	1,266	4,002	676	468	1,269	946	138	1,104	1,598	681	40,097	



**Transport
for NSW**

- **Sydney Metro City &
Southwest**

- Central Station Main Works
Contract Schedules**

- Schedule C1

- **Scope of Works and Technical Criteria
Appendix D1
SWTC Drawings**

PROJECT	Sydney Metro City & Southwest	DATE	20 February 2018
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.1
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00003502
FILE NAME	Central Station Main Works (CSM) SWTC Drawings		

Contents

1 **SWTC Drawings**

1

1 SWTC Drawings

(a) The drawings listed in Table 1 below are included at Attachment 1 to this Appendix D1.

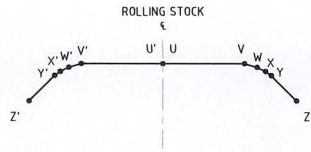
Table 1 – SWTC Drawings

Drawing Number	Drawing Revision	Drawing Title
NWRL0TS-NRT-SWD-PW-DRG-550850	A	North West Rail Link System Wide Location Permanent Way Transit Space Plain Line KE
NWRLSRT-PBA-SHC-TU-DWG-930050	04	Sydney Metro City & Southwest Tunnels & Station Excavation Running Tunnel Axis Control Line (RT01) Horizontal Alignment
NWRLSRT-PBA-SHC-TU-DWG-930051	02	Sydney Metro City & Southwest Tunnels & Station Excavation Running Tunnel Axis Control Line (RT01) Vertical Alignment
NWRLSRT-PBA-SHC-TU-DWG-930052	04	Sydney Metro City & Southwest Tunnels & Station Excavation Running Tunnel Axis Control Line (RT02) Horizontal Alignment
NWRLSRT-PBA-SHC-TU-DWG-930053	02	Sydney Metro City & Southwest Tunnels & Station Excavation Running Tunnel Axis Control Line (RT02) Vertical Alignment

Drawing Number	Drawing Revision	Drawing Title
NWRLSRT-PBA-SHC-TU-DWG-930054	03	Sydney Metro City & Southwest Tunnels & Station Excavation Track Formation Control Line (Up/down MSW & up/down MNW) Horizontal and vertical alignment
NWRLSRT-PBA-SHC-TU-DWG-930060	01	Sydney Metro City & Southwest Tunnels & Station Excavation Mathematical Formulae for Horizontal Transitions and Vertical Curves
NWRLSRT-SCS-RD-DWG-938211	01	Central Station General Arrangement
NWRLSRT-SCS-RD-DWG-938215	01	Central Station Track Formation Control Line (Up/Down MSW & Up/ Down MNW) Horizontal Alignment
NWRLSRT-SCS-RD-DWG-938216	01	Central Station Track Formation Control Line (Up/Down MSW & Up/ Down MNW) Vertical Alignment
NWRLSRT-PBA-SCS-ST-DWG-938311	02	Metro Station Works Excavation Setout – Metro Platform Level
NWRLSRT-PBA-SCS-AT-DWG-938151	03	Central Walk Works Station Finishes Extent Metro Concourse & East Concourse & ESR & Eastern Entry
NWRLSRT-PBA-SCS-AT-DWG-938152	01	Central Station Main Works Metro Platform Level

Drawing Number	Drawing Revision	Drawing Title
NWRLSRT-PBA-SCS-AT-DWG-938153	01	Central Station Works Station Finishes Extent North Concourse Level
NWRLSRT-PBA-SCS-ST-DWG-938154	03	Central Station Works Station Finishes Extent North Concourse
620/T/000/MTR/N82/003	A2	Contract 620 Lifts & Escalators Typical Entrance Elevation for Passenger Lift
620/T/000/MTR/N99/001	A3	Contract 620 Lifts & Escalators Typical Escalator Civil Dimensions
620/T/000/MTR/N99/005	A1	Contract 620 Lifts & Escalators Typical Details of Trimming Angle at Escalator Landings
620/T/000/MTR/N99/006	A3	Contract 620 Lifts & Escalators Typical Escalator Layout
620/T/000/MTR/N99/007	A1	Contract 620 Lifts & Escalators Typical Escalator Layout for ME1-ME3, ME5-ME6, ME7-ME9 in Central Station
HW_TW_D-003	A	SIL(E) Front of House Headwall/Tailwall Units HW/TW Unit Elevation & Sections Wall Mount Type
HW_TW_D-004	A	SIL(E) Front of House Headwall/Tailwall Units HW/TW Unit Plan & Sections Wall Mount Type
2177519_STAR_MASTERWITHOPTIONS_Rev4	Rev4	STAR Master with Options Document number: 2177519
TSE -JHO-TUN-TS-DRG-5002	01	Tunnels – North and South Tunnels – TD1, TD3 segmental lining General Arrangement 6+0 Universal Ring Type - Tapered

Attachment 1

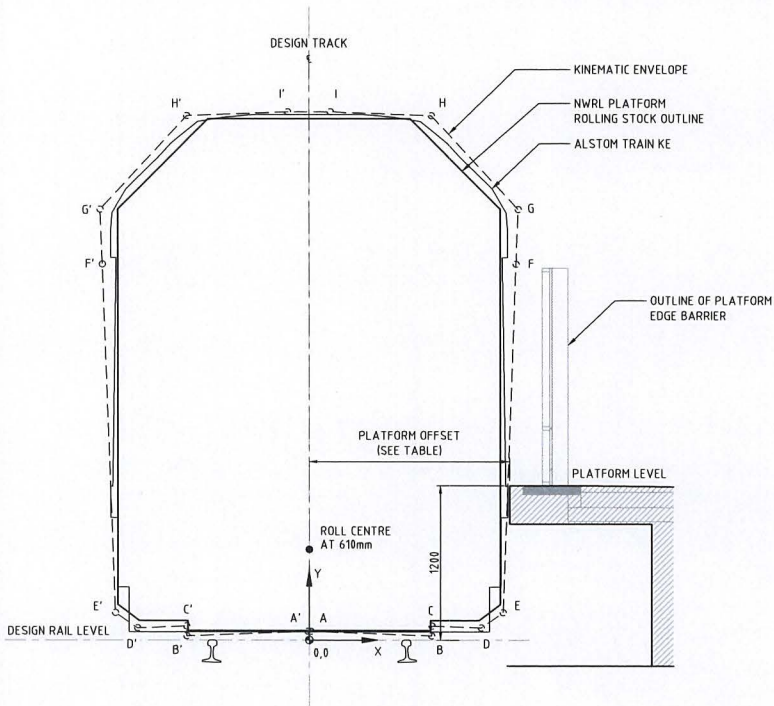


MAXIMUM PANTOGRAPH PROFILE
SCALE 1:25

PANTOGRAPH DIMENSIONS		
POINT	LATERAL (X)	VERTICAL (Y)
U	0	0
V	634	0
W	731	-29
X	796	-59
Y	84.0	-89
Z	1038	-288
U'	0	0
V'	-634	0
W'	-731	-29
X'	-796	-59
Y'	-84.0	-89
Z'	-1038	-288

STATIC TRAIN DIMENSIONS STRAIGHT TRACK		
POINT	LATERAL (X)	VERTICAL (Y)
A	0	75
B	94.0	75
C	94.0	152
D	1320	152
E	1485	275
F	1485	2930
G	1485	3360
H	785	4060
I	0	4060
A'	0	75
B'	-94.0	75
C'	-94.0	152
D'	-1320	152
E'	-1485	275
F'	-1485	2930
G'	-1485	3360
H'	-785	4060
I'	0	4060
BOGIE CENTRES		14850
BODY OVERHANG (MIN)		3040
VEHICLE LENGTH		20930
VEHICLE WIDTH		2970

ROLLING STOCK TOLERANCES			
ROLLING STOCK: NWRL PLATFORMS			
DIRECTION	RELATIVE TO	DESCRIPTION	TOLERANCE
LATERAL	RELATIVE TO THE PLANE OF SUPERELEVATION (WITH ANY SUPERELEVATION VARIATION APPLIED)	BODY TO WHEELSET	± 24mm TOTAL
		WHEEL WEAR	
		WHEEL/RAIL FREE PLAY	
VERTICAL	RELATIVE TO THE DISPLACED VEHICLE CENTRELINE	EXTRA CLEARANCE	+ 0mm
		BOUNCE UPWARDS	+ 50mm
		BOUNCE DOWNWARDS	- 0mm
		EXTRA CLEARANCE UPWARDS	+ 0mm
ROTATIONAL	ROLL ABOUT THE DISPLACED ROLL CENTRE OF THE ROLLING STOCK OUTLINE	EXTRA CLEARANCE DOWNWARDS	- 0mm
		THE ROLL CENTRE MOVES Laterally AND VERTICALLY WITH ROLLING STOCK OUTLINE	± 2°



PLATFORM STRUCTURE GAUGE & KINEMATIC ENVELOPE
NOT TO SCALE

PLATFORM TRACK KE DIMENSIONS STRAIGHT TRACK		
POINT	LATERAL (X)	VERTICAL (Y)
A	11	68
B	950	32
C	953	109
D	1333	94
E	1505	211
F	1606	2929
G	1623	3358
H	950	4085
I	166	4115
A'	-11	68
B'	-950	32
C'	-953	109
D'	-1333	94
E'	-1505	211
F'	-1606	2929
G'	-1623	3358
H'	-950	4085
I'	-166	4115

MINIMUM CONTACT WIRE HEIGHT	
LOCATION	DIMENSION (mm)
RTRF YARD	5000
NWRL TUNNEL	4400
NWRL OPEN TRACK	4500
ECRL TUNNEL	4750
ECRL OPEN TRACK	4800

TRACK TOLERANCES			
TRACK CONFIGURATION			PLATFORMS
DIRECTION	RELATIVE TO	DESCRIPTION	TOLERANCE
LATERAL	RELATIVE TO THE PLANE OF THE DESIGN SUPERELEVATION	RAIL WEAR	± 5mm TOTAL
		HORIZONTAL CURVES - 2000m RADIUS AND TANGENT TRACK	
		HORIZONTAL CURVES - 2000m RADIUS	
VERTICAL	RELATIVE TO THE VERTICAL PLANE WITH RESPECT TO THE DESIGN RAIL LEVEL	LEVEL	± 5mm
ROTATIONAL	RELATIVE TO THE VERTICAL PLANE WITH RESPECT TO THE DESIGN SUPERELEVATION	SUPERELEVATION	± 5mm

PLATFORM OFFSET	
PLATFORM TYPE	OFFSET DISTANCE
PSD (PLATFORM SCREEN DOORS)	1555
PEB (PLATFORM EDGE BARRIERS)	1565

NOTES

- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
- CLEARANCES THROUGH PLATFORMS ARE DERIVED FROM KINEMATIC ENVELOPE CALCULATIONS.
- INFRASTRUCTURE MAINTENANCE VEHICLES TO FIT WITHIN THE KINEMATIC ENVELOPE.
- HORIZONTAL AND VERTICAL OFFSETS SHALL BE ADJUSTED FOR ROLLING STOCK CURVING EFFECTS IN ACCORDANCE WITH THE REQUIREMENTS OF THE NRT DESIGN STANDARDS MANUAL.

HOLD
1. DESIGN TO BE CONFIRMED

NOT FOR CONSTRUCTION

<p>100mm AT FULL SIZE Rev Date: 13/08/16 - 10:15 Call File: C:\PRINT\NWRL\OTS-NRT-SWD-PW-DRG-550850.dwg</p>		<p>DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING</p>	<p>CLIENT</p> <p>NSW Transport for NSW</p>	<p>This information shown on this drawing is for the purposes of the North West Rail Link (NWRL) Project only. No warranty is given or intended as to its suitability for any other purpose. The Service Provider accepts no liability arising from the use of this drawing and the information shown therein for any purpose other than the North West Rail Link (NWRL) Project.</p> <p>SERVICE PROVIDERS</p> <p>DRAWN: C. TORRES DESIGNED: R. BERRHAM DRG CHECK: A. T. WILSON DESIGN CHECK: G. WATSON APPROVED: A. GAFFEY</p>	<p>NORTH WEST RAIL LINK SYSTEM WIDE LOCATION PERMANENT WAY TRANSIT SPACE PLATFORM KE</p> <p>STATUS: DESIGN STAGE 3 SHEET 1 OF 1 DRG No: NWRL\OTS-NRT-SWD-PW-DRG-550850</p>
<p>SCALES</p>	<p>INDEPENDENT CERTIFIER CERTIFICATE</p>	<p>NOTE: Do not scale from this drawing.</p>	<p>NSW GOVERNMENT</p>	<p>northwest rapid transit caring for life's journeys</p>	<p>APPROVED: A. GAFFEY 11/08/16</p>

REV	BY	DATE	DESCRIPTION	APPD
A	CT	11/08/16	DESIGN LOT 204 - ISSUED FOR STAGE 3 SUBMISSION	GW

Co-ordinate System: MGA Zone 56 Height Datum: A.H.D. This sheet may be prepared using colour and may be incomplete if copied

NOTES
 1. REFER TU-DWG-93060 FOR MATHEMATICAL FORMULAE FOR HORIZONTAL TRANSITIONS AND VERTICAL CURVES.

RUNNING TUNNEL (RT01)
 AXIS CONTROL LINE - HORIZONTAL

POINT	KILOMETRAGE (m)	EASTING (m)	NORTHING (m)	ELEMENT	BEARING	ELEMENT LENGTH (m)
TP	0m 000.000	331222.8070	624444.7877	SPIRAL	54° 16' 48.35"	
Center		331888.8337	624554.9330		R = +1209.0550	557.6430
TRS	0m 557.6430	331739.8444	624444.8862	SPIRAL	82° 52' 07.74"	55.7335
TP	0m 613.6165	331795.4851	624444.8885	STRAIGHT	84° 12' 17.69"	35.7398
TP	0m 649.3563	331831.0422	624444.6971	SPIRAL	84° 12' 17.69"	72.3809
TRS	0m 721.7717	331903.1486	6244652.7885		86° 47' 46.85"	63.7256
Center		331947.8856	6245893.8700		R = +866.1594	
TRS	0m 785.4427	331966.8491	6244653.7438	SPIRAL	91° 21' 34.02"	72.3809
TP	0m 857.8436	332039.1084	624444.9461	STRAIGHT	93° 57' 03.80"	564.2258
TP	1m 422.0494	332402.8033	6244410.9702	SPIRAL	93° 57' 03.80"	109.9638
TRS	1m 532.0332	332711.8951	6244466.2163		89° 32' 10.97"	289.8168
Center		332746.6499	6247378.8094		R = -713.6494	
TRS	1m 821.8500	332993.2716	6244466.5465	SPIRAL	64° 16' 01.04"	109.8707
TP	1m 938.9707	333096.3276	6247475.6549	STRAIGHT	61° 53' 17.86"	232.4409
TP	2m 163.9636	333295.7653	6244824.9877	SPIRAL	61° 53' 17.86"	122.4022
TRS	2m 285.3893	333401.8655	6244886.3116		54° 00' 38.31"	711.9566
Center		333461.3453	6247379.8561		R = -615.1919	
TRS	2m 997.9450	333462.3067	6247556.2882	SPIRAL	34° 23' 59.14"	122.5926
TP	3m 120.5330	333631.5884	6247624.9596	STRAIGHT	34° 33' 12.91"	216.7563
TP	3m 337.2894	333970.5836	6247832.9541	SPIRAL	34° 33' 12.91"	107.5565
TRS	3m 444.8459	333543.0715	6247936.9059		348° 15' 45.54"	459.1964
Center		334199.1721	6248073.3566		R = +670.1394	
TRS	3m 904.0423	333604.8163	6248382.9195	SPIRAL	27° 30' 43.38"	107.5565
TP	4m 011.9988	333659.5119	6248475.6410	STRAIGHT	32° 06' 36.00"	738.5489
TP	4m 500.7478	334052.0819	6249181.0635		32° 06' 36.00"	17.2149
Center		333860.3307	6249233.9501		R = -250.0000	
TP	4m 767.2627	334060.7294	6249195.9485	STRAIGHT	28° 09' 52.67"	10.0000
TP	4m 777.2627	334065.4495	6249124.7644		28° 09' 52.67"	10.0000
Center		334285.8482	6249008.7628		R = +250.0000	
TP	4m 794.5776	334074.8709	6249199.6494	STRAIGHT	32° 06' 36.00"	956.4858
TP	4m 951.9634	334073.3362	6249272.2991		32° 06' 36.00"	17.3354
Center		334364.8916	6249179.4415		R = -250.0000	
TP	4m 948.5888	334167.0503	6249286.4535	STRAIGHT	34° 34' 58.72"	10.0000
TP	4m 978.5888	334172.9338	6249294.7332		34° 34' 58.72"	17.9584
Center		333970.8986	6249431.9723		R = -250.0000	
PRC	4m 996.4732	334182.8864	6249389.6108		31° 58' 01.97"	75.1163
Center		335516.9440	6248642.4286		R = +1600.1717	
TRS	5m 071.5935	334224.2364	6249372.3821	SPIRAL	34° 39' 24.59"	24.5521
TP	5m 096.5156	334238.3802	6249392.5862	STRAIGHT	35° 05' 44.99"	10.3773
TP	5m 111.5229	334248.8673	6249487.5423		35° 05' 44.99"	

RUNNING TUNNEL (RT01)
 AXIS CONTROL LINE - HORIZONTAL

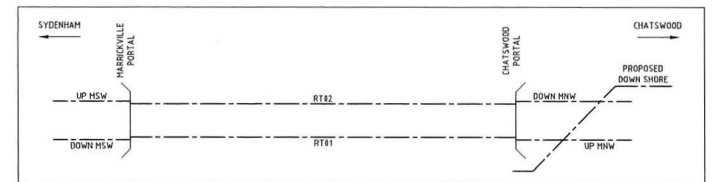
POINT	KILOMETRAGE (m)	EASTING (m)	NORTHING (m)	ELEMENT	BEARING	ELEMENT LENGTH (m)
TP	5m 204.8169	334298.8995	6249482.2465	SPIRAL	21° 57' 15.13"	89.1410
Center		333886.1051	6249731.1918		R = -498.5850	274.0738
TRS	5m 478.8907	334364.5097	6249744.6040	SPIRAL	358° 27' 38.71"	89.1410
TP	5m 547.5847	334354.7597	6249833.7297	STRAIGHT	353° 18' 58.85"	46.8562
TP	5m 654.4439	334344.4507	6249919.9958	SPIRAL	353° 18' 58.85"	63.3921
TRS	5m 717.8931	334348.1051	6249983.0444		355° 35' 09.49"	93.7376
Center		335037.8867	6250044.4269		R = +800.9550	
TRS	5m 811.5706	334338.3153	6250076.7125	SPIRAL	2° 17' 53.27"	63.3921
TP	5m 874.9628	334342.5866	6250139.5600	STRAIGHT	4° 34' 03.91"	446.8361
TP	6m 321.7949	334378.1736	6250585.3149	SPIRAL	4° 34' 03.91"	82.4182
TRS	6m 404.2151	334386.6139	6250647.3426		8° 30' 07.07"	71.8332
Center		334982.1667	6250578.8464		R = +480.1680	
TRS	6m 476.8483	334440.4552	6250737.5819	SPIRAL	10° 21' 35.41"	82.4182
TP	6m 558.4465	334428.8969	6250895.9576	STRAIGHT	10° 17' 38.57"	10.3754
TP	6m 574.8622	334432.9665	6250933.1012	SPIRAL	10° 17' 38.57"	90.0686
TRS	6m 664.9108	334460.5820	6250919.0978		14° 59' 29.22"	58.4421
Center		333891.2920	625076.1957		R = -599.7820	
TRS	6m 725.5529	334472.9605	6250976.3048	SPIRAL	9° 23' 19.54"	90.0686
TP	6m 815.6275	334483.1857	6250885.7884	STRAIGHT	5° 05' 10.19"	200.8663
TP	7m 016.4878	334500.9332	6251265.8438	SPIRAL	5° 05' 10.19"	69.8729
TRS	7m 095.5687	334504.2882	6251334.7917		358° 00' 34.00"	454.2654
Center		334224.8868	6251225.8811		R = -279.6420	
TRS	7m 539.8261	334208.1197	6251483.4315	SPIRAL	244° 54' 08.44"	69.8729
TP	7m 608.8990	334192.0972	6251951.9039	STRAIGHT	257° 51' 34.27"	35.6732
TP	7m 644.5721	334097.2219	6251084.4015	SPIRAL	257° 51' 34.27"	63.8309
TRS	7m 707.6931	334035.1542	6251073.4518		264° 48' 05.75"	381.2018
Center		334015.5890	6251032.4912		R = +240.1100	
TRS	8m 088.8040	333954.5586	6251082.0386	SPIRAL	348° 46' 14.56"	63.8309
TP	8m 151.8350	333949.2107	6251084.6107	STRAIGHT	355° 42' 44.04"	437.4368
TP	8m 589.2718	333716.5166	6251280.8235	SPIRAL	355° 42' 44.04"	82.3944
TRS	8m 674.6662	333710.2553	6251263.9901		359° 48' 04.06"	108.5126
Center		334307.3979	6251264.4254		R = +395.1680	
TRS	8m 772.1788	333716.1620	6251443.1714	SPIRAL	9° 21' 19.45"	82.3944
TP	8m 854.5732	333737.2885	6252543.7463	STRAIGHT	13° 19' 17.47"	371.9292
TP	9m 224.5925	333822.8866	6252965.4698	SPIRAL	13° 19' 17.47"	91.8052
TRS	9m 317.5277	333841.7596	6252994.7154		0° 04' 18.25"	270.4512
Center		333295.8317	6253091.6427		R = -413.6430	

RUNNING TUNNEL (RT01)
 AXIS CONTROL LINE - HORIZONTAL

POINT	KILOMETRAGE (m)	EASTING (m)	NORTHING (m)	ELEMENT	BEARING	ELEMENT LENGTH (m)
TRS	9m 586.1789	333825.6490	6253262.4595	SPIRAL	343° 47' 57.90"	91.0252
TP	9m 678.2841	333795.3905	6253348.8860	STRAIGHT	339° 32' 58.68"	57.2182
TP	9m 736.6413	333775.6415	6253402.2905	SPIRAL	339° 32' 58.68"	100.6376
TRS	9m 836.8518	333744.2967	6253477.7163		344° 44' 24.76"	319.2838
Center		334133.7807	6253599.4978		R = +600.1520	
TRS	10m 96.1357	333796.1342	6253804.2453	SPIRAL	32° 27' 24.77"	100.6376
TP	10m 254.5733	333856.8872	6253884.1369	STRAIGHT	39° 38' 50.86"	95.5840
TP	10m 252.6727	333917.8757	6253957.7351	SPIRAL	39° 38' 50.86"	109.8227
TRS	10m 461.1799	333995.2418	6254043.4805		35° 16' 16.68"	279.1461
Center		333482.6473	6254455.1780		R = -713.6000	
TRS	10m 746.3260	334098.3630	6254294.6653	SPIRAL	12° 51' 29.10"	109.8227
TP	10m 849.3487	334111.1777	6254494.0236	STRAIGHT	8° 28' 52.95"	342.8420
TP	10m 912.1986	334167.7427	6254743.7162	SPIRAL	8° 28' 52.95"	108.2391
TRS	10m 980.4297	334179.9315	6254850.6380		2° 26' 39.29"	566.6810
Center		333646.8225	6254872.5184		R = -513.5760	
TRS	10m 984.9707	333917.7328	6255328.6224	SPIRAL	299° 14' 44.43"	108.2391
TP	10m 915.1498	333819.8599	6255364.7284	STRAIGHT	293° 12' 28.68"	124.7939
TP	12m 099.9438	333795.9442	6255415.8979	SPIRAL	293° 12' 28.68"	101.8870
TRS	12m 201.8336	333641.9651	6255459.9537		298° 59' 10.79"	168.6882
Center		333857.7554	6255991.0957		R = +585.1380	
TRS	12m 358.5197	333495.3004	6255549.1764	SPIRAL	315° 51' 05.16"	101.8870
TP	12m 452.4076	333429.4356	6255624.8523	STRAIGHT	321° 37' 47.26"	209.5886
TP	12m 661.9161	333299.3852	6255791.1104	SPIRAL	321° 37' 47.26"	73.1289
TRS	12m 735.0450	333253.2966	6255847.8936		319° 32' 03.42"	84.1876
Center		332492.6942	6255991.0957		R = -999.7500	
TRS	12m 819.2326	333164.6366	6255909.5583	SPIRAL	314° 42' 34.13"	73.1289
TP	12m 892.3415	333142.8235	6255959.7200	STRAIGHT	312° 34' 50.29"	1771.7055
TP	14m 664.6070	332838.9487	6257059.2629	SPIRAL	312° 34' 50.29"	92.4178
TRS	14m 756.6849	332772.3612	6257223.3834		316° 23' 43.50"	610.9959
Center		332275.3587	6257784.1884		R = -700.1690	
TRS	15m 348.4808	332683.6711	6257785.5640	SPIRAL	6° 28' 38.29"	92.4178
TP	15m 460.8986	332598.3219	6257876.4268	STRAIGHT	10° 15' 31.50"	52.7993
TP	15m 513.6879	332607.5181	6257928.2934	SPIRAL	10° 15' 31.50"	60.5417
TRS	15m 574.1636	332617.7945	6257987.9541		8° 48' 47.31"	52.8830
Center		332632.1898	6258071.7333		R = -1199.7660	
TP	15m 627.6326	332624.7387	6258064.3744	STRAIGHT	6° 17' 15.67"	



LEGEND
 HORIZONTAL
 TP TANGENT POINT
 TRS TRANSITION POINT
 R RADIUS
 CENTER OF CIRCLE
 VERTICAL
 SVC START VERTICAL CURVE
 IP INTERSECTION POINT
 EVC END VERTICAL CURVE



100mm AT FULL SIZE Plot Date: 19/09/17 - 10:38 Client: C:\Users\pcauser\OneDrive\gruam\dms21\NWRLSRT-PBA

100mm AT FULL SIZE Plot Date: 18/01/17 - 16:29

Client File: X:\S3_CADD\Drawings\CONTRACT\3\SHC\5\WRLSRT-PBA-SHC-TU-DWG-930051.dwg

RUNNING TUNNEL (RT01) AXIS CONTROL LINE - VERTICAL

Element	Stationing (m)	Elevation (m)	Heighting (m)	Existing (m)	Radius (m)	Grade (%)	Length (m)
Element: Linear	0m 000.0000	-8.8169	624443.7877	33122.0078		-4.299	73.5069
LP	0m 073.5065	-12.8772	624442.7326	33128.4352			
Element: Symmetrical Parabola					3264.6431		100.0000
SVC	0m 073.5065	-12.8772	624442.7326	33136.7352			
LP	0m 163.5065	-15.9445	624425.1878	33163.3112			
EVC	0m 253.5065	-14.8533	624561.1711	33144.0388			
Element: Linear	0m 253.5065	-14.8533	624561.1711	33144.0388		1.215	226.1490
EVC	0m 479.6554	-12.1804	624626.4162	33162.8292			
Element: Symmetrical Parabola					3764.1164		160.0000
SVC	0m 479.6554	-12.1804	624626.4162	33162.8292			
LP	0m 559.6554	-11.1047	624493.0524	33171.8417			
EVC	0m 639.6554	-13.6186	624445.5176	33181.3919			
Element: Linear	0m 639.6554	-13.6186	624445.5176	33181.3919		-3.195	629.1845
EVC	0m 268.8240	-33.1534	624461.5291	33244.9121			
Element: Symmetrical Parabola					4436.2642		180.0000
SVC	0m 268.8240	-33.1534	624461.5291	33244.9121			
LP	0m 358.8240	-35.9478	624445.3279	332536.9982			
EVC	0m 448.8240	-35.0655	624469.1674	332628.6970			
Element: Linear	0m 448.8240	-35.0655	624469.1674	332628.6970		0.980	1052.8683
EVC	0m 508.5501	-4.2349	625078.7892	33410.7892			
Element: Symmetrical Parabola					2123.9502		120.0000
SVC	0m 508.5501	-4.2349	625078.7892	33410.7892			
LP	0m 588.5501	-8.8764	625025.4748	33430.2266			
EVC	0m 628.5501	-12.1244	625082.2629	33449.6480			
Element: Linear	0m 628.5501	-12.1244	625082.2629	33449.6480		1.250	192.2985
EVC	0m 740.8486	-4.7011	625191.2464	33477.8252			
Element: Symmetrical Parabola					4798.5388		60.0000
SVC	0m 740.8486	-4.7011	625191.2464	33477.8252			
LP	0m 798.8486	-10.0950	625164.0974	33480.9427			
EVC	0m 828.8486	-10.0950	625197.9750	33483.6491			
Element: Linear	0m 828.8486	-10.0950	625197.9750	33483.6491		0.0000	189.9957
EVC	0m 810.8444	-4.0950	625198.7950	33483.6491			
Element: Symmetrical Parabola					1619.6176		60.0000
SVC	0m 810.8444	-4.0950	625198.7950	33483.6491			
LP	0m 840.8444	-4.0950	625198.7950	33483.6491			
EVC	0m 870.8444	-5.2044	625198.7950	33483.6491			
Element: Linear	0m 870.8444	-5.2044	625198.7950	33483.6491		-3.705	415.8693
EVC	0m 740.8486	-4.7011	625191.2464	33477.8252			
Element: Linear	0m 740.8486	-4.7011	625191.2464	33477.8252		1.250	192.2985
EVC	0m 628.5501	-12.1244	625082.2629	33449.6480			
Element: Linear	0m 628.5501	-12.1244	625082.2629	33449.6480		1.250	192.2985
EVC	0m 508.5501	-4.2349	625078.7892	33410.7892			
Element: Linear	0m 508.5501	-4.2349	625078.7892	33410.7892		0.0000	189.9957
EVC	0m 448.8240	-35.0655	624469.1674	332628.6970			
Element: Linear	0m 448.8240	-35.0655	624469.1674	332628.6970		0.980	1052.8683
EVC	0m 328.8240	-7.7200	624767.5356	33362.8799			
Element: Symmetrical Parabola					4436.2642		60.0000
SVC	0m 328.8240	-7.7200	624767.5356	33362.8799			
LP	0m 358.8240	-7.7200	624768.4626	33365.9649			
EVC	0m 388.8240	-8.1534	624787.5100	33365.7353			
Element: Linear	0m 388.8240	-8.1534	624787.5100	33365.7353		-1.445	544.2596
EVC	0m 328.8240	-7.7200	624767.5356	33362.8799			
Element: Linear	0m 328.8240	-7.7200	624767.5356	33362.8799		0.0000	190.8718
EVC	0m 268.8240	-33.1534	624461.5291	33244.9121			
Element: Linear	0m 268.8240	-33.1534	624461.5291	33244.9121		2.000	608.6123
EVC	0m 187.9162	-18.8169	624863.9600	33316.7938			
Element: Symmetrical Parabola					5225.2561		180.0000
SVC	0m 187.9162	-18.8169	624863.9600	33316.7938			
LP	0m 207.9162	-17.3173	624840.8621	33362.8729			
EVC	0m 227.9162	-15.5173	624857.0747	33370.7021			
Element: Linear	0m 227.9162	-15.5173	624857.0747	33370.7021		2.000	608.6123
EVC	0m 187.9162	-18.8169	624863.9600	33316.7938			
Element: Symmetrical Parabola					2999.9794		60.0000
SVC	0m 187.9162	-18.8169	624863.9600	33316.7938			
LP	0m 217.9162	-20.2451	625198.7950	33483.6491			
EVC	0m 247.9162	-20.2451	625198.7950	33483.6491			
Element: Linear	0m 247.9162	-20.2451	625198.7950	33483.6491		2.000	608.6123
EVC	0m 187.9162	-18.8169	624863.9600	33316.7938			
Element: Linear	0m 187.9162	-18.8169	624863.9600	33316.7938		0.0000	190.1838
EVC	0m 147.9162	-12.8169	624463.9600	33116.7938			
Element: Symmetrical Parabola					1371.2769		60.0000
SVC	0m 147.9162	-12.8169	624463.9600	33116.7938			
LP	0m 167.9162	-12.8169	624463.9600	33116.7938			
EVC	0m 167.9162	-12.8169	624463.9600	33116.7938			
Element: Linear	0m 167.9162	-12.8169	624463.9600	33116.7938		0.0000	190.1838
EVC	0m 147.9162	-12.8169	624463.9600	33116.7938			
Element: Linear	0m 147.9162	-12.8169	624463.9600	33116.7938		0.0000	190.1838
EVC	0m 127.9162	-10.8169	624263.9600	32916.7938			
Element: Linear	0m 127.9162	-10.8169	624263.9600	32916.7938		0.0000	190.1838
EVC	0m 107.9162	-8.8169	624063.9600	32716.7938			
Element: Linear	0m 107.9162	-8.8169	624063.9600	32716.7938		0.0000	190.1838
EVC	0m 87.9162	-6.8169	623863.9600	32516.7938			
Element: Linear	0m 87.9162	-6.8169	623863.9600	32516.7938		0.0000	190.1838
EVC	0m 67.9162	-4.8169	623663.9600	32316.7938			
Element: Linear	0m 67.9162	-4.8169	623663.9600	32316.7938		0.0000	190.1838
EVC	0m 47.9162	-2.8169	623463.9600	32116.7938			
Element: Linear	0m 47.9162	-2.8169	623463.9600	32116.7938		0.0000	190.1838
EVC	0m 27.9162	-0.8169	623263.9600	31916.7938			
Element: Linear	0m 27.9162	-0.8169	623263.9600	31916.7938		0.0000	190.1838
EVC	0m 7.9162	-1.8169	623063.9600	31716.7938			
Element: Linear	0m 7.9162	-1.8169	623063.9600	31716.7938		0.0000	190.1838
EVC	0m -2.1838	-3.8169	622863.9600	31516.7938			
Element: Linear	0m -2.1838	-3.8169	622863.9600	31516.7938		0.0000	190.1838
EVC	0m -4.1838	-5.8169	622663.9600	31316.7938			
Element: Linear	0m -4.1838	-5.8169	622663.9600	31316.7938		0.0000	190.1838
EVC	0m -6.1838	-7.8169	622463.9600	31116.7938			
Element: Linear	0m -6.1838	-7.8169	622463.9600	31116.7938		0.0000	190.1838
EVC	0m -8.1838	-9.8169	622263.9600	30916.7938			
Element: Linear	0m -8.1838	-9.8169	622263.9600	30916.7938		0.0000	190.1838
EVC	0m -10.1838	-11.8169	622063.9600	30716.7938			
Element: Linear	0m -10.1838	-11.8169	622063.9600	30716.7938		0.0000	190.1838
EVC	0m -12.1838	-13.8169	621863.9600	30516.7938			
Element: Linear	0m -12.1838	-13.8169	621863.9600	30516.7938		0.0000	190.1838
EVC	0m -14.1838	-15.8169	621663.9600	30316.7938			
Element: Linear	0m -14.1838	-15.8169	621663.9600	30316.7938		0.0000	190.1838
EVC	0m -16.1838	-17.8169	621463.9600	30116.7938			
Element: Linear	0m -16.1838	-17.8169	621463.9600	30116.7938		0.0000	190.1838
EVC	0m -18.1838	-19.8169	621263.9600	29916.7938			
Element: Linear	0m -18.1838	-19.8169	621263.9600	29916.7938		0.0000	190.1838
EVC	0m -20.1838	-21.8169	621063.9600	29716.7938			
Element: Linear	0m -20.1838	-21.8169	621063.9600	29716.7938		0.0000	190.1838
EVC	0m -22.1838	-23.8169	620863.9600	29516.7938			
Element: Linear	0m -22.1838	-23.8169	620863.9600	29516.7938		0.0000	190.1838
EVC	0m -24.1838	-25.8169	620663.9600	29316.7938			
Element: Linear	0m -24.1838	-25.8169	620663.9600	29316.7938		0.0000	190.1838
EVC	0m -26.1838	-27.8169	620463.9600	29116.7938			
Element: Linear	0m -26.1838	-27.8169	620463.9600	29116.7938		0.0000	190.1838
EVC	0m -28.1838	-29.8169	620263.9600	28916.7938			
Element: Linear	0m -28.1838	-29.8169	620263.9600	28916.7938		0.0000	190.1838
EVC	0m -30.1838	-31.8169	620063.9600	28716.7938			
Element: Linear	0m -30.1838	-31.8169	620063.9600	28716.7938		0.0000	190.1838
EVC	0m -32.1838	-33.8169	619863.9600	28516.7938			
Element: Linear	0m -32.1838	-33.8169	619863.9600	28516.7938		0.0000	190.1838
EVC	0m -34.1838	-35.8169	619663.9600	28316.7938			
Element: Linear	0m -34.1838	-35.8169	619663.9600	28316.7938		0.0000	190.1838
EVC	0m -36.1838	-37.8169	619463.9600	28116.7938			

RUNNING TUNNEL (RT02)
AXIS CONTROL LINE HORIZONTAL

POINT	KILOMETRAGE (m)	EASTING (m)	NORTHING (m)	ELEMENT	BEARING	ELEMENT LENGTH (m)
TP	0m 000.000	33116.0053	624445.2941	SPIRAL	55°05'48.41"	
Center					R = +112.7910	543.5547
TRS	0m 543.5547	33117.7104	624444.8869	SPIRAL	82°20'47.75"	
TP	0m 405.8241	33117.5935	624445.4735	STRAIGHT	83°54'27.31"	37.1568
TP	0m 442.9809	33116.5404	624446.9211	SPIRAL	83°54'27.31"	
TRS	0m 724.7867	33119.9274	624466.4658	SPIRAL	84°43'58.92"	
Center					R = +828.4373	63.5249
TRS	0m 788.2316	33194.1256	624466.4439	SPIRAL	91°07'31.57"	
TP	0m 889.9573	33204.0299	624466.1543	STRAIGHT	93°57'03.18"	564.8573
TP	9m 434.8164	33266.5448	624466.2349	SPIRAL	93°57'03.18"	
TRS	9m 537.5475	332709.1454	624466.1945	SPIRAL	89°44'51.28"	
Center					R = -798.1414	289.5107
TRS	9m 827.8572	332996.2163	624467.9138	SPIRAL	64°03'19.83"	
TP	9m 929.7881	333881.9278	624467.1246	STRAIGHT	61°51'07.93"	237.9500
TP	2m 167.3311	333291.3233	624469.3876	SPIRAL	61°51'07.93"	
TRS	2m 284.7002	333392.9771	624469.8739	SPIRAL	54°14'59.88"	
Center					R = -598.0370	499.3757
TRS	2m 496.0759	333448.3295	6247505.7849	SPIRAL	34°49'23.30"	
TP	3m 101.0580	333619.0861	624748.9255	STRAIGHT	34°39'12.91"	218.6868
TP	3m 319.7448	333557.5380	6247828.7724	SPIRAL	34°39'12.91"	
TRS	3m 433.3815	333528.5969	6247938.6258	SPIRAL	34°24'54.28"	
Center					R = +883.7040	444.5882
TRS	3m 897.9496	333591.0871	6248319.0221	SPIRAL	27°20'54.63"	
TP	4m 011.6843	333448.7835	6248487.8817	STRAIGHT	32°04'36.00"	733.7580
TP	4m 745.3642	334038.8099	6249189.3760	SPIRAL	32°04'36.00"	
Center					R = +250.0000	17.2149
TP	4m 762.5792	334048.4551	6249123.6511	STRAIGHT	31°03'19.33"	18.0080
TP	4m 772.9791	334054.3497	6249131.7356	SPIRAL	31°03'19.33"	
Center					R = -250.0000	17.2149
TP	4m 789.7741	334063.9859	6249145.9907	STRAIGHT	32°04'36.00"	95.2218
TP	4m 744.0759	334165.9619	6249276.6211	SPIRAL	32°04'36.00"	
Center					R = -250.0000	16.7692
TP	4m 760.7851	334154.3927	6249279.1103	STRAIGHT	28°16'00.38"	18.0080
TP	4m 770.7851	334159.1084	6249297.9108	SPIRAL	28°16'00.38"	
Center					R = -250.0000	15.1699
CTP	4m 785.9550	334166.7304	6249313.0554	SPIRAL	31°44'36.42"	
Center					R = +1199.2780	78.5457
TRS	5m 056.5207	334205.5820	6249371.9395	SPIRAL	35°04'48.81"	
TP	5m 071.4993	334229.4510	6249445.3566	STRAIGHT	34°05'47.78"	41.7886
TP	5m 095.8989	334234.5410	6249442.0570	SPIRAL	34°05'47.78"	

RUNNING TUNNEL (RT02)
AXIS CONTROL LINE HORIZONTAL

POINT	KILOMETRAGE (m)	EASTING (m)	NORTHING (m)	ELEMENT	BEARING	ELEMENT LENGTH (m)
TRS	5m 187.4294	334289.7504	6249479.3177	SPIRAL	31°16'34.88"	
Center					R = -485.1510	390.5314
TRS	5m 578.1008	334335.6638	6249855.4896	SPIRAL	345°09'18.14"	
TP	5m 659.7912	334309.7665	6249933.0745	STRAIGHT	34.0°2'05.31"	67.1754
TP	5m 726.9645	334287.1004	624996.3319	SPIRAL	34.0°2'05.31"	
TRS	5m 797.1210	334245.5016	6250843.0340	SPIRAL	345°21'47.44"	
Center					R = +399.4830	85.1922
TRS	5m 882.3132	334252.8886	6250847.1244	SPIRAL	357°34'32.89"	
TP	5m 952.4677	334254.0245	6250817.2456	STRAIGHT	2°34'15.23"	408.8195
TP	6m 253.2782	334272.2369	6250817.6621	SPIRAL	2°34'15.23"	
TRS	6m 444.3599	334276.2921	6250848.5388	SPIRAL	8°27'48.98"	
Center					R = +249.6520	68.8210
TRS	6m 473.8809	334295.6187	6250734.3641	SPIRAL	24°16'29.31"	
TP	6m 524.2427	334319.3649	6250779.3590	STRAIGHT	39°07'03.84"	51.8617
TP	6m 528.4735	334324.8476	6250791.6686	SPIRAL	39°07'03.84"	
TRS	6m 578.6294	334344.5904	6250824.4308	SPIRAL	28°07'02.84"	
Center					R = -575.0760	211.1281
TRS	6m 789.7577	334410.0775	6251024.7493	SPIRAL	7°05'09.83"	
TP	6m 829.9138	334414.1023	6251044.7890	STRAIGHT	5°05'09.48"	48.0561
TP	7m 039.7288	334432.7026	6251275.4898	SPIRAL	5°05'09.48"	
TRS	7m 104.9388	334435.4541	6251348.7837	SPIRAL	337°36'54.99"	
Center					R = -250.8660	393.7223
TRS	7m 498.6610	334474.4778	6251580.1819	SPIRAL	267°24'08.75"	
TP	7m 563.8710	334489.8862	6251571.5883	STRAIGHT	25°55'54.15"	45.2100
TP	7m 580.6745	334493.3395	6251548.6584	SPIRAL	25°55'54.15"	
TRS	7m 649.4378	334425.0421	6251559.4433	SPIRAL	267°09'14.51"	
Center					R = +273.5400	387.6513
TRS	8m 037.2810	333743.9541	6251777.4367	SPIRAL	348°21'05.73"	
TP	8m 107.5743	333735.3102	6251847.1801	STRAIGHT	355°42'44.04"	78.2873
TP	8m 537.7231	333703.0541	6252276.3101	SPIRAL	355°42'44.04"	
TRS	8m 627.8749	333846.4513	6252366.1671	SPIRAL	359°59'01.50"	
Center					R = +666.7020	95.6914
TRS	8m 723.5663	333786.0799	6252441.6418	SPIRAL	9°03'02.80"	
TP	8m 813.7811	333724.7418	6252549.6351	STRAIGHT	10°19'17.47"	98.1518
TP	9m 187.1070	333810.7963	6252912.9749	SPIRAL	10°19'17.47"	
TRS	9m 249.2522	333827.9427	6252993.5741	SPIRAL	9°23'14.31"	
Center					R = -400.1448	271.3274

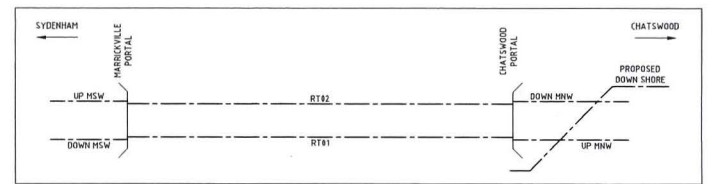
RUNNING TUNNEL (RT02)
AXIS CONTROL LINE HORIZONTAL

POINT	KILOMETRAGE (m)	EASTING (m)	NORTHING (m)	ELEMENT	BEARING	ELEMENT LENGTH (m)
TRS	9m 540.8526	333811.2173	6252362.0743	SPIRAL	343°29'01.83"	
Center					R = -485.1510	82.4382
TP	9m 623.2788	333784.2012	6252339.9226	STRAIGHT	339°32'58.67"	57.4970
TP	9m 680.7478	333744.1120	6252393.7958	SPIRAL	339°32'58.67"	
TRS	9m 789.2444	333730.7138	6252346.9159	SPIRAL	347°03'50.04"	
Center					R = +413.5630	325.3117
TRS	10m 114.5561	333783.5498	6252389.6475	SPIRAL	32°07'59.64"	
TP	10m 223.8272	333849.0187	6252389.8716	STRAIGHT	39°38'50.87"	108.4766
TP	10m 318.2572	333909.7778	6252396.1929	SPIRAL	39°38'50.87"	
TRS	10m 420.8615	333973.2379	6252404.7857	SPIRAL	35°21'26.15"	
Center					R = -685.1620	278.0793
TRS	10m 496.9408	334042.4548	6252474.7982	SPIRAL	12°46'17.67"	
TP	10m 793.5452	334100.3111	6254395.8440	STRAIGHT	8°28'52.95"	353.3241
TP	11m 144.8693	334152.4221	6254375.5961	SPIRAL	8°28'52.95"	
TRS	11m 248.7571	334144.8488	6254384.4810	SPIRAL	2°42'10.84"	
Center					R = -595.1380	543.3354
TRS	11m 812.0724	333902.8819	6255312.7129	SPIRAL	298°48'38.26"	
TP	11m 913.9402	333810.5549	6255355.8932	STRAIGHT	293°01'48.16"	101.8918
TP	12m 832.4415	333701.5112	6255482.2478	SPIRAL	293°01'48.16"	
TRS	12m 144.5832	333863.4194	6255448.0535	SPIRAL	299°10'05.71"	
Center					R = -504.6750	143.7798
TRS	12m 284.3630	333849.6781	6255534.9475	SPIRAL	315°29'29.71"	
TP	12m 392.4947	333849.6781	6255611.2338	STRAIGHT	321°37'47.26"	108.1336
TP	12m 408.8887	333285.7806	6255786.2615	SPIRAL	321°37'47.26"	
TRS	12m 671.3793	333245.9742	6255835.4430	SPIRAL	319°49'01.00"	
Center					R = -1000.1600	91.0960
TRS	12m 745.4497	333181.9748	6255904.3874	SPIRAL	314°25'36.54"	
TP	12m 828.7493	333135.8539	6255947.7255	STRAIGHT	312°38'58.29"	63.2968
TP	14m 405.9513	331828.6244	6257150.3730	SPIRAL	312°38'58.29"	
TRS	14m 704.4434	331757.0616	6257219.3459	SPIRAL	314°36'17.39"	
Center					R = +719.6170	628.9319
TRS	15m 333.4012	331671.4567	6257797.8457	SPIRAL	7°04'06.43"	
TP	15m 432.8133	331644.3097	6257895.7970	STRAIGHT	11°05'33.52"	99.4120
TP	15m 516.6888	331640.4470	6257978.1056	SPIRAL	11°05'33.52"	
TRS	15m 581.3416	331612.1810	6258041.7064	SPIRAL	9°11'33.77"	
Center					R = -975.1528	64.6278
TP	15m 581.7883	331612.2051	6258042.1218	SPIRAL	9°10'03.64"	

NOTES
1. REFER TU-DWG-93060 FOR MATHEMATICAL FORMULAE FOR HORIZONTAL TRANSITIONS AND VERTICAL CURVES.

LEGEND
TANGENT POINT
TRANSITION POINT
RADIUS
CENTRE OF CURVE
VERTICAL
SVC START VERTICAL CURVE
IP INTERSECTION POINT
EVC END VERTICAL CURVE

100mm AT FULL SIZE Plot Date: 19/09/17 - 10:39
 Scale: 1:1000
 File: C:\temp\pba-southwest\gms\dwg\21\NWRSRT-PBA-SHC-TU-DWG-930052.dwg



REV	BY	DATE	DESCRIPTION	APPD.
04	JS	28.08.17	TABLE REVISED AS SHOWN	IMW
03	JS	28.07.17	RUNNING TUNNEL CONTROL LINE REVISED	IMW
02	JS	18.01.17	RUNNING TUNNEL CONTROL LINE REVISED	IMW
01	JS	29.08.16	ISSUED FOR TENDER	IMW

SCALES
A1 Original
Co-ordinate System: MGA Zone 56
Height Datum: A.H.D.
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CLIENT
NSW GOVERNMENT
Transport for NSW
Plot Date: 19/09/17 - 10:39

Service Providers
PARSONS BRINCKERHOFF
AECOM
COX HASSELL

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DESIGNED: JULIAN SINGH
DRAWN: MATTHEW EDWARDS
DRG CHECK: ABDULLAH MAHAMUD
DESIGN CHECK: ANTON KUPRAS
APPROVED: IAN MCLWHAINE WHITTON

SYDNEY METRO CITY & SOUTHWEST
TUNNELS & STATION EXCAVATION
RUNNING TUNNEL AXIS CONTROL LINE (RT02)
HORIZONTAL ALIGNMENT
STATUS: TENDER
SHEET 1 OF 1
NWRL Dwg No. NWRSRT-PBA-SHC-TU-DWG-930052

CSI File: X_09_CADDDrawings_CONTRACT_01_SHC-SYDNEYMETRO-SYDNEY-RT02-TU-DWG-930055.dwg

10mm AT FULL SIZE Plot Date: 18/01/17 - 16:29

RUNNING TUNNEL (RT02) AXIS CONTROL LINE - VERTICAL

Table with columns: Element, Kilometerage (m), Elevation (m), Northing (m), Easting (m), Radius (m), Grade (%), Length (m). Contains data for RT02 vertical alignment.

RUNNING TUNNEL (RT01) AXIS CONTROL LINE - VERTICAL

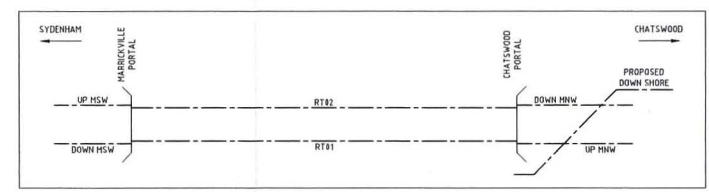
Table with columns: Element, Kilometerage (m), Elevation (m), Northing (m), Easting (m), Radius (m), Grade (%), Length (m). Contains data for RT01 vertical alignment.

RUNNING TUNNEL (RT02) AXIS CONTROL LINE - VERTICAL

Table with columns: Element, Kilometerage (m), Elevation (m), Northing (m), Easting (m), Radius (m), Grade (%), Length (m). Contains data for RT02 vertical alignment.

NOTES
1. REFER TU-DWG-93060 FOR MATHEMATICAL FORMULAE FOR HORIZONTAL TRANSITIONS AND VERTICAL CURVES.

LEGEND
HORIZONTAL: TP TANGENT POINT, TRS TRANSITION POINT, R RADIUS, CENTRE CENTRE OF CURVE
VERTICAL: SVC START VERTICAL CURVE, IP INTERSECTION POINT, EVC END VERTICAL CURVE



Revision table with columns: No, Date, Description, App'd.

Scale table with columns: Scale, Drawing Name, App'd.

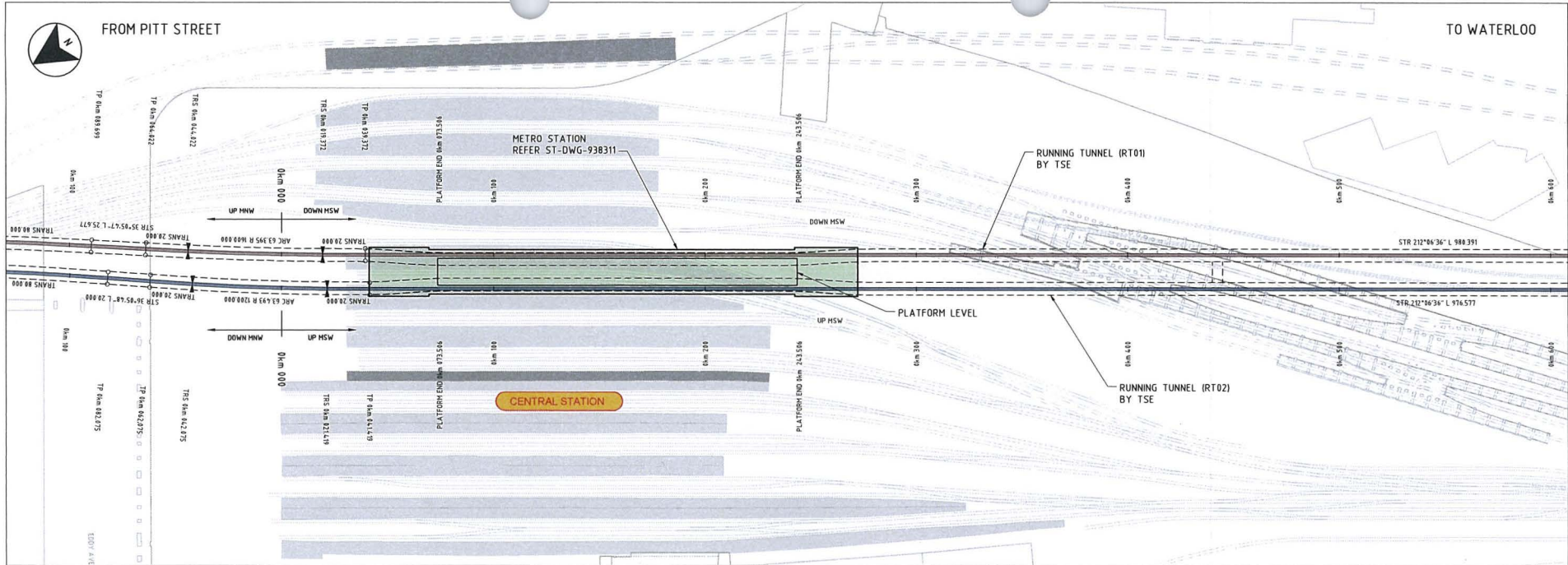
Client: Transport for NSW
Plot Date: 18/01/17 - 16:29
NOTE: Do not scale from this drawing.



Service Providers: PARSONS BRINCKERHOFF, AECOM, COX HASSELL
Client: SYDNEY METRO CITY & SOUTHWEST

SYDNEY METRO CITY & SOUTHWEST
TUNNELS & STATION EXCAVATION
RUNNING TUNNEL AXIS CONTROL LINE (RT02)
VERTICAL ALIGNMENT
STATUS: TENDER SHEET 1 OF 1
HWRL Dwg No. N\WLSRT-PBA-SHC-TU-DWG-930053

100mm AT FULL SIZE Plot Date: 14/06/17 - 10:16 C:\PP\NWRLSRT-PBA-SCS-RD-DWG-938211.dwg



PLAN
SCALE 1:1000

NOTES

1. CO-ORDINATE SYSTEM IS TO MAP GRID OF AUSTRALIA - MGA ZONE 56.
2. ALL LEVELS ARE TO THE AUSTRALIAN HEIGHT DATUM (AHD).
3. ALL DIMENSIONS ARE IN METRES UNLESS SHOWN OTHERWISE.
4. REFER RD-DWG-938215 & 938216 FOR TRACK FORMATION CONTROL LINE SETOUT TABLES.
5. LEVELS AND DIMENSIONS SHOWN ARE INDICATIVE ONLY.
6. ARRANGEMENT, SIZING AND LEVELS ARE SUBJECT TO CONFIRMATION DURING DETAILED DESIGN.

LEGEND

- 0km 400 KILOMETRAGE
- TP TANGENT POINT
- TBS TRANSITION POINT
- METRO STATION
- PROPOSED UP HSW / DOWN MHW
- PROPOSED DOWN HSW / UP MHW
- EXISTING SYDNEY TRANS
- PROPOSED TBM TUNNEL ALIGNMENT

REV	BY	DATE	DESCRIPTION	APPRO.
01	JS	13.06.17	ISSUED FOR TENDER	IMW

SCALES

1:1000 FULL SIZE A1

0 10 20 30 40m

Plot Date: 14/06/17 - 10:16

NOTE: Do not scale from this drawing.

CLIENT

Transport for NSW

Service Providers

PARSONS BRINCKERHOFF
AECOM
COX HASSELL

DESIGNED BY: ARTHUR GRIMAS
DRAWN BY: MATTHEW EDWARDS
DRG CHECK: MATTHEW EDWARDS
DESIGN CHECK: PAUL STOVES
APPROVED: IAN MCKILWANE-WHITTON

SYDNEY METRO CITY & SOUTHWEST

CENTRAL STATION
GENERAL ARRANGEMENT PLAN

STATUS: TENDER SHEET 1 OF 1

NWRL Dwg No. NWRLSRT-PBA-SCS-RD-DWG-938211

100mm AT FULL SIZE Plot Date: 14/06/17 - 10:16 C:\p\m\w\l\s\pba-scs-rd-dwg-938215.dwg

TRACK FORMATION CONTROL LINE (DOWN MSW) - HORIZONTAL

POINT	KILOMETRAGE (m)	NORTHING (m)	EASTING (m)	ELEMENT	BEARING	LENGTH (m)
TP	0km 073.2666	6249275.7884	334161.9391		212°46'36.00"	
				STRAIGHT		94.6558
TP	1km 019.7635	6248474.0186	333658.7998		212°46'36.00"	

NOTE
THIS ELEMENT OVERLAPS THE UP METRO NORTHWEST STRAIGHT ELEMENT THROUGH CENTRAL STATION.
FOR LENGTH OF ENTIRE STRAIGHT REFER TO GENERAL ARRANGEMENT PLAN NWRLSRT-PBA-SCS-RD-DWG-938211.

TRACK FORMATION CONTROL LINE (UP MSW) - HORIZONTAL

POINT	KILOMETRAGE (m)	NORTHING (m)	EASTING (m)	ELEMENT	BEARING	LENGTH (m)
TP	0km 073.2660	6249284.3011	334148.3612		212°46'36.00"	
				STRAIGHT		94.6790
TP	1km 017.9962	6248484.8362	333646.1616		212°46'36.00"	

NOTE
THIS ELEMENT OVERLAPS THE DOWN METRO NORTHWEST STRAIGHT ELEMENT THROUGH CENTRAL STATION.
FOR LENGTH OF ENTIRE STRAIGHT REFER TO GENERAL ARRANGEMENT PLAN NWRLSRT-PBA-SCS-RD-DWG-938211.

TRACK FORMATION CONTROL LINE (UP MNW) - HORIZONTAL

POINT	KILOMETRAGE (m)	NORTHING (m)	EASTING (m)	ELEMENT	BEARING	LENGTH (m)
TP	0km 243.206	6249191.7854	334071.5762		32°46'36.00"	
				STRAIGHT		203.8337
TP	0km 39.3723	6249304.4385	334179.9232		32°46'36.00"	
				SPIRAL		28.0000
TRS	0km 19.3723	6249321.3568	334190.5894		32°28'05.21"	
Centre		6248462.4286	335540.4940	R = -1600.0000		63.3948
TRS	0km 044.0225	6249374.1543	334225.6722		34°44'17.78"	

NOTE
THIS ELEMENT OVERLAPS THE DOWN METRO SOUTHWEST STRAIGHT ELEMENT THROUGH CENTRAL STATION.
FOR LENGTH OF ENTIRE STRAIGHT REFER TO GENERAL ARRANGEMENT PLAN NWRLSRT-PBA-SCS-RD-DWG-938211.

TRACK FORMATION CONTROL LINE (DOWN MNW) - HORIZONTAL

POINT	KILOMETRAGE (m)	NORTHING (m)	EASTING (m)	ELEMENT	BEARING	LENGTH (m)
TP	0km 243.2060	6249140.3061	334057.9983		32°46'36.00"	
				STRAIGHT		201.7873
TP	0km 414.187	6249311.2258	334165.2576		32°46'36.00"	
				SPIRAL		28.0000
TRS	0km 214.187	6249328.1368	334175.9356		32°35'15.00"	
Centre		6248481.8324	335187.0195	R = -1200.0000		63.4933
TRS	0km 042.0747	6249388.7049	334211.5313		35°37'08.70"	

NOTE
THIS ELEMENT OVERLAPS THE UP METRO SOUTHWEST STRAIGHT ELEMENT THROUGH CENTRAL STATION.
FOR LENGTH OF ENTIRE STRAIGHT REFER TO GENERAL ARRANGEMENT PLAN NWRLSRT-PBA-SCS-RD-DWG-938211.

NOTES

1. TRACK FORMATION CONTROL LINE KILOMETRAGE SHOWN ARE REFERENCED FROM CENTRAL STATION PLATFORM 1 BUFFER STOP.
2. FOR HORIZONTAL TRANSITIONS AND VERTICAL CURVES FORMULAE REFER TO ASA PRACTICE STANDARD ESC 210.
3. LEVELS AND DIMENSIONS SHOWN ARE INDICATIVE ONLY.
4. ARRANGEMENT, SIZING AND LEVELS ARE SUBJECT TO CONFIRMATION DURING DETAILED DESIGN.

LEGEND

HORIZONTAL	VERTICAL
TP TANGENT POINT	SVC START VERTICAL CURVE
TRS TRANSITION POINT	IP INTERSECTION POINT
R RADIUS	EVC END VERTICAL CURVE
CENTRE CENTRE OF CIRCLE	

REV	BY	DATE	DESCRIPTION	APPD.
01	JS	13.06.17	ISSUED FOR TENDER	IMW

Co-ordinate System: MGA Zone 56
Height Datum: A.H.D.
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SCALE: _____
Plot Date: 14/06/17 - 10:16
NOTE: Do not scale from this drawing.



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SERVICE PROVIDERS
PARSONS BRINCKERHOFF
AECOM
COX HASSELL

DRAWN BY: ARTHUR GRIMAS
 DESIGNED BY: MATTHEW EDWARDS
 DRG CHECK: MATTHEW EDWARDS
 DESIGN CHECK: PAUL STOVES
 APPROVED: IAN MCKILWANE-WHITTON

SYDNEY METRO CITY & SOUTHWEST

CENTRAL STATION
TRACK FORMATION CONTROL LINE (UP / DOWN MSW & UP / DOWN MNW)
HORIZONTAL ALIGNMENT

STATUS: TENDER

SHEET 1 OF 1

NWRL Dwg No. NWRLSRT-PBA-SCS-RD-DWG-938215

NWRL REV. 01

TRACK FORMATION CONTROL LINE (DOWN MSW) - VERTICAL

ELEMENT	KILOMETRAGE (m)	ELEVATION (m)	NORTHING (m)	EASTING (m)	RADIUS (m)	GRADE (%)	LENGTH (m)
Element: Linear						0.000%	180.0000
IP.	0km 073.2060	-4.6500	6249275.7804	3341619391			
SVC	0km 253.2060	-4.6500	6249123.3151	334066.2697			
Element: Symmetrical Parabola					3080.0000		60.0000
SVC	0km 253.2060	-4.6500	6249123.3151	334066.2697			
IP.	0km 283.2060	-4.6500	6249097.9943	334050.3143			
EVC	0km 313.2060	-5.2500	6249072.4934	334034.3679			
Element: Linear						-2.000%	608.618
EVC	0km 313.2060	-5.2500	6249072.4934	334034.3679			
SVC	0km 921.0237	-17.4224	6249556.9765	333710.0594			

NOTE
THIS ELEMENT OVERLAPS THE UP METRO NORTHWEST GRADE THROUGH CENTRAL STATION.
ACTUAL LENGTH OF GRADE IS 196m.

NOTES

1. TRACK FORMATION CONTROL LINE KILOMETRAGE SHOWN ARE REFERENCED FROM CENTRAL STATION PLATFORM 1 BUFFER STOP.
2. FOR HORIZONTAL TRANSITIONS AND VERTICAL CURVES FORMULAE REFER TO ASA RAILCORP STANDARD ESC 210.
3. LEVELS AND DIMENSIONS SHOWN ARE INDICATIVE ONLY.
4. ARRANGEMENT, SIZING AND LEVELS ARE SUBJECT TO CONFIRMATION DURING DETAILED DESIGN.

LEGEND

HORIZONTAL	IP TANGENT POINT	VERTICAL	SVC START VERTICAL CURVE
TRS TRANSITION POINT	IP INTERSECTION POINT	EVC END VERTICAL CURVE	
R RADIUS			
CENTRE CENTRE OF CIRCLE			

TRACK FORMATION CONTROL LINE (UP MSW) - VERTICAL

ELEMENT	KILOMETRAGE (m)	ELEVATION (m)	NORTHING (m)	EASTING (m)	RADIUS (m)	GRADE (%)	LENGTH (m)
Element: Linear						0.000%	179.9999
IP.	0km 073.2061	-4.6500	6249284.3010	334164.3611			
SVC	0km 253.2060	-4.6500	6249131.8358	334052.6828			
Element: Symmetrical Parabola					2999.9993		60.0000
SVC	0km 253.2060	-4.6500	6249131.8358	334052.6828			
IP.	0km 283.2060	-4.6500	6249106.4249	334036.7364			
EVC	0km 313.2060	-5.2500	6249081.0140	334020.7961			
Element: Linear						-2.000%	613.995
EVC	0km 313.2060	-5.2500	6249081.0140	334020.7961			
SVC	0km 927.2012	-17.5299	6249560.9422	333694.4231			

NOTE
THIS ELEMENT OVERLAPS THE DOWN METRO NORTHWEST GRADE THROUGH CENTRAL STATION.
ACTUAL LENGTH OF GRADE IS 196m.

TRACK FORMATION CONTROL LINE (UP MNW) - VERTICAL

ELEMENT	KILOMETRAGE (m)	ELEVATION (m)	NORTHING (m)	EASTING (m)	RADIUS (m)	GRADE (%)	LENGTH (m)
Element: Linear						0.000%	179.9999
IP.	0km 243.2060	-4.6500	6249131.7854	3340715762			
SVC	0km 63.2061	-4.6500	6249284.2506	334167.2545			
Element: Symmetrical Parabola					13714.10		60.0000
SVC	0km 63.2061	-4.6500	6249284.2506	334167.2545			
IP.	0km 312.0641	-4.6500	6249309.6608	334183.2019			
EVC	0km 3.2061	-5.9625	6249336.9521	334199.3367			
Element: Linear						-4.375%	242.7605
EVC	0km 3.2061	-5.9625	6249336.9521	334199.3367			
SVC	0km 239.5544	-16.5834	6249540.6890	334327.2015			

NOTE
THIS ELEMENT OVERLAPS THE DOWN METRO SOUTHWEST GRADE THROUGH CENTRAL STATION.
ACTUAL LENGTH OF GRADE IS 196m.

TRACK FORMATION CONTROL LINE (DOWN MNW) - VERTICAL

ELEMENT	KILOMETRAGE (m)	ELEVATION (m)	NORTHING (m)	EASTING (m)	RADIUS (m)	GRADE (%)	LENGTH (m)
Element: Linear						0.000%	179.9997
IP.	0km 243.206	-4.6500	6249160.3061	334057.9983			
SVC	0km 63.2063	-4.6500	6249292.7711	334153.6765			
Element: Symmetrical Parabola					13713.980		60.0000
SVC	0km 63.2063	-4.6500	6249292.7711	334153.6765			
IP.	0km 33.2063	-4.6500	6249318.1800	334169.6262			
EVC	0km 3.2063	-5.9625	6249343.4070	334185.8686			
Element: Linear						-4.375%	252.6765
EVC	0km 3.2063	-5.9625	6249343.4070	334185.8686			
SVC	0km 249.4702	-17.0174	6249557.2911	334318.8562			

NOTE
THIS ELEMENT OVERLAPS THE UP METRO SOUTHWEST GRADE THROUGH CENTRAL STATION.
ACTUAL LENGTH OF GRADE IS 196m.

100mm AT FULL SIZE Plot Date: 14/06/17 - 10:16

REV.	BY	DATE	DESCRIPTION	APPD.
01	JS	13.06.17	ISSUED FOR TENDER	IMW

Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

CLIENT

Plot Date: 14/06/17 - 10:16

Service Providers

PARSONS BRINCKERHOFF
AECOM
COX HASSELL

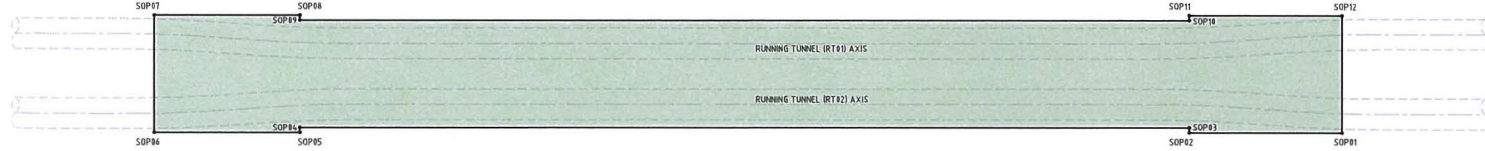
DESIGNED BY: ARTHUR GRMAS
DESIGNED BY: MATTHEW EDWARDS
DESIGN CHECK: MATTHEW EDWARDS
DESIGN CHECK: PAUL STOVES
APPROVED: IAN MCKELWAHE WHITTON

SYDNEY METRO CITY & SOUTHWEST

CENTRAL STATION
TRACK FORMATION CONTROL LINE (UP / DOWN MSW & UP / DOWN MNW)
VERTICAL ALIGNMENT

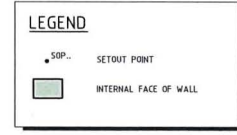
STATUS: TENDER | SHEET 1 OF 1 | ©

MWRL Dwg No. **NWRLSRT-PBA-SCS-RD-DWG-938216** | MWRL Rev. 01

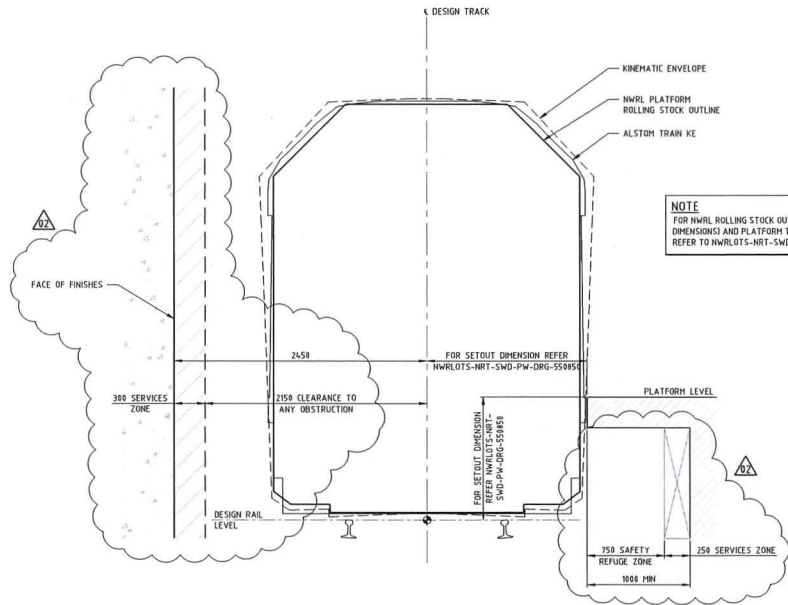


METRO STATION MINIMUM INTERNAL WALL SETOUT - PLAN
SCALE 1:500

- NOTES**
1. CO-ORDINATE SYSTEM IS TO MAP GRID OF AUSTRALIA - MGA ZONE 56.
 2. ALL LEVELS ARE TO THE AUSTRALIAN HEIGHT DATUM (AHD).
 3. ALL DIMENSIONS ARE IN METRES UNLESS SHOWN OTHERWISE.
 4. LEVELS AND DIMENSIONS SHOWN ARE INDICATIVE ONLY.
 5. ARRANGEMENT, SIZING AND LEVELS ARE SUBJECT TO CONFIRMATION DURING DETAILED DESIGN.



METRO STATION SETOUT		
POINT	EASTING	NORTHING
SOP01	334 039.619	624 9117.603
SOP02	334 055.432	624 914 2.802
SOP03	334 056.278	624 914 2.271
SOP04	334 14.8 24.4	624 9288 820
SOP05	334 14.7 398	624 9289 351
SOP06	334 162 4.06	624 9313 266
SOP07	334 181.913	624 9301.025
SOP08	334 166.910	624 9277.118
SOP09	334 166.064	624 9277.649
SOP10	334 074.092	624 9131.092
SOP11	334 074.940	624 9130.560
SOP12	334 059.126	624 9105.361



PLATFORM STRUCTURE GAUGE & KINEMATIC ENVELOPE
SCALE 1:25

100mm AT FULL SIZE Plot Date: 11/08/17 - 11:06

REV.	BY	DATE	DESCRIPTION	APPD.
02	JS	11.08.17	RE-ISSUED FOR TENDER	IMW
01	JS	13.06.17	ISSUED FOR TENDER	IMW

SCALES

0.25 0 0.25 0.50 0.75m

1:25 FULL SIZE A1

5 0 5 10 15m

1:500 FULL SIZE A1

Plot Date: 11/08/17 - 11:06

CLIENT

Transport for NSW

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SERVICE PROVIDERS

PARSONS BRINCKERHOFF

AECOM

COX HASSELL

DRAWN: ARTHUR GERVAS

DESIGNED: MATTHEW O'LEARY

DWG CHECK: MATTHEW O'LEARY

DESIGN CHECK: IAN MCKILWANE WHITTON

APPROVED: IAN MCKILWANE WHITTON

SYDNEY METRO CITY & SOUTHWEST

METRO STATION WORKS

MINIMUM INTERNAL WALL SETOUT - METRO PLATFORM LEVEL

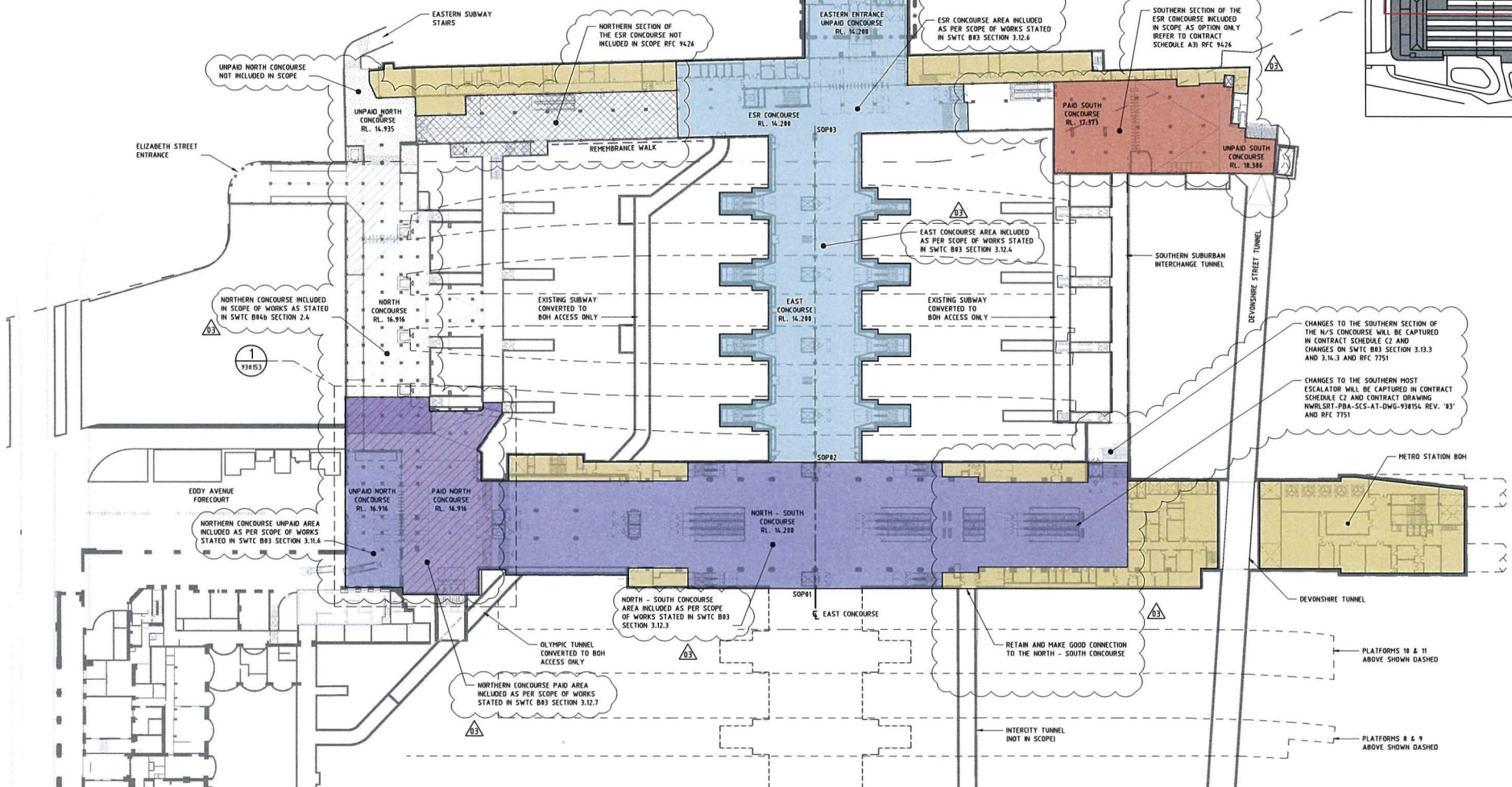
STATUS: TENDER

SHEET 1 OF 1

NWRL Dwg No. NWRLSRT-PBA-SCS-ST-DWG-938311

NWRL REV. 02

100mm AT FULL SIZE Plot Date: 15/02/18 - 10:15 Client File: C:\bms\wsp-pba-us-pw-c0\arthur_groves\dms5591\NWRLSRT-PBA-SCS-AT-DWG-938151.dwg



LEGEND

- MINIMUM EXTENT OF CENTRAL WALK FINISHES
- MINIMUM EXTENT OF CENTRAL STATION FINISHES - PUBLIC AREAS
- POSSIBLE BACK-OF-HOUSE WORKS DEPENDANT ON CONTRACTORS DESIGN
- GATELINE OPTION

NOTES

1. LEVELS AND DIMENSIONS SHOWN ARE INDICATIVE ONLY.
2. ARRANGEMENT, SIZING AND LEVELS ARE SUBJECT TO CONFIRMATION DURING DETAILED DESIGN.

EAST CONCOURSE SETOUT		
POINT	EASTING	NORTHING
SOP#1	334128.826	6269252.313
SOP#2	334165.640	6269236.351
SOP#3	334212.798	6269194.895

REV	BY	DATE	DESCRIPTION	APPD.
03	JS	12.02.18	INCORPORATION OF VE REVISIONS	IMW
02	JS	22.01.18	INCORPORATION OF VE REVISIONS	IMW
01	JS	13.06.17	ISSUED FOR TENDER	IMW

SCALES

1:500 FULL SIZE A1

Plot Date: 15/02/18 - 10:15

NOTE: Do not scale from this drawing.

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SERVICE PROVIDERS

PARSONS BRINCKERHOFF
AECOM
COX HASSELL

DESIGNED: ARTHUR GROVES
 DESIGNED: MATTHEW O'LEARY
 DRG CHECK: MATTHEW O'LEARY
 DESIGN CHECK: MATTHEW O'LEARY
 APPROVED: IAN MCLWANE-WHITTON

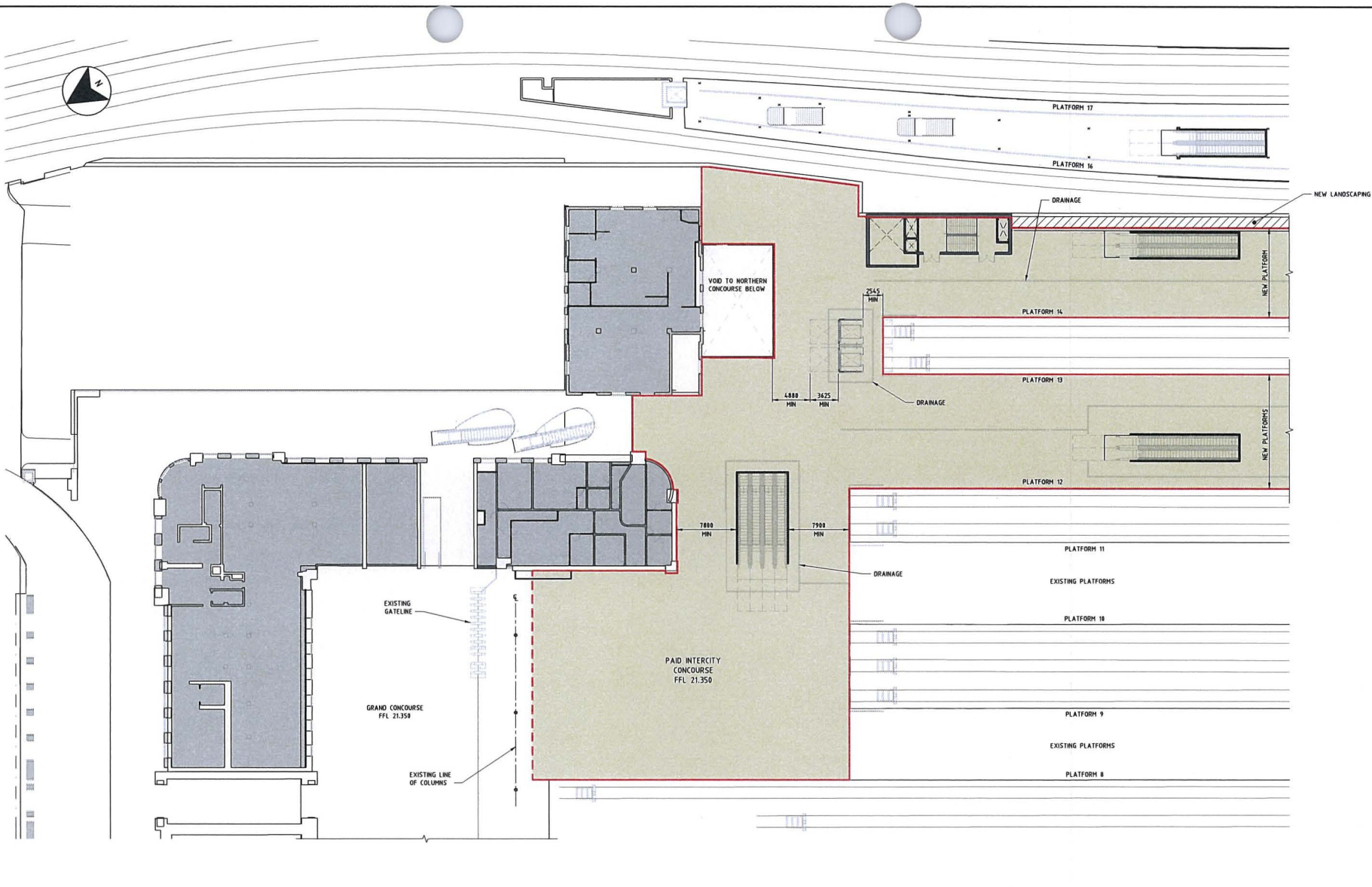
SYDNEY METRO CITY & SOUTHWEST

CENTRAL WALK WORKS
 STATION FINISHES EXTENT
 METRO CONCOURSE & EAST CONCOURSE & ESR & EASTERN ENTRY

STATUS: TENDER SHEET 1 OF 1

NWRL Proj No. NWRLSRT-PBA-SCS-AT-DWG-938151 NWRL REV. 03

100mm AT FULL SIZE Plot Date: 14/05/17 - 10:15 Client File: C:\PDP\NWRLSRT-PBA-SCS-AT-DWG-938152.dwg



LEGEND

- MINIMUM EXTENT OF FINISHES
CENTRAL STATION WORKS AT THE NORTHERN END
- EXISTING BUILDING & FACILITIES

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
2. LEVELS AND DIMENSIONS SHOWN ARE INDICATIVE ONLY.
3. ARRANGEMENT, SIZING AND LEVELS ARE SUBJECT TO CONFIRMATION DURING DETAILED DESIGN.

REV	BY	DATE	DESCRIPTION	APPD.
01	JS	13.06.17	ISSUED FOR TENDER	IMW

SCALES	
	1:250 FULL SIZE A1

Plot Date: 14/05/17 - 10:15

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SERVICE PROVIDERS
PARSONS BRINCKERHOFF
AECOM
COX HASSELL

DRAWN: MATHEW GRIMAS
 DESIGNED: MATTHEW O'LEARY
 DRG CHECK: MATTHEW O'LEARY
 DESIGN CHECK: _____
 APPROVED: IAN MCKELWANE WHITTON

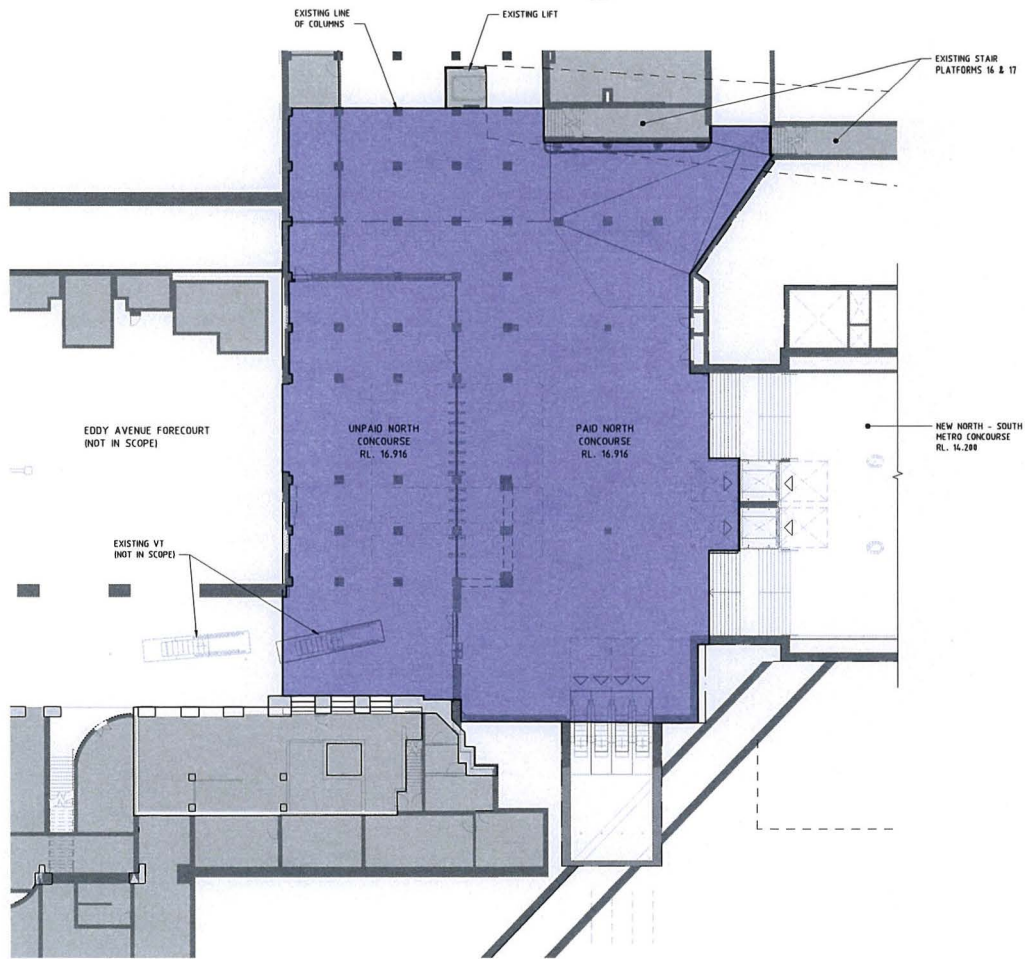
SYDNEY METRO CITY & SOUTHWEST

CENTRAL STATION WORKS
 MINIMUM FINISHES EXTENT
 NORTH CONCOURSE LEVEL

STATUS: TENDER

HWRL Dwg No. **NWRLSRT-PBA-SCS-AT-DWG-938152** HWRL REV. **01**

100mm AT FULL SIZE Plot Date: 14/05/17 - 14:04 Client: C:\PDP\NWRLSRT-PBA-SCS-AT-DWG-938153.dwg



1 NORTHERN ENTRANCES FLOOR PLAN RL. 16.916
SCALE 1:200

LEGEND

- MINIMUM EXTENT OF FINISHES
- CENTRAL STATION MAIN WORKS AT THE NORTHERN END
- EXISTING BUILDING & FACILITIES

NOTES

1. LEVELS AND DIMENSIONS SHOWN ARE INDICATIVE ONLY.
2. ARRANGEMENT, SIZING AND LEVELS ARE SUBJECT TO CONFIRMATION DURING DETAILED DESIGN.

REV	BY	DATE	DESCRIPTION	APPD.
01	JS	13.06.17	ISSUED FOR TENDER	IMW

SCALES
<p>1:200 FULL SIZE A1</p>

Plot Date: 14/05/17 - 14:04

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SERVICE PROVIDERS

PARSONS BRINCKERHOFF

AECOM

COX HASSELL

DESIGNED BY: ARTHUR GRIMAS
 DESIGNED BY: MATTHEW O'LEARY
 DRG CHECK BY: MATTHEW O'LEARY
 DESIGN CHECK: JAN MCKILWANE-WHITTON

SYDNEY METRO CITY & SOUTHWEST

CENTRAL STATION MAIN WORKS
 MINIMUM FINISHES EXTENT
 NORTH CONCOURSE

STATUS: TENDER

SHEET 1 OF 1

NWRL Dep No: NWRLSRT-PBA-SCS-AT-DWG-938153

NWRL REV 01

A1 Original Co-ordinate System: MGA Zone 56 Height Datum: A.H.D. This sheet may be prepared using colour and may be incomplete if copied

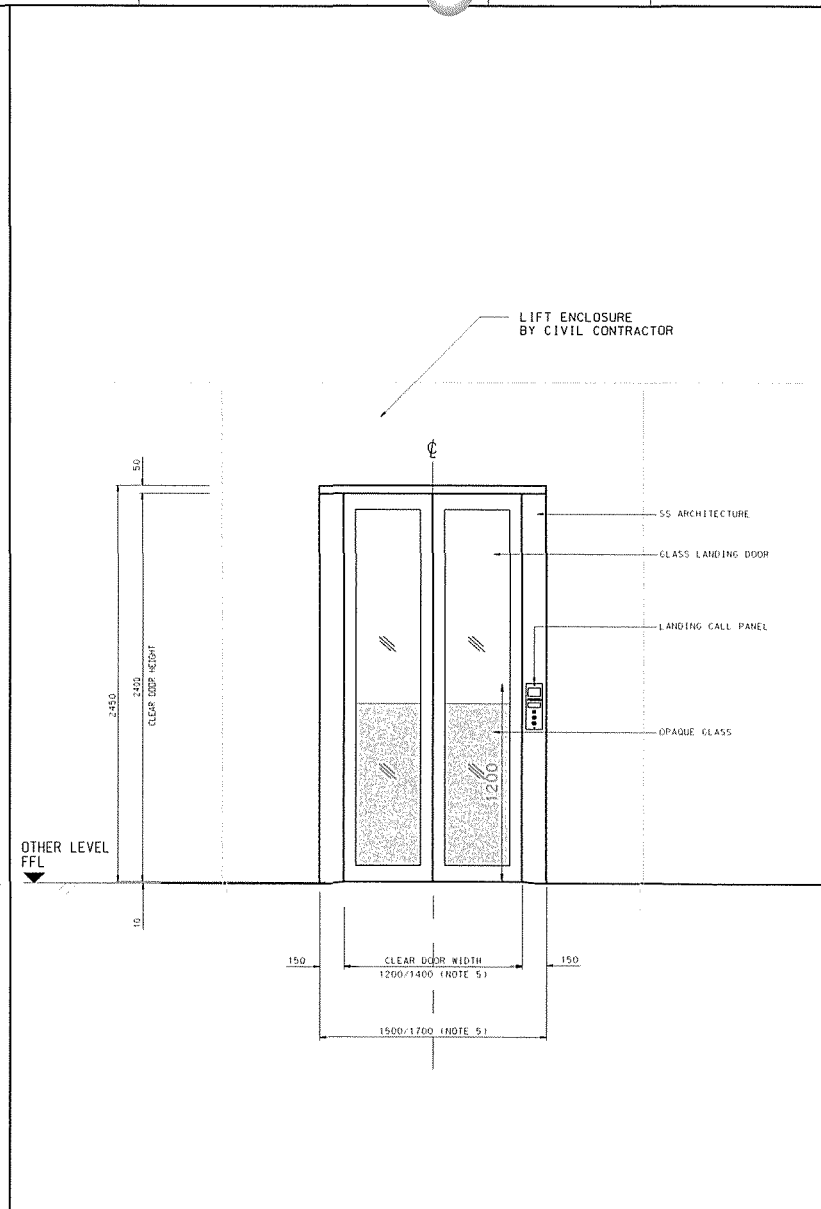
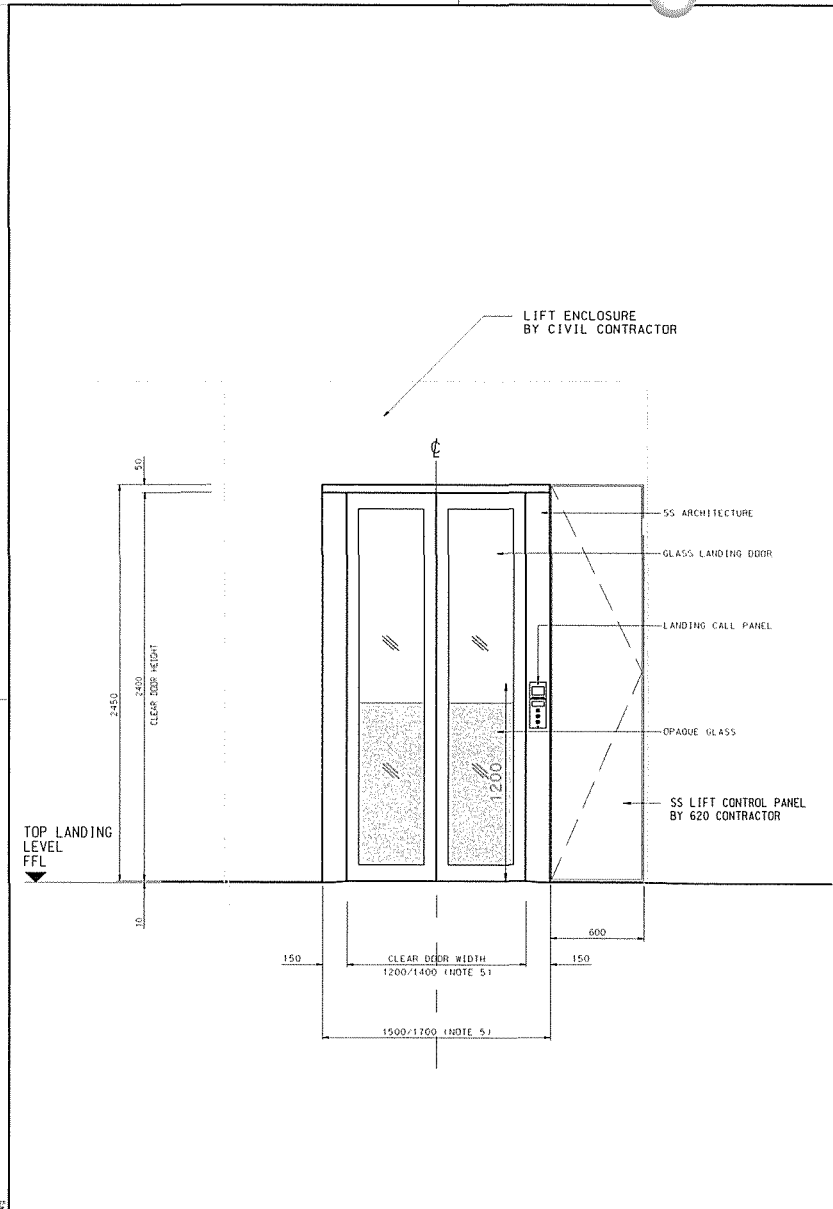
NOTE: Do not scale from this drawing.

LEGEND :

SS STAINLESS STEEL

NOTES:

1. ALL REQUIRED LIFT EQUIPMENT & COMPONENTS TO BE SUPPLIED & INSTALLED BY 620 CONTRACTOR UNLESS OTHERWISE SPECIFIED.
2. ALL DIMENSIONS AND STRUCTURAL MEMBER SIZES ARE INDICATIVE ONLY. 620 CONTRACTOR SHALL VERIFY THESE DIMENSIONS TO ENSURE MEETING THE SPECIFIC PROJECT REQUIREMENTS.
3. LIFT SHAFT ENCLOSURE TO BE CONSTRUCTED BY CIVIL CONTRACTOR.
4. FOR SPECIFIC FINISHES REFER TO GENERAL ARRANGEMENT PLANS, ELEVATIONS, SECTIONS AND FINISHES SCHEDULE.
5. CLEAR DOOR WIDTH SHALL REFER TO THE LIFT CAPACITY:
1400mm FOR 2025 kg LIFT
1200MM FOR 1275 kg LIFT
6. PRIOR TO FINALIZING THE REVISION, THIS DRAWING IS FOR INFORMATION ONLY. WITH A NUMERIC SUFFIX APPENDED TO THE REVISION CODE FOR VERSION CONTROL AND RELEASE DISTINCTION. THE REVISION FOR THE FINAL ISSUE OF THE DRAWING SHALL BE "A".



01 ELEVATION : LIFT LANDING DOOR AND ARCHITRAVE (FOR TOP LANDING LEVEL)

1 : 25 (A1)
1 : 50 (A3)

02 ELEVATION : LIFT LANDING DOOR AND ARCHITRAVE (FOR OTHER LEVEL)

1 : 25 (A1)
1 : 50 (A3)

FOR INFORMATION ONLY

FILE NO: EX-1001
 DRAWING NO: 620 T 000 MTR N82 003 A2
 DATE: 2017/04/17

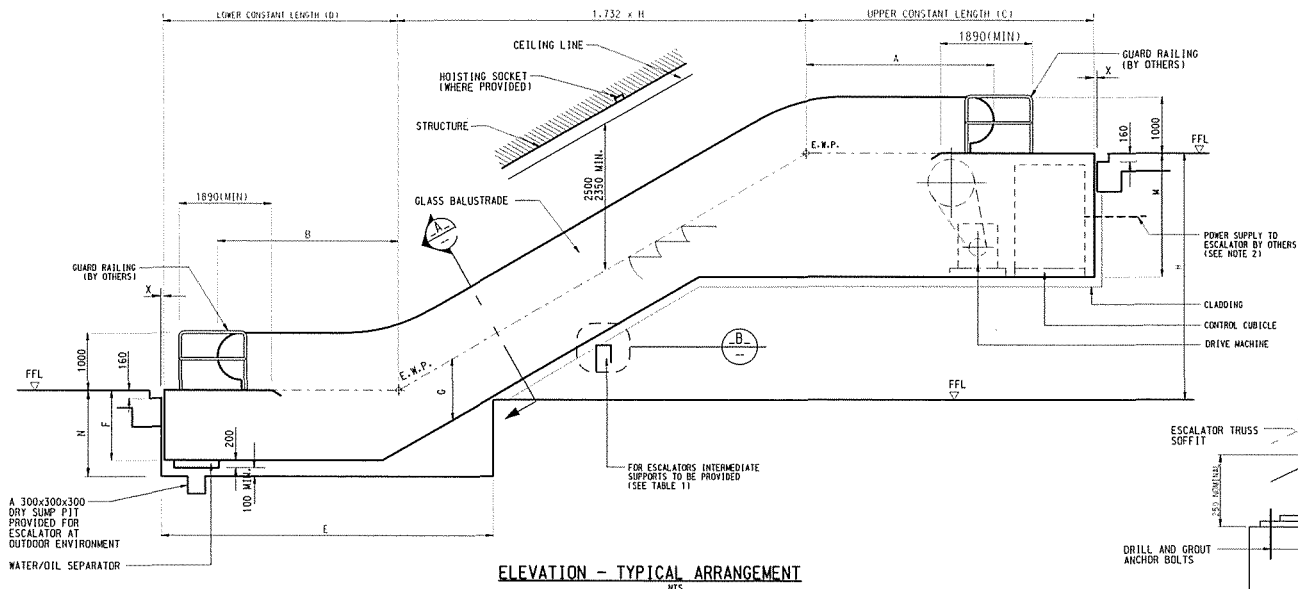
REV	DESCRIPTION	BY	DATE	APPROVED	REV
A2	DIMENSION FOR LCP INCORPORATED	CW	APR17	EY	
A1	FIRST DRAFT	CW	FEB17	EY	

BY	DATE	APPROVED
CW	APR17	EY
CW	FEB17	EY

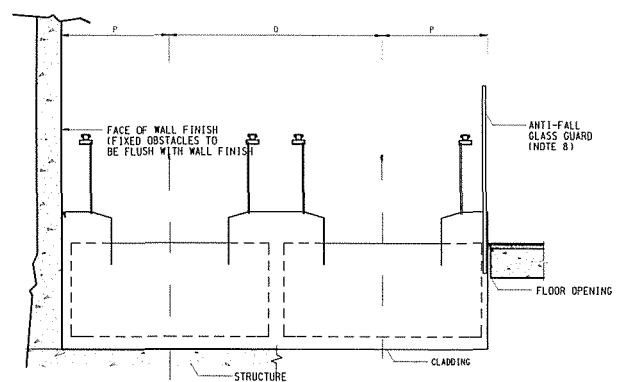
DRAWN	C Wong
DESIGNED	E Young
CHECKED	E Young
APPROVED	Zoe Tan
DATE	APR/2017

MTR
SYDNEY METRO CITY & SOUTHWEST
 ENGINEERING DIVISION | E&M ENGINEERING DEPARTMENT
 CADD REF: 620 T 000 MTR N82 003 A2.dwg

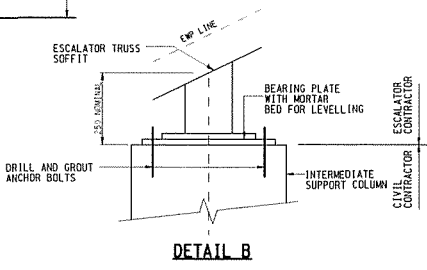
CONTRACT 620
LIFTS & ESCALATORS
 TITLE
TYPICAL ENTRANCE ELEVATION FOR PASSENGER LIFT
 SCALE: AS SHOWN | DRAWING NO: 620/T/000/MTR/N82/003 | REV: A2



ELEVATION - TYPICAL ARRANGEMENT



SECTION A - TYPICAL ARRANGEMENT



DETAIL B

- NOTES :
- THE DIMENSIONS ARE SUBJECT TO VARIATION WITHIN THE MAX. VALUES AS SHOWN. EXACT DIMENSIONS ARE TO BE CONFIRMED BY 620 CONTRACTOR.
 - OPENINGS FOR CABLE ENTRY AND VENTILATION TO BE PROVIDED. EXACT SIZE AND LOCATION TO BE ADVISED BY 620 CONTRACTOR.
 - INTERMEDIATE SUPPORTS ARE ASSUMED EVENLY SPACED BETWEEN THE LOWER AND UPPER END SUPPORTS ON PLAN, AND LOCATED ON BOTH SIDES OF ESCALATORS UNDERNEATH THE ESCALATOR TRUSSES.
 - CIVIL DESIGNER SHALL VERIFY THE STRUCTURAL DESIGN CRITERIA WITH 620 CONTRACTOR IN DETAILED DESIGN STAGE.
 - # - THESE DIMENSIONS ARE THE MAXIMUM DIMENSION OF THE TRUSS DEPTH FROM FINISHED FLOOR LEVEL.
 - FOR ESCALATOR WITH 2 NOS. OF INTERMEDIATE SUPPORTS, THE DIMENSION SHALL TO BE CONFIRMED BY 620 CONTRACTOR.
 - ESCALATOR WITH RISE GREATER THAN 15M IS NOT RECOMMENDED FOR GLASS BALUSTRADE ESCALATOR. EXACT ARRANGEMENT WILL BE REVIEWED CASE BY CASE.
 - ANTI-FALL GLASS GUARD SHALL BE PROVIDED FOR ESCALATORS INSTALLED IN OPEN VOID AREA WITH VERTICAL RISE GREATER THAN 3m.
 - PRIOR TO FINALIZING THE REVISION, THIS DRAWING IS FOR INFORMATION ONLY. WITH A NUMERIC SUFFIX APPENDED TO THE REVISION CODE FOR VERSION CONTROL AND RELEASE DISTINCTION. THE REVISION FOR THE FINAL ISSUE OF THE DRAWING SHALL BE "A".

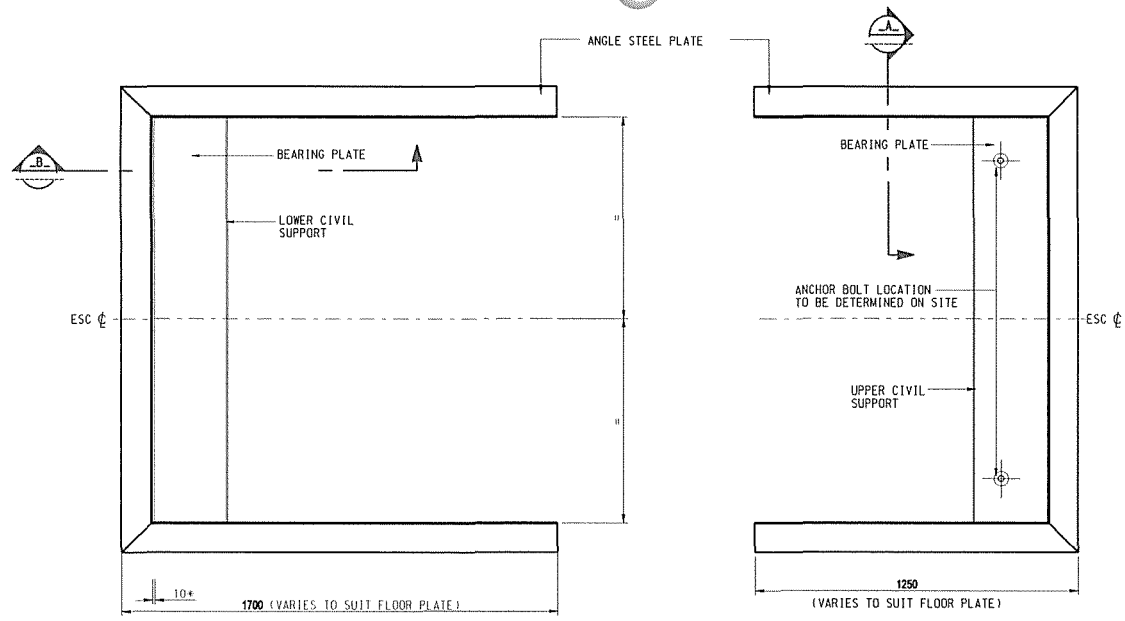
RISE (m)	KEY DIMENSIONS (mm) (NOTE 1)											SINGLE ESC			PARALLEL ARRANGEMENT (ADJACENT ESC. OF SAME RISE)			NO. OF INTERMEDIATE SUPPORT	REACTION (kN) AT SUPPORTS			
	H	A	B	C	C + X	D	D + X	E	F# (NOTE 5)	G (NOTE 6)	M# (NOTE 5)	N	P (MIN.)	O (MIN.)	P (MIN.)							
																UPPER	INTERMEDIATE		LOWER			
UP TO 5m	3250	2800	4900	4950	4000	4050	6600	1200	1300	2100	1500	950	1800	950	0	165	N.A.	N.A.	140			
5m < H ≤ 7m	3250	2800	4900	4950	4000	4050	7650	1200	2000	2100	1800	950	1800	950	0	195	N.A.	N.A.	165			
7m < H ≤ 10m	3250	2800	4900	4950	4000	4050	6600	1200	1300	2100	1500	950	1800	950	1	85	165	N.A.	85			
10m < H ≤ 15m	3250	2800	5300	5350	4000	4050	6600	1200	1300	2100	1500	950	1800	950	1	110	220	N.A.	85			
15m < H ≤ 20M (NOTE 7)	3500	2800	5900	5950	4000	4050	6600	1200	NOTE 6	2100	1500	1000	1900	1000	2	110	195	195	85			
15m < H ≤ 20M (NOTE 7)	3500	2800	6300	6350	4300	4350	7200	1200	NOTE 6	2100	1500	1050	2000	1050	2	140	305	305	140			

TABLE 1 ESCALATOR DIMENSIONS

FOR INFORMATION ONLY

PLOT NO: 620T001A3
 USER NAME: D:\A3\A3.dwg
 FILENAME: 620 T 000 MTR N99 001 A3.dwg
 3/23/2017 14:58 PM
 USER: RUIHEI

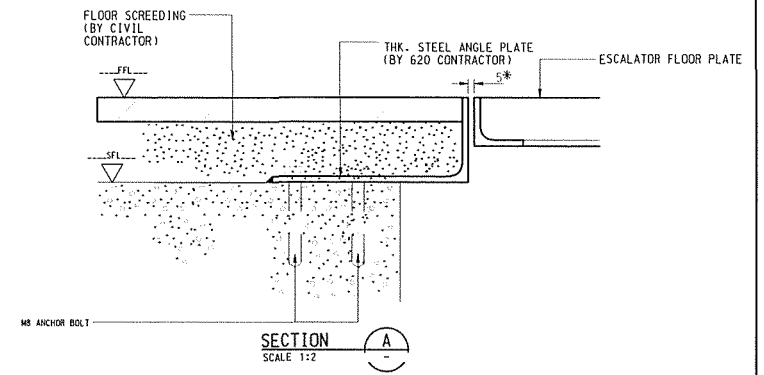
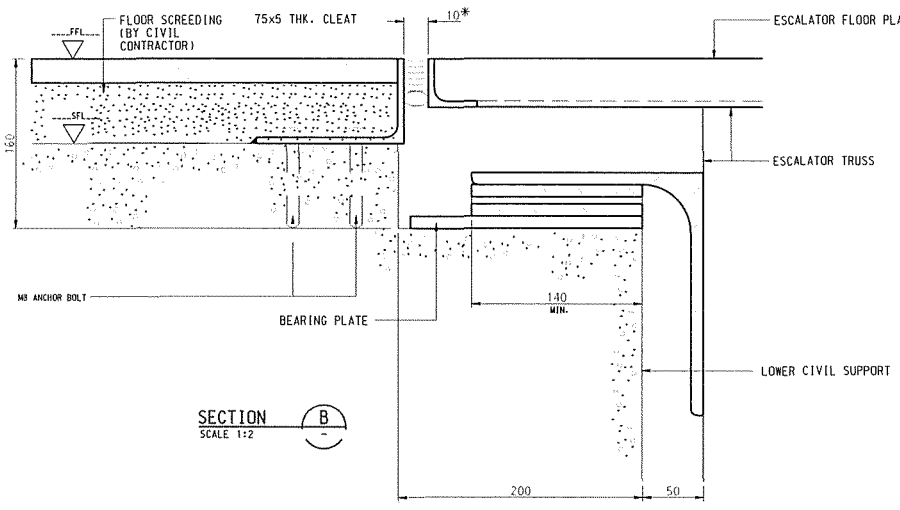
A3 ANTI-FALL GLASS GUARD UPDATED A2 LOADING REQUIREMENT INCORPORATED A1 FIRST DRAFT				CK M4Y17 EY CK M4R17 EY CK FEB17 EY				DRAWN: C Wong DESIGNED: E Young CHECKED: E Young APPROVED: Zoe Tee DATE: FEB/2017				MTR SYDNEY METRO CITY & SOUTHWEST ENGINEERING DIVISION EAM ENGINEERING DEPARTMENT				TITLE: CONTRACT 620 LIFTS & ESCALATORS TYPICAL ESCALATOR CIVIL DIMENSIONS			
SCALE: N.T.S.				DRAWING NO: 620/T/000/MTR/N99/001				CADD REF: 620 T 000 MTR N99 001 A3.dwg				REV: A3							



- NOTES :
1. ALL DIMENSIONS ARE GIVEN IN mm UNLESS OTHERWISE SPECIFIED.
 2. STEEL PLATES SHALL BE PROVIDED AND FIXED BY 620 CONTRACTOR.
 3. BEARING PLATES SHALL BE PROVIDED AND SET BY 620 CONTRACTOR.
 4. FLOOR PLATE TRIM ANGLE TO BE FIXED BY 620 CONTRACTOR AFTER ESCALATOR LANDING PLATES ARE IN POSITION.
 5. 'x' GAPS BETWEEN FLOOR PLATE TRIM ANGLE AND FLOOR PLATE SHALL BE FILLED UP WITH APPROVED POLYSULPHIDE BASED SEALANT BY 620 CONTRACTOR.
 6. DIMENSIONS SHOWN IN THIS DRAWING ARE FOR INDICATIVE PURPOSES ONLY. EXACT DIMENSIONS TO BE PROVIDED BY ESCALATOR CONTRACTOR.
 7. PRIOR TO FINALIZING THE REVISION, THIS DRAWING IS FOR INFORMATION ONLY, WITH A NUMERIC SUFFIX APPENDED TO THE REVISION CODE FOR VERSION CONTROL AND RELEASE DISTINCTION. THE REVISION FOR THE FINAL ISSUE OF THE DRAWING SHALL BE "A".

FLOOR PLATE TRIM ANGLE AT LOWER SUPPORT
SCALE: 1:10

FLOOR PLATE TRIM ANGLE AT UPPER SUPPORT
SCALE: 1:10



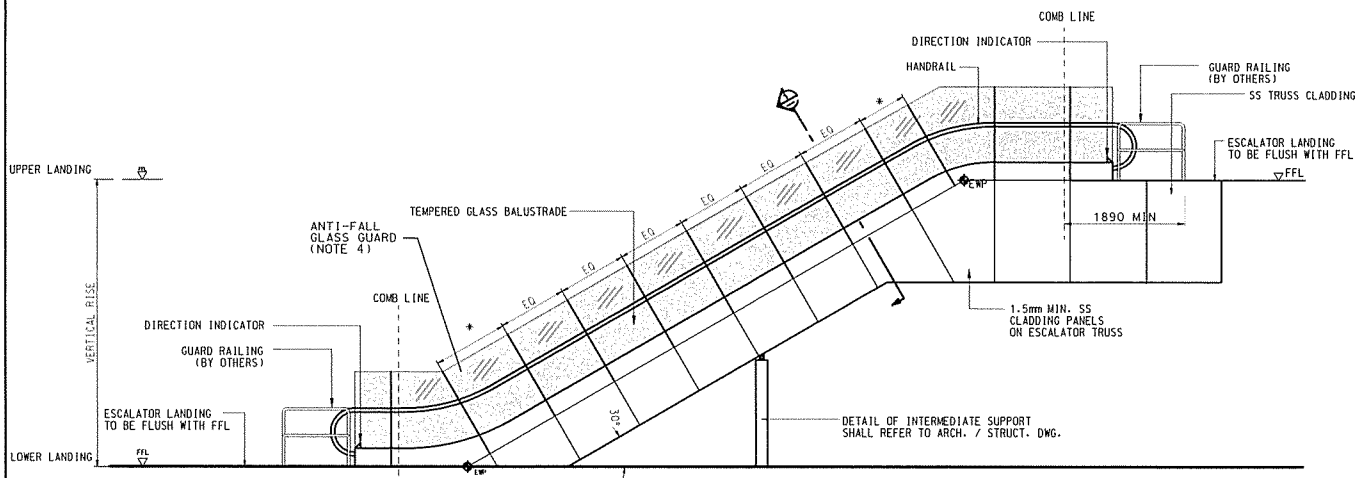
SECTION B
SCALE 1:2

SECTION A
SCALE 1:2

FOR INFORMATION ONLY

PLOT BY: BILSON33 PRINTED BY: N999
 MODIFIED: 24 FEB 2017 14:57
 PLOTTING: 22 FEB 2017 14:57

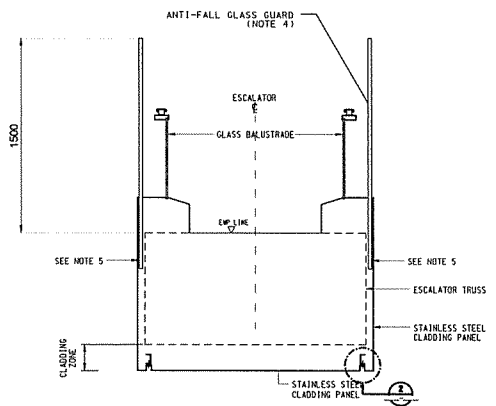
DRAWN: C Wong DESIGNED: E Yeung CHECKED: E Yeung APPROVED: Zoe Tse DATE: FEB/2017				MTR SYDNEY METRO CITY & SOUTHWEST ENGINEERING DIVISION EAM ENGINEERING DEPARTMENT				TITLE: CONTRACT 620 LIFTS & ESCALATORS TYPICAL DETAILS OF TRIMMING ANGLE AT ESCALATOR LANDINGS			
AT FIRST DRAFT				CAD REF: 620 T 000 MTR N99 005.dwg				SCALE AS SHOWN @ A1 DRAWING NO. 620/T/000/MTR/N99/005 REV. A1			



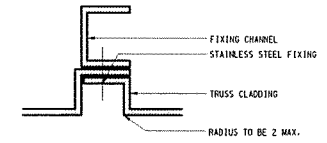
ELEVATION VIEW

- NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED.
 2. ALL MEASUREMENTS TO BE VERIFIED ON SITE.
 3. "R" DIMENSION TO BE DETERMINED BY 620 CONTRACTOR AND DEPENDANT ON EVENTUAL TRANSITION RADIUS.
 4. ANTI-FALL GLASS GUARD SHALL BE PROVIDED FOR ESCALATORS INSTALLED IN OPEN VOID AREA WITH VERTICAL RISE GREATER THAN 3m. THE COLOR OF THE ANTI-FALL GLASS GUARD SHALL BE SUBJECT TO THE STATION DESIGN. THE COLOR TO BE CONFIRMED AFTER CONTRACT AWARD.
 5. FIXING DETAILS OF THE ANTI-FALL GLASS GUARD SHALL BE DESIGNED BY 620 CONTRACTOR AND SUBMITTED FOR APPROVAL.
 6. PRIOR TO FINALIZING THE REVISION, THIS DRAWING IS FOR INFORMATION ONLY. WITH A NUMERIC SUFFIX APPENDED TO THE REVISION CODE FOR VERSION CONTROL AND RELEASE DISTINCTION. THE REVISION FOR THE FINAL ISSUE OF THE DRAWING SHALL BE "A".

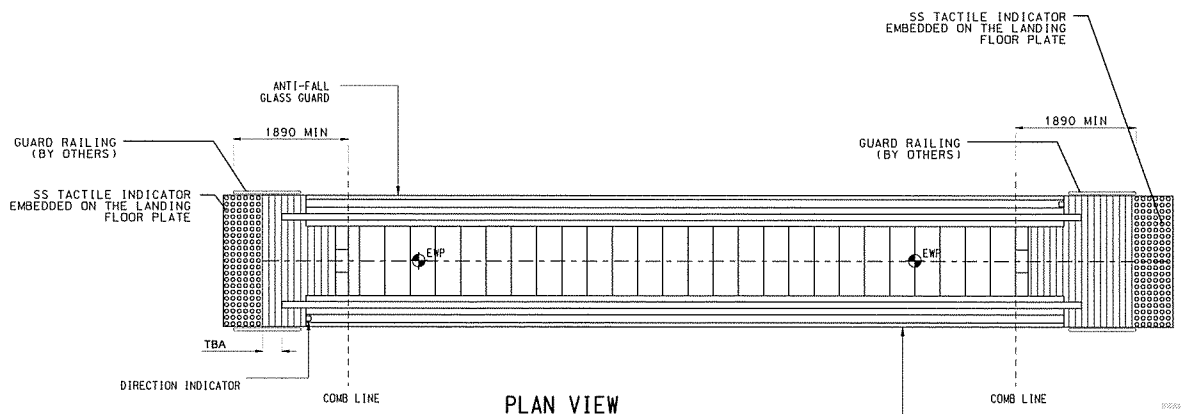
LEGEND
SS STAINLESS STEEL



SECTION 1



RECESSED JOINT DETAIL 2

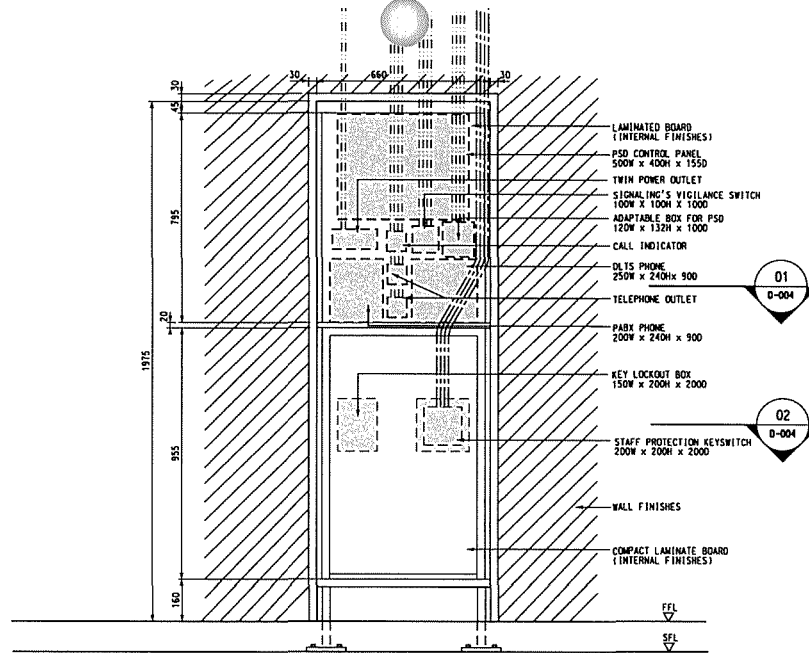
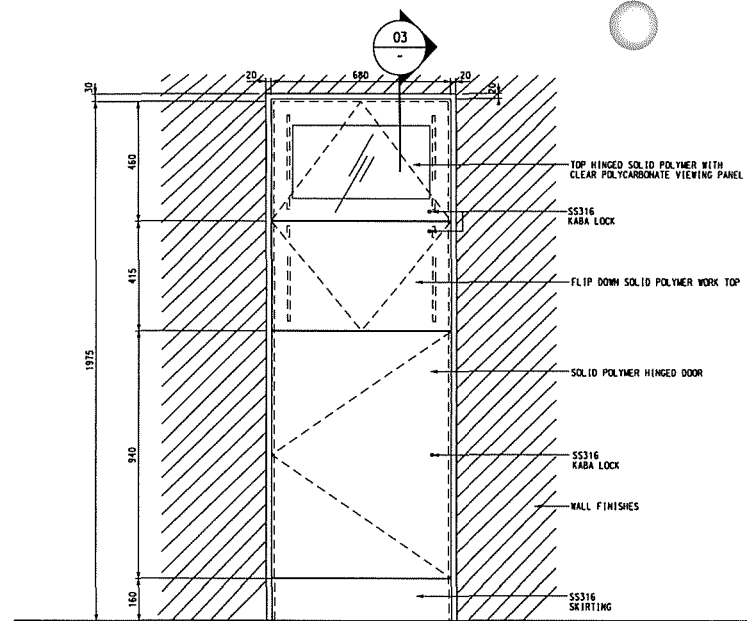


PLAN VIEW

FOR INFORMATION ONLY

DATE: 2014/05/14
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 PLOTTED BY: 3/1/2017 14:58 PM
 PLOTTED: 620/T/000/MTR/N99/006/A3.dwg

DRAWN: C Wong DESIGNED: E Young CHECKED: E Young APPROVED: Zoe Tse				MTR SYDNEY METRO CITY & SOUTHWEST ENGINEERING DIVISION E&M ENGINEERING DEPARTMENT				TITLE: CONTRACT 620 LIFTS & ESCALATORS TYPICAL ESCALATOR LAYOUT	
DATE: FEB/2017 A3 ANTI-FALL GLASS GUARD UPDATED A2 GLASS GUARD SUPPORTING POST REMOVED, GUARD RAILING INCORPORATED A1 FIRST DRAFT				DATE: FEB/2017 CW MAY17 EY CW MAY17 EY CW FEB17 EY BY DATE APPROVED				SCALE: NTS DRAWING NO: 620/T/000/MTR/N99/006 REV: A3	
REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED



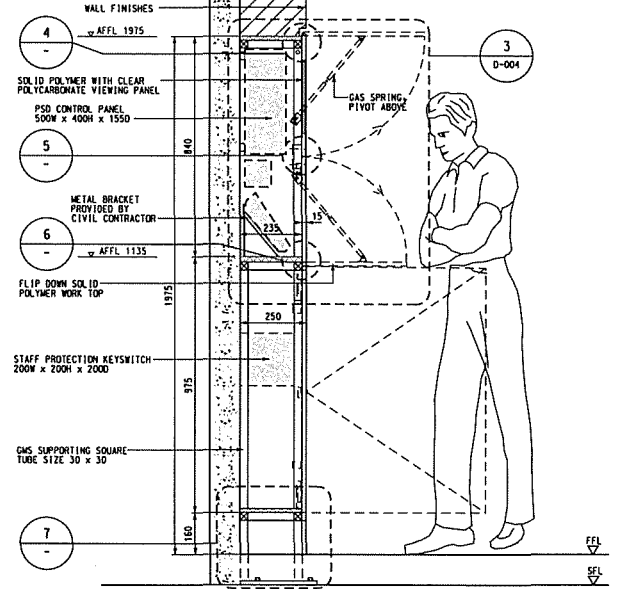
- LEGEND :
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- NOTES :
- CAST-IN GWS CONDUITS & JUNCTIONS BOXES BY BS CONTRACTOR; LOCATION TO BE COORDINATED.
 - ADD SIGNS ON DOORS AS REQUIRED. ARTWORK FOR SIGN TO BE PROVIDED BY MTRCL.
 - SPECIFICATION OF STAINLESS STEEL REFER TO SS316 P.S. AND ALL STAINLESS STEEL SHOULD BE SUPPORTED WITH COMPACT LAMINATE BOARD BACKING.
 - SPECIFICATION OF HEADWALL / TAILWALL UNITS REFER TO ACOT P.S.
 - PAINT COLOR OF GWS TO MATCH COMPACT LAMINATE BOARD FINISHES

01 FRONT ELEVATION : HW/TW UNIT

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1 : 20 (A3)

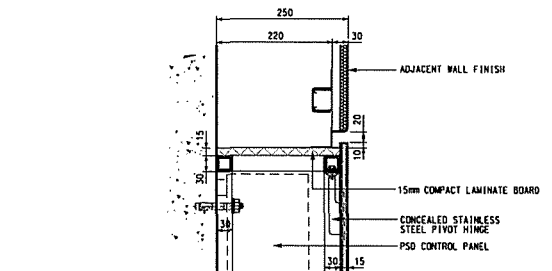
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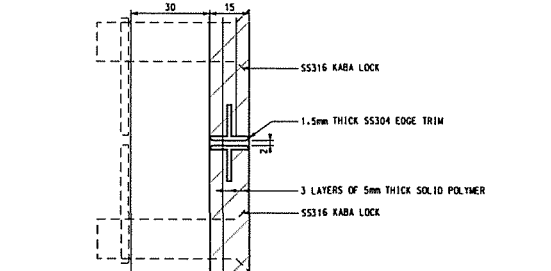


03 SECTION : HW/TW UNIT

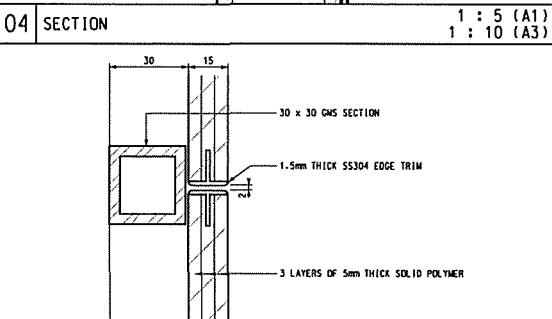
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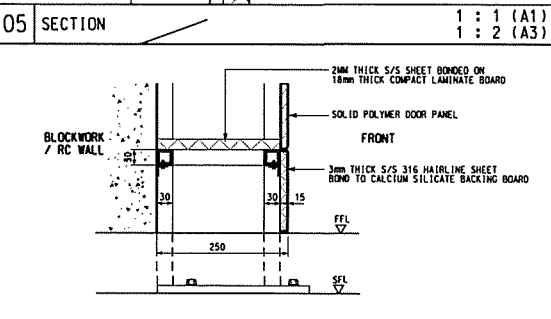
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1 : 1 (A1)
1 : 2 (A3)



1 : 1 (A1)
1 : 2 (A3)



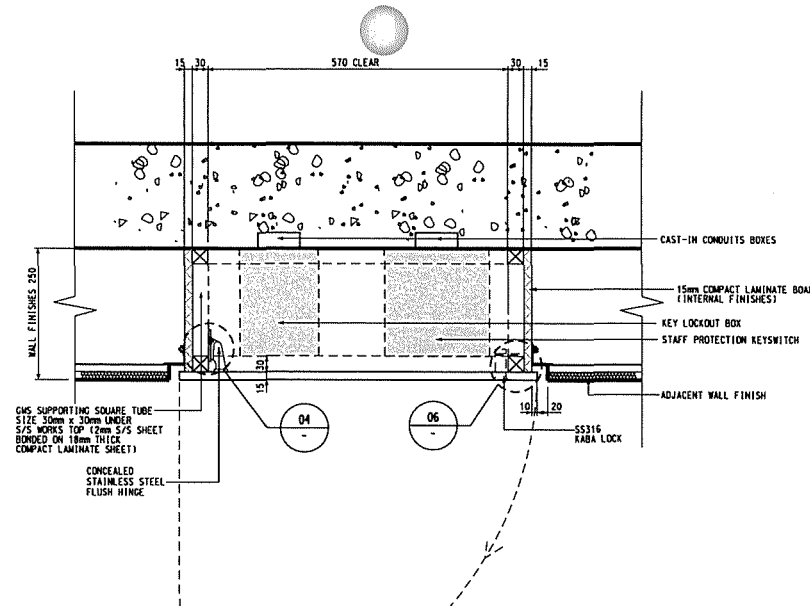
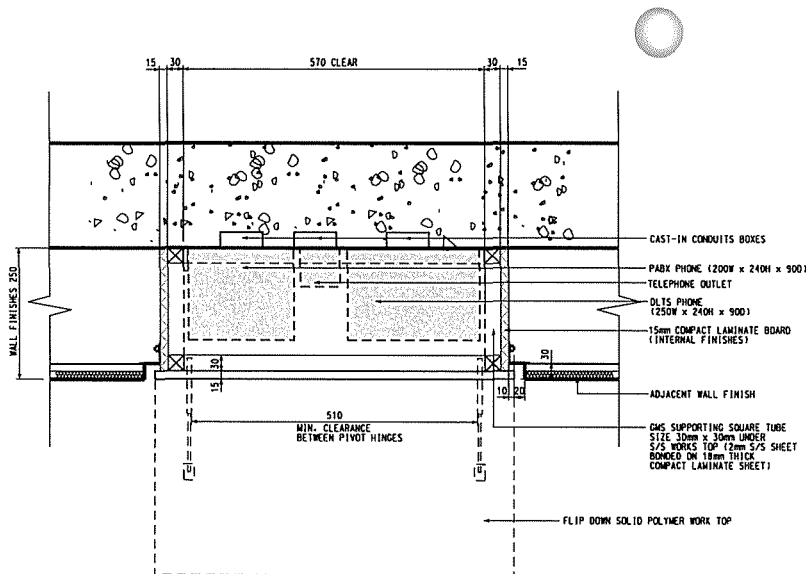
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TITLE
SIL(E) FRONT OF HOUSE
HEADWALL/TAILWALL UNITS
HW/TW UNIT ELEVATION & SECTIONS
WALL MOUNT TYPE

SCALE AS SHOWN DRAWING NO. HW_TW_D-003

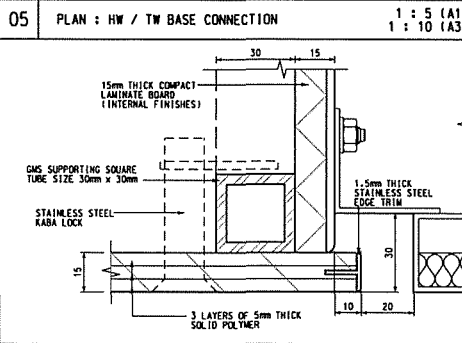
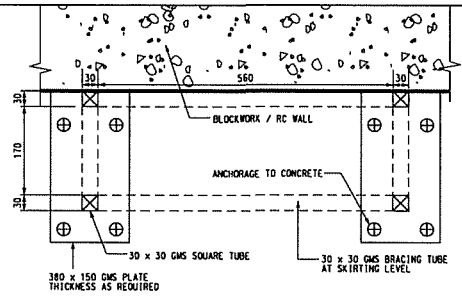
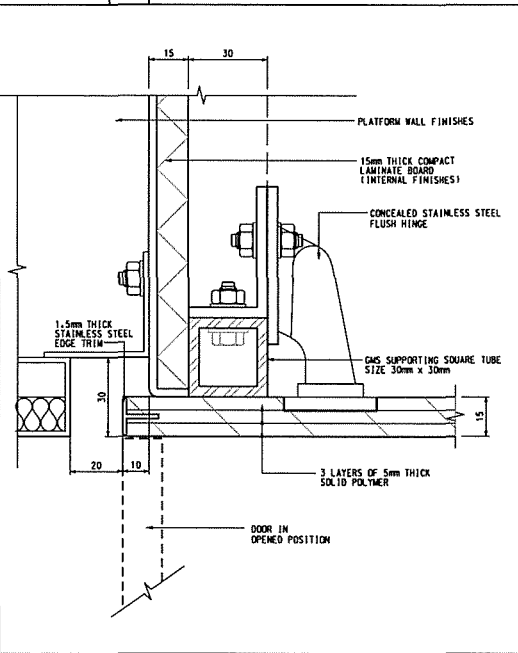
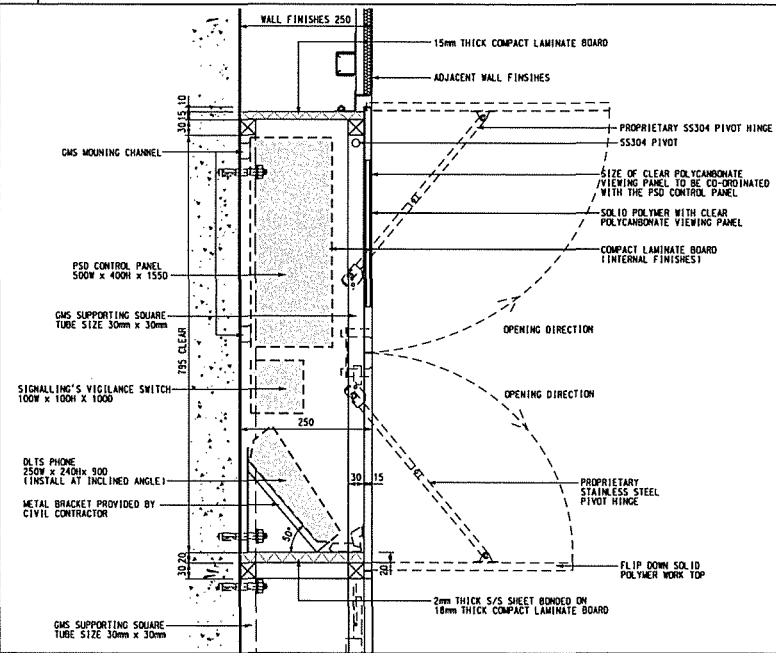
REV. A

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01 PLAN : HW/TW UPPER CASING 1 : 5 (A1) 1 : 10 (A3)

02 PLAN : HW/TW LOWER CASING 1 : 5 (A1) 1 : 10 (A3)



03 SECTION : HW/TW UPPER CASING 1 : 5 (A1) 1 : 10 (A3)

04 PLAN : HINGED DOOR 1 : 1 (A1) 1 : 2 (A3)

06 PLAN : HINGED DOOR 1 : 1 (A1) 1 : 2 (A3)

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NOTES :

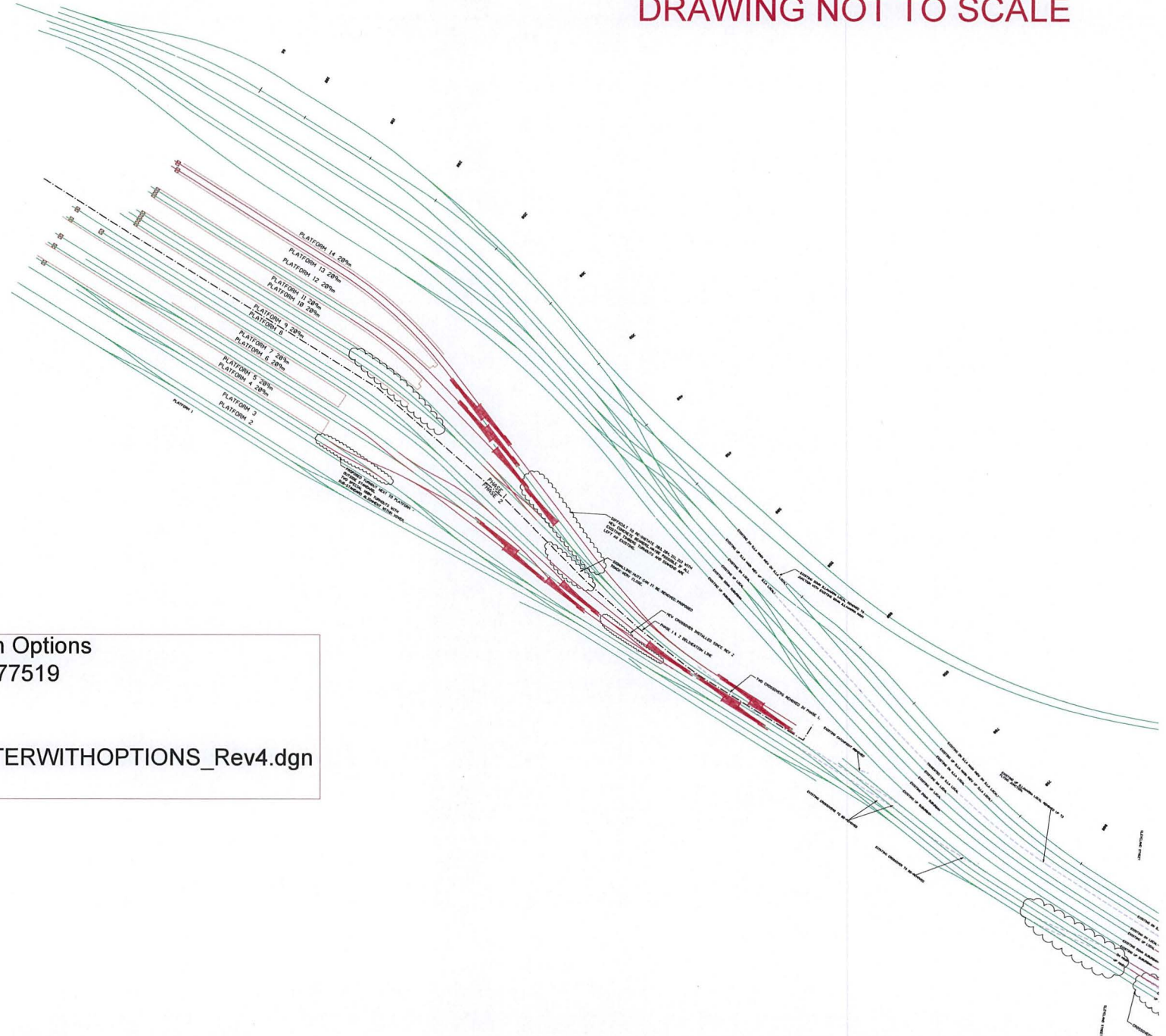
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- ADD SIGNS ON DOORS AS REQUIRED. ARTWORK FOR SIGN TO BE PROVIDED BY MTRCL.
- SPECIFICATION OF STAINLESS STEEL REFER TO CS03 P.S. AND ALL STAINLESS STEEL SHOULD BE SUPPORTED WITH COMPACT LAMINATE BOARD BACKING.
- SPECIFICATION OF HEADWALL / TAILWALL UNITS REFER TO AC07 P.S.
- PAINT COLOR OF GMS TO MATCH COMPACT LAMINATE BOARD FINISHES

TITLE
 SIL(E) FRONT OF HOUSE
 HEADWALL/TAILWALL UNITS
 HW/TW UNIT PLANS AND SECTION
 WALL MOUNT TYPE

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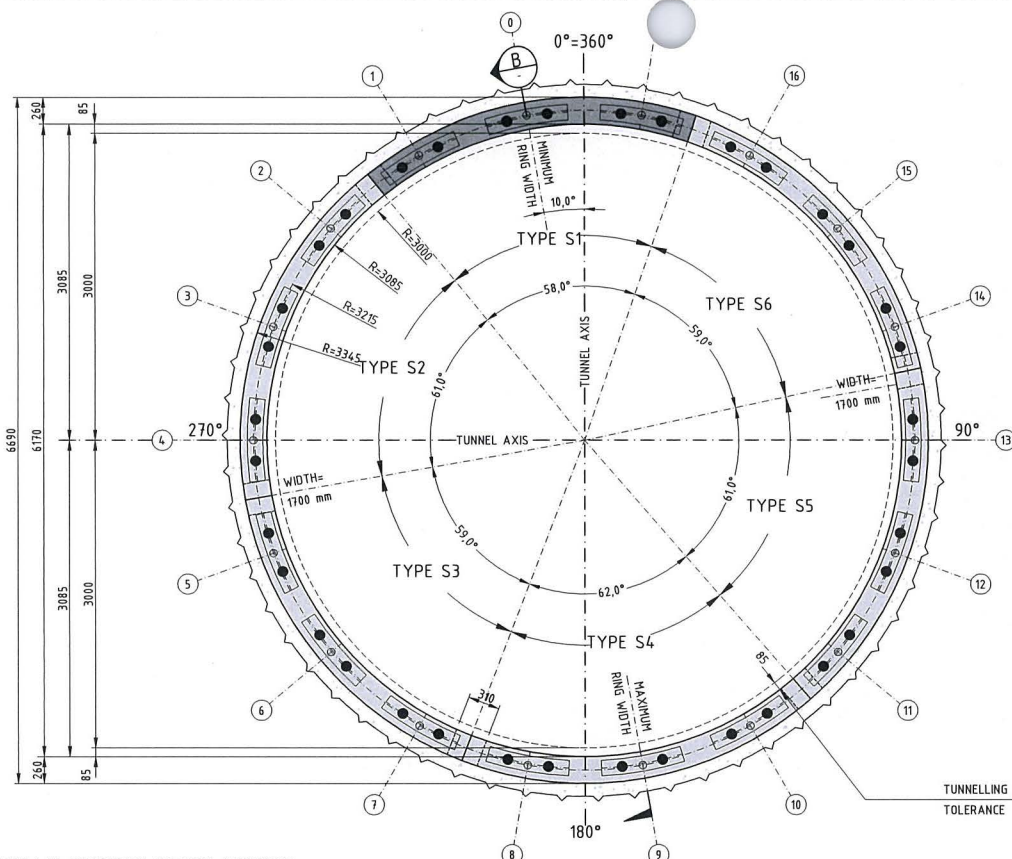
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 PLOT BY: svenef
 PLOT DEVICE: HP-GL/2
 PLOT SCALE: 1:1
 PLOT SHEET: 1 of 1

DRAWING NOT TO SCALE



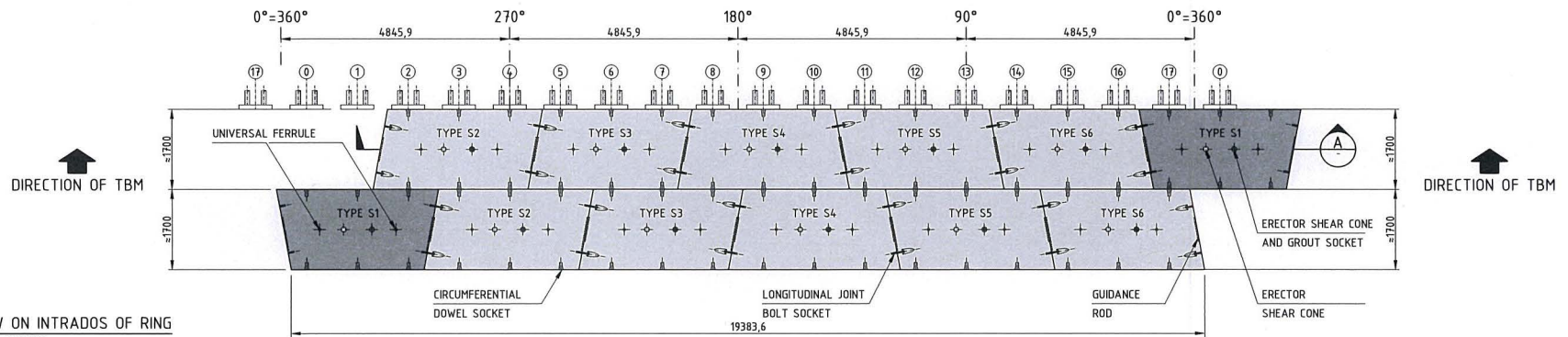
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Revision: 4
Date: 2-Jun-17
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VIEW IN DIRECTION OF TBM ADVANCE
TYPICAL CROSS SECTION OF RING
SCALE 1:25

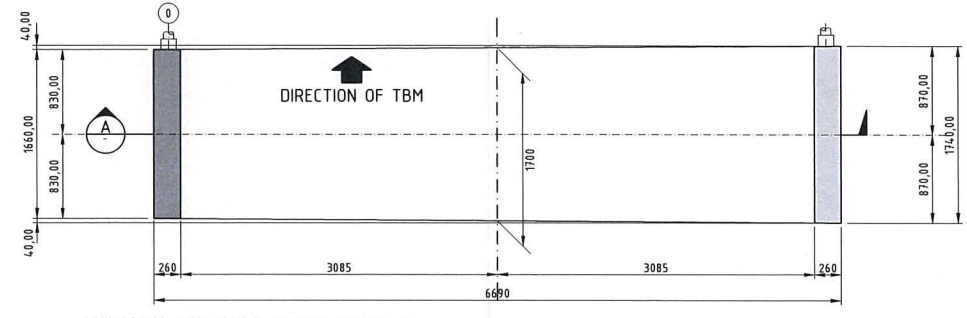
SECTION A
SCALE 1:25



DEVELOPED VIEW ON INTRADOS OF RING
SCALE 1:50

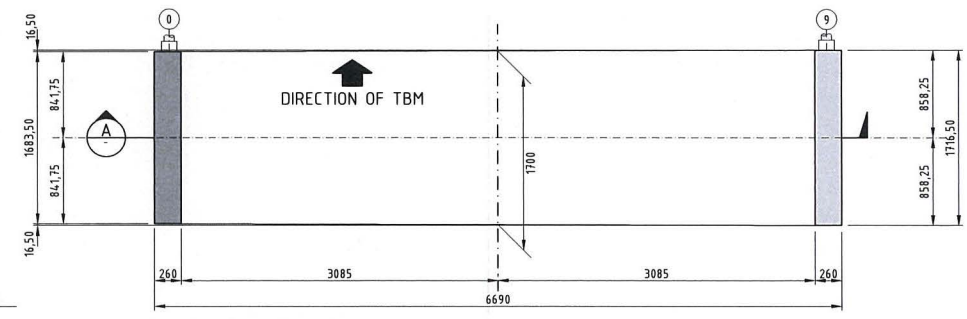
NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
2. ALL DETAILS AND DIMENSIONS ARE SUBJECT TO FINAL DESIGN CONFIRMATION.



UNIVERSAL RING TYPE / TAPERING 80 mm

SECTION B
SCALE 1:25



UNIVERSAL RING TYPE / TAPERING 33 mm

SECTION B
SCALE 1:25

TENDER

SYDNEY METRO CITY & SOUTHWEST

TUNNELS - NORTH AND SOUTH
TUNNELS - TD1, TD3 SEGMENTAL LINING
GENERAL ARRANGEMENT 6+0
UNIVERSAL RING TYPE - TAPERED

REV	BY	DATE	DESCRIPTION	APPRO.
01	FMP	16.12.16	ISSUED FOR TENDER	GMM

SCALES	
250	0 250 500 750mm
1:25	FULL SIZE A1
500	0 500 1000 1500mm
1:50	FULL SIZE A1

DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING	
INDEPENDENT CERTIFIER CERTIFICATE	



SERVICE PROVIDERS	DRAWN: F. MENDELKAMP
	DESIGNED: E. HEYNECK
	DRG CHECK: G. NUSSBAUM
	DESIGN CHECK: D. SCHULTE
	APPROVED: C. SCHULTE

STATUS: TENDER DESIGN	SHEET 1 OF 1
TSE-DRG No. TSE-JHO-TUN-TS-DRG-5002	TSE REV. 01

- **Sydney Metro City &
Southwest**

- Central Station Main Works**

- Schedule C1

- **Scope of Works and Technical Criteria
Appendix E01**

- Metro Station Works Interface Schedule**

PROJECT	Sydney Metro City & Southwest	DATE	25 August 2017
GROUP	Sydney Metro City & Southwest	STATUS	FINAL
AUTHOR	Transport for NSW	REVISION	1.1
COMPANY	Transport for NSW	FILE NUMBER	SM-17-00000445
FILE NAME	Central Station Main Works (CSM) SWTC App E01		

1 Metro Station Works Interface Schedule

- (a) The "Interface Requirements Specifications" (or IRSs) listed below are included at Attachment 1 to this Appendix E01.
- (i) Sydney Metro City and Southwest Project, Interface Requirements Specification – Track and Tunnel Services/Overhead Wiring and Traction Supply (TRK_TUS_OHW_TRS Contractor).
 - (ii) Sydney Metro City and Southwest Project, Interface Requirements Specification – High Voltage Power Supply (HV Contractor).
 - (iii) Sydney Metro City and Southwest Project, Interface Requirements Specification – Tunnel Ventilation System (TVS Contractor).
 - (iv) Sydney Metro City and Southwest Project, Interface Requirements Specification – Platform Screen Door (PSD Contractor).
 - (v) Sydney Metro City and Southwest Project, Interface Requirements Specification – Radio (RAD Contractor).
 - (vi) Sydney Metro City and Southwest Project, Interface Requirements Specification – Signalling System (SIG Contractor)
 - (vii) Sydney Metro City and Southwest Project, Interface Requirements Specification – Central Control System (CCS Contractor).
 - (viii) Sydney Metro City and Southwest Project, Interface Requirements Specification – Communications System (COM Contractor).
- (b) The IRSs identify Interface Work for some elements of the Project Works.
- (c) The CSM Contractor must undertake all tasks and things necessary to complete the elements of Metro Station Works addressed by IRSs, including the works identified in the IRSs as being the responsibility of the CSM Contractor.
- (d) The Interface Contractors will undertake all the Interface Work identified as being the responsibility of an Interface Contractor in the IRSs.
- (e) Where an IRS identifies a party as being the "Lead Contractor" that party must:
- (i) incorporate input from the party identified as the "Match Contractor", and must prepare and submit the required interface documentation based on the interface requirements stipulated in the Contract.
 - (ii) upon agreement with the Match Contractor on the content of a particular interface document, prepare a clean copy for sign-off by both parties. The signed off interface document must be submitted separately by the Lead Contractor and the Match Contractor on a date agreed to by both parties, which shall be within the time specified in the Contract.

- (f) Where an IRS identifies a party as being the Match Contractor, that party must provide the design input as deemed necessary to the Lead Contractor in accordance with the agreed programme for exchange of information. A common set of interface documentation shall be used between the Lead Contractor and the Match Contractor to ensure consistency and compatibility.
- (g) Where there is no assignment of Lead Contractor or Match Contractor for a particular interface, the CSM Contractor must prepare and submit all required interface documents.

Attachment 1 - Interface Requirements Specifications

**Sydney Metro
City and Southwest Project**

Interface Requirements Specification

**Track & Tunnel Services/Overhead Wiring & Traction Supply (TRK_TUS_OHW_TRS Contractor)
and
Central Station Main Works (CSM Contractor)**

CONTENTS

- 1 INTERFACE DEMARCATION DRAWINGS
- 2 PHYSICAL INTERFACE SCHEDULE
- 3 FUNCTIONAL INTERFACE SCHEDULE
- 4 MESSAGE/DATA EXCHANGE
- 5 DESIGN CONSTRAINT
- 6 INTERFACE DOCUMENTATION RESPONSIBILITY / COORDINATION REQUIREMENT
- 7 INTER-SYSTEM ELECTROMAGNETIC COMPATIBILITY
- 8 INTERFACE INSPECTION AND TEST SCHEDULE
- 9 EXCHANGE OF DESIGN INFORMATION SCHEDULE
- 10 WALK THROUGH
- 11 NAMING CONVENTION
- 12 ATTACHMENT

1 INTERFACE DEMARCATION DRAWINGS

- 1.1 The general physical demarcation and interfaces of tunnel services between the works of the TRK_TUS_OHW_TRS Contractor and the works of the CSM Contractor are shown in the interface demarcation diagrams Fig.Infs.TRK&TUS-CSM.01, Fig.Infs.TRK&TUS-CSM.02. and Fig.Infs.OHW&TRS-CSM.01.

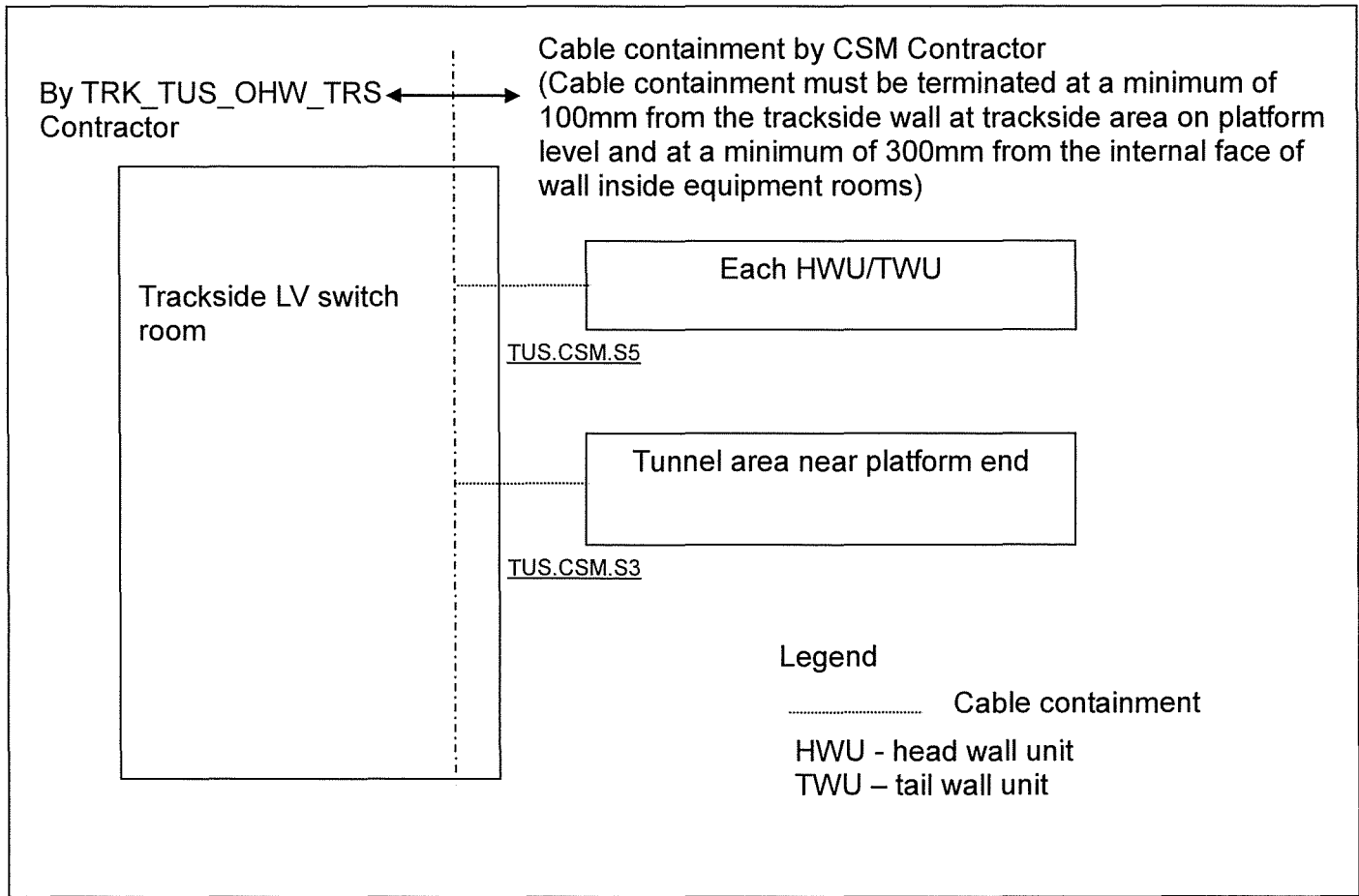


Fig.Infs.TRK&TUS-CSM.01

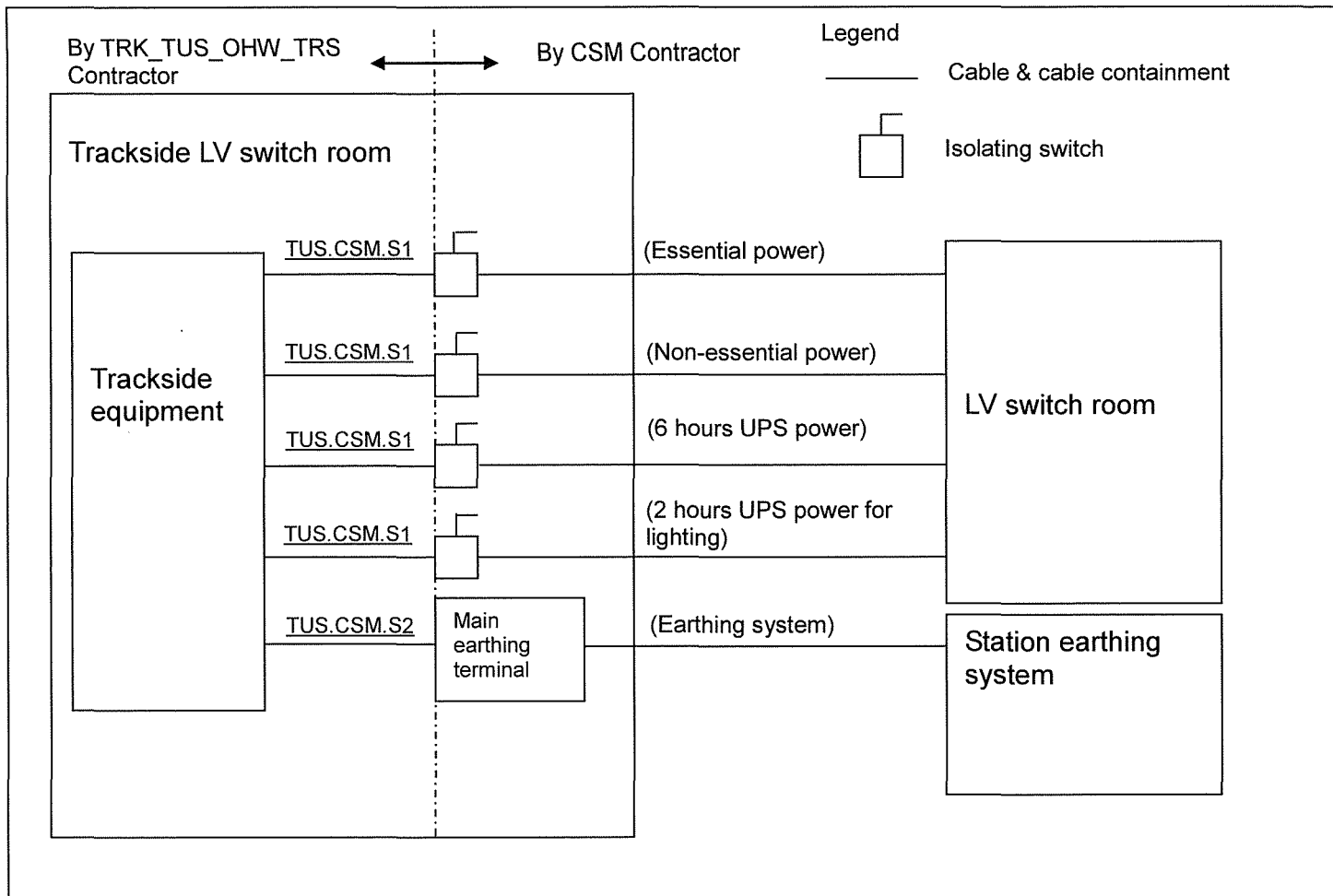


Fig.Infs.TRK&TUS-CSM.02

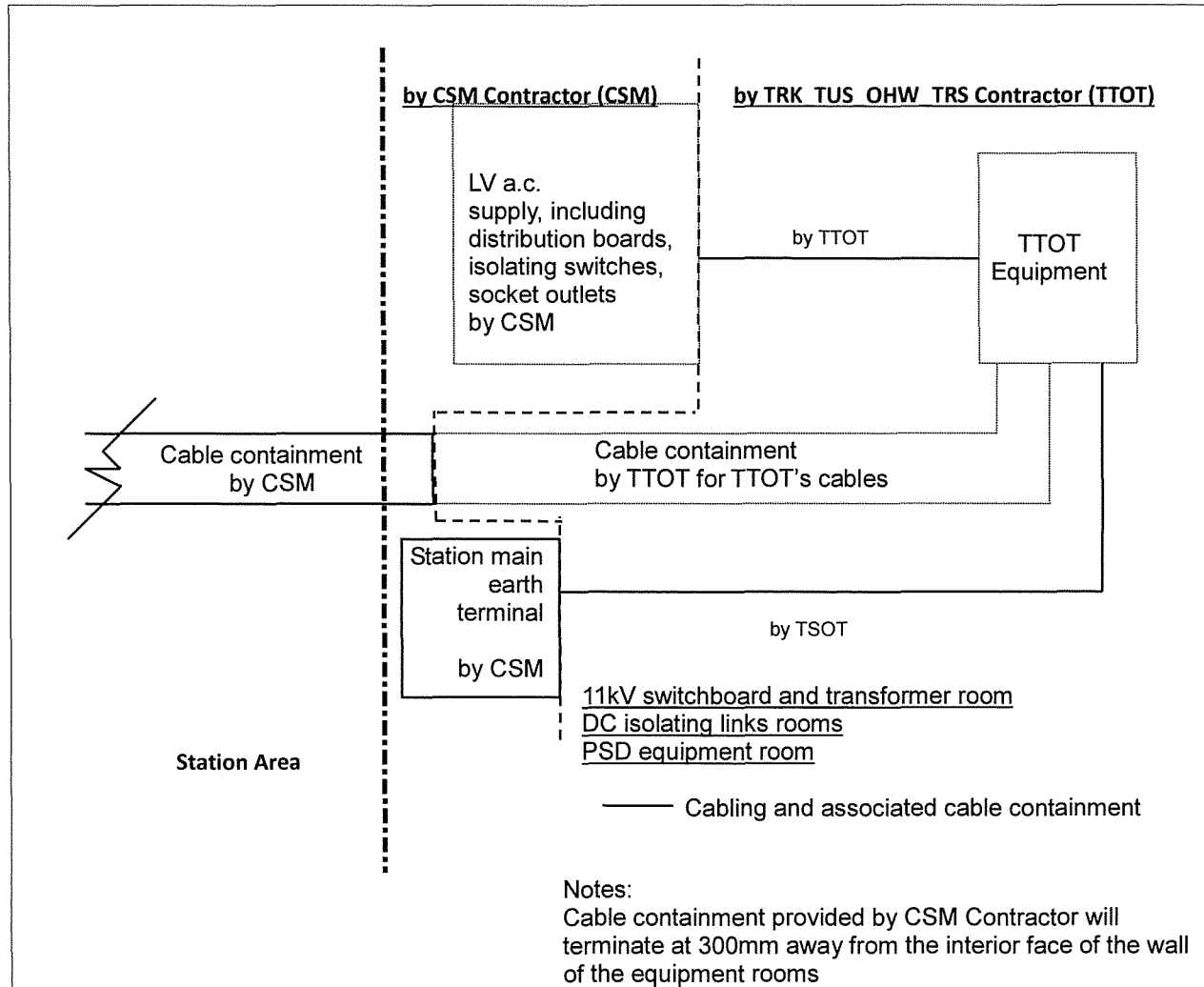


Fig. Infs.OHW&TRS-CSM.01

2 PHYSICAL INTERFACE SCHEDULE

2.1 The scope of works to be provided by the TRK_TUS_OHW_TRS Contractor and the CSM Contractor will be in accordance with the following table Tab.Infs. TRK&TUS.CSM.01 and Tab.Infs. OHW&TRS -CSM.01.

For Track & Tunnel Services:

Physical Interface Item Ref.	Work by TRK_TUS_OHW_TRS Contractor	Work by CSM Contractor	Location of Interface	Purpose of interface
TUS.CSM.S1	Provide downstream cables, 400V 3-phase / 230V 1-phase booster transformers and distribution boards to supply power to trackside equipment	Provide 400V 3-phase / 230V 1-phase isolating switches for power supply to trackside LV equipment	Trackside LV switch room at platform	LV power supply system to trackside equipment (essential power to trackside equipment, 2 hours UPS power to trackside emergency lighting, 6 hours UPS power to trackside communication system and non-essential power to trackside advertising panels)
TUS.CSM.S2	Provide downstream earthing conductors and terminate onto the main earth terminal	Provide main earth terminals and connect to station earthing system	Trackside LV switch room at platform	Trackside earthing system

Physical Interface Item Ref.	Work by TRK_TUS_OHW_TRS Contractor	Work by CSM Contractor	Location of Interface	Purpose of interface
TUS.CSM.S3	<ol style="list-style-type: none"> 1. Install cables from trackside LV switch room to trackside equipment. 2. Provide equipotential bonding between the cable containments provided by the TRK_TUS_OHW_TRS Contractor and the CSM Contractor. 3. Provide protective enclosures (such as galvanised metal sleeve). 4. Seal the space between cables and the protective cover. 	Provide cable containment to be terminated at a minimum of 100mm from the trackside wall at trackside area on platform level and at a minimum of 300mm from the internal face of wall inside equipment rooms	Trackside LV switch room and station ends at platform as indicated on the CSM Contractor's CSD drawings	Cable Installation and openings sealing
TUS.CSM.S4	Provide trackside fire services pumps	Provide power supply to trackside fire services pumps	Trackside FS Pump Room 1	Power supply to trackside fire services pumps

Physical Interface Item Ref.	Work by TRK_TUS_OHW_TRS Contractor	Work by CSM Contractor	Location of Interface	Purpose of interface
TUS.CSM.S5	<ol style="list-style-type: none"> 1. Install cables from trackside LV switch room to lighting switches at HWU/TWU. 2. Provide equipotential bonding between the cable containments provided by the TRK_TUS_OHW_TRS Contractor and the CSM Contractor. 	Provide cable containment up to 300mm from the internal face of wall inside trackside LV switch room to lighting switches at HWU/TWU	Trackside LV switch room and HWU/TWU as indicated on the CSM Contractor's CSD drawings	Cable Installation
TUS.CSM.S6	Provide monitoring points for monitoring of trackside facilities (including trackside sump pit and sump pump, trackside lighting, trackside advertising panel, portal lighting, cross passage exit sign)	Provide BMS points to receive status/alarm from trackside facilities and transmit to CCS.	Adjacent to BMS panel	Monitoring of trackside facilities (including trackside sump pit and sump pump, trackside lighting, trackside advertising panel, portal lighting)
TUS.CSM.S7	Provide control of trackside facilities (including trackside sump pit and sump pump, trackside lighting, trackside advertising panel, portal lighting, cross passage exit sign)	Provide BMS points to receive control command from CCS and issue the command to the respective trackside facilities accordingly.	Adjacent to BMS panel	Remote control of trackside facilities (including trackside sump pit and sump pump, trackside lighting, trackside advertising panel, portal lighting)

Physical Interface Item Ref.	Work by TRK_TUS_OHW_TRS Contractor	Work by CSM Contractor	Location of Interface	Purpose of interface
TUS.CSM.S8	Provide monitoring points for trackside fire services pumps and fire water storage tanks	Provide BMS points to receive status/alarm from trackside fire services pumps and fire water storage tanks	Adjacent to BMS panel	Monitoring of trackside fire services pumps and fire water storage tanks
TUS.CSM.C2	Provide cables / pipes; Undertake the sealing within the protective enclosures for the cables and cable containment.	<ul style="list-style-type: none"> - Provide the protective enclosures (such as galvanised metal sleeve) for cables and cable containment - Undertake the sealing works of the cross section between the protective enclosures (sleeves, & etc.) and the wall/floor/ceiling openings. 	In station as indicated on the TRK_TUS_OHW_TRS Contractor' SEM drawings	Cable / pipe protection and fire or water barrier security
TUS.CSM.C3	Provide electrical and mechanical equipment weight	Provide, fix and test the hoisting facilities; verify the loading and to be endorsed by authorized laboratory	Delivery chamber to platform level	Lifting of electrical and mechanical equipment
TUS.CSM.C4	Specify the cross track duct location, quantity, bending radius, etc.; install cables across track	<p>Provide cross-track cable ducts with draw wires and protective caps within and up to 100mm above track support slab</p> <p>Seal any unused openings/cross track ducts. The sealing work must be compatible with the fire separation requirements of the corresponding wall/floor/ceiling.</p>	In station as indicated in the TRK_TUS_OHW_TRS Contractor's SEM drawings	Cross track cable installation

Physical Interface Item Ref.	Work by TRK_TUS_OHW_TRS Contractor	Work by CSM Contractor	Location of Interface	Purpose of interface
TUS.CSM.C5	Specify sizes and locations of sump pits for tunnel drainage for station design.	Provide the required sizes of sump pits at designated locations in station	In station area	Tunnel drainage
TUS.CSM.C6	Provide tunnel sump pumps and rising mains	Provide infrastructure (including drainage filter, pipes and blanket) for collection of station groundwater to tunnel sump.	In station area	Tunnel drainage
TUS.CSM.C7	Provide tunnel sump pumps and local motor control panel.	Provide power supply to tunnel sump pumps and local motor control panel.	Tunnel sump pits in station area	Power supply to tunnel sump pumps and local motor control panel at station
TUS.CSM.C8	Specify requirements (including sizes) of equipment plinths and the tank for tunnel fire hydrant system	Provide concrete tank and plinths for tunnel fire hydrant system	Trackside FS Pump Room 1	Tanks and plinths for tunnel fire hydrant system
TUS.CSM.T1	Provide cable, pipe, cable containment, etc. at trackside	Review opening size & location and form opening/slot.	Trackside and tunnel as indicated in the TRK_TUS_OHW_TRS Contractor's SEM drawings	Cable, pipe and cable containment installation
TUS.CSM.T2	Specify the recess/niche/pipe trench location, quantity etc.	Provide recess/niche/pipe trench along trackside	Trackside and tunnel as indicated in the TRK_TUS_OHW_TRS Contractor's SEM drawings	Electrical and mechanical and systemwide equipment installation

Physical Interface Item Ref.	Work by TRK_TUS_OHW_TRS Contractor	Work by CSM Contractor	Location of Interface	Purpose of interface
TUS.CSM.T3	Provide cables / pipes; Provide the protective enclosures (such as galvanised metal sleeve) and undertake the sealing within the protective enclosures for the cables, pipes and containment.	Undertake the sealing works of the cross section between the protective enclosures (sleeves, & etc.) and the wall/floor/ceiling openings.	Trackside and tunnel as indicated in the TRK_TUS_OHW_TRS Contractor's SEM drawings	Cable / pipe protection and fire or water barrier security
TUS.CSM.T4	Specify the cross track duct location, quantity, bending radius, etc.; install cables across track	Provide cross-track cable ducts with draw wires and protective caps within and up to 100mm above track support slab	Trackside and tunnel as indicated in the TRK_TUS_OHW_TRS Contractor's SEM drawings	Cross track cable installation

Physical Interface Item Ref.	Work by TRK_TUS_OHW_TRS Contractor	Work by CSM Contractor	Location of Interface	Purpose of interface
TUS.CSM.T5	Supply cable brackets, cable containment and unistrut supports to the CSM Contractor. (coordinate and agree with the CSM Contractor for bracket handover date and deliver the cable bracket to the CSM Contractor's site storage area in a single batch). Check the cable brackets and unistrut supports after installation by the CSM Contractor.	Install cable containment/cable brackets/unistrut supports, supplied by the TRK_TUS_OHW_TRS Contractor, for light fixtures (max 10 m interval), cables (max 2m interval), pipes and hydrant outlets (max 60m interval) in accordance with the TRK_TUS_OHW_TRS Contractor's CSD, SEM and bracket detail drawings. Provide all fixing including socket, insert, channel, bolt, nut and the like for supporting the cable brackets, cable containment, unistrut supports and auxiliary items supplied by the TRK_TUS_OHW_TRS Contractor.	Trackside and tunnel as indicated in the TRK_TUS_OHW_TRS Contractor's SEM/CSD drawings	Cable brackets, pipe and cable containment installation
TUS.CSM.T6	Provide and install the bonding conductor to the bonding terminal	Provide bonding terminal at handrail	Tunnel as indicated in the TRK_TUS_OHW_TRS Contractor's SEM/CSD drawings	Bonding for handrail

Physical Interface Item Ref.	Work by TRK_TUS_OHW_TRS Contractor	Work by CSM Contractor	Location of Interface	Purpose of interface
TRK.CSM.T1	Install the trackform slab which includes track concrete slab, fastenings and rails	Construct civil structure with the required trackform depth for trackwork installation	Trackform depth and width	To meet the trackform design requirement
TRK.CSM.T2	Install the trackform slab above the station structural concrete	Provide the required surface finishes of the station structural concrete	Station invert slab and the vertical face of station wall	To allow proper bonding between the station structural concrete and the trackform slab
TRK.CSM.T3	Provide permanent covers to drainage access pits (if applicable) and to connect track drainage into drainage pipes by CSM Contractor.	Provide temporary covers to drainage access pits and to terminate drain pipes on station structural concrete with female socket (with plugs) at positions to be agreed	Track drainage	To allow for track drainage of seepage water and track wash water
TRK.CSM.T4	Supply pipeworks and fittings for connection to cater for the use of plant and equipment. To cover and protect the station drainage system to avoid blockage by debris prior to track washing. Reinstatement of the station drainage system after washing.	Provide temporary water supply points at 200m intervals for each track up to the point of track washing prior to trial running	Temporary water supply for construction use and track washing	To provide water supply for construction use and allow for track washing prior to trial running

Physical Interface Item Ref.	Work by TRK_TUS_OHW_TRS Contractor	Work by CSM Contractor	Location of Interface	Purpose of interface
TRK.CSM.T5	Avoid blockage of drainage pipes so as to protect the permanent drainage system before commencement of works	De-silt and clean drainage manholes & pipes before site access is given to TRK_TUS_OHW_TRS Contractor for track laying works	Track drainage system	Maintain the track drainage system in a clean and operable state
TRK.CSM.T6	Maintain the permanent drainage system in a clean and operable state.	Provide temporary drainage utilizing the permanent drainage facilities along the mainline track during track laying	Temporary drainage	Waste water management

Tab.Infs.TRK&TUS-CSM.01

For Overhead Wiring and Traction Supply:

Physical Interface Item Ref.	Works by CSM Contractor	Works by TRK_TUS_OHW_TRS Contractor	Location of Interface	Purpose of Interface
OHW&TRS.CSM.1	Provide main earth terminals	Provide downstream earthing conductors and terminate earthing tape/cable onto the main earth terminal	a) DC isolating links rooms b) PSD equipment room	Earthing of traction power supply equipment
OHW&TRS.CSM.2	Provide cable containment system outside the equipment rooms and terminate at 300mm away from the interior face of the wall inside of the equipment rooms.	a) Provide cable containment inside the equipment rooms for power and control cables b) Provide equipotential bonding between the cable containments provided by the CSM Contractor and the TRK_TUS_OHW_TRS Contractor.	a) DC isolating links rooms b) PSD equipment room c) 11kV switchboard and transformer room	Cable containment for traction power supply equipment
OHW&TRS.CSM.3	Provide dedicated LV distribution boards connected with isolating switches for use by the TRK_TUS_OHW_TRS Contractor	Provide and connect cables from the distribution boards to traction power supply equipment to obtain low voltage power	a) DC isolating links rooms b) PSD equipment room	Auxiliary power supply for traction power supply equipment
OHW&TRS.CSM.2	Provide cable containment system connected from the DC isolating links rooms to the trackside of Up Track and Down Track	Provide and install DC positive cables and negative cables from the DC isolating links rooms to Up Track and Down Track	OHW and each track of Up Track and Down at trackside	Cable containment for DC positive cables and negative cables from OHW / tracks to the DC isolating links rooms

Physical Interface Item Ref.	Works by CSM Contractor	Works by TRK_TUS_OHW_TRS Contractor	Location of Interface	Purpose of Interface
OHW&TRS.CSM.5	Provide cable containment system connected from the PSD equipment room to the trackside of Up Track or Down Track	Provide and install voltage limiting device cables from the PSD equipment room to Up Track or Down Track	Running rails of Up Track or Down Track near platform end	Cable containment for voltage limiting device bonding cables
OHW&TRS.CSM.6	Provide cable containment system connected from the trackside of Up Track to the trackside of Down Track	Provide and install the cross track bonding cables	Near PSD equipment room at platform end	Cable containment for cross track bonding cables
OHW&TRS.CSM.7	Provide the protective enclosures (such as galvanised metal sleeve) for cables and cable containment Undertake the sealing works of the cross section between the protective enclosures (such as galvanised metal sleeves) and the wall/floor/ceiling openings.	Undertake the sealing within the protective enclosures for the cables and cable containment.	Wall and slab openings as indicated on the CSM Contractor's CSD/SEM drawings	Cable protection
OHW&TRS.CSM.8	Form concrete cable trenches with covers	Cabling	In station as indicated on the CSM Contractor's CSD/SEM drawings	Cable protection

Physical Interface Item Ref.	Works by CSM Contractor	Works by TRK_TUS_OHW_TRS Contractor	Location of Interface	Purpose of Interface
OHW&TRS.CSM.9	Cut cable trench cover to the shape required by the TRK_TUS_OHW_TRS Contractor and install in position.	Provide CSM Contractor with requirements for cable trench cover shape for the TRK_TUS_OHW_TRS Contractor's equipment installation	Cable trenches for the TRK_TUS_OHW_TRS Contractor's equipment	Cable protection
OHW&TRS.CSM.10	Provide station linings, walls and soffit surfaces for the OHW equipment installation	Supply and install OHW equipment by drill and fix method	Station linings, walls and soffits	Fixing of OHW equipment by the TRK_TUS_OHW_TRS Contractor
OHW&TRS.CSM.11	Provide civil provisions and lifting facilities	Deliver and install equipment and supporting framework	In the station as indicated on the CSM Contractor's CSD/SEM drawings	Facilitate the delivery and installation works
OHW&TRS.CSM.12	Provide adequate access route for equipment delivery	Deliver traction power supply equipment to equipment rooms	Access route of equipment delivery	Delivery of traction power supply equipment to equipment rooms.
OHW&TRS.CSM.13	Provide civil provisions and lifting facilities	Install traction power supply cable, equipment and support framework.	Cable route for traction power supply cable and equipment	Fixing of traction power supply cable and equipment by the TRK_TUS_OHW_TRS Contractor

Tab.Infs. OHW&TRS-CSM.01

3 FUNCTIONAL INTERFACE SCHEDULE

3.1 Not used.

4 MESSAGE/DATA EXCHANGE

4.1 Not used.

5 DESIGN CONSTRAINT Not used.

6 INTERFACE DOCUMENTATION RESPONSIBILITY / COORDINATION REQUIREMENT

6.1 The TRK_TUS_OHW_TRS Contractor and the CSM Contractor are responsible for coordinating with each other to ensure all the interface requirements are captured and the interfaces works are designed, installed and tested.

6.2 The division of responsibility between the TRK_TUS_OHW_TRS Contractor and the CSM Contractor in preparing those portions of interface documents related to interface must be in accordance with table below:

Item Ref.	Interface Documents	Responsibilities of TRK_TUS_OHW_TRS Contractor	Responsibilities of CSM Contractor
6.2.1	Detailed Interface Specification	As Lead Contractor	As Match Contractor
6.2.2	Detailed Interface Test Plan	As Lead Contractor	As Match Contractor
6.2.3	Interface Test Specification	As Lead Contractor	As Match Contractor

7 INTER-SYSTEM ELECTROMAGNETIC COMPATIBILITY

- 7.1 The TRK_TUS_OHW_TRS Contractor and the CSM Contractor must exchange all necessary information concerning EMC/EMI in the respective systems to ensure electromagnetic compatibility in the design and operations. The information must include the operating frequencies and associated susceptibility or emission levels of each subsystem in both normal and fault conditions, and their locations.
- 7.2 The information shall be properly addressed in the EMI hazard analysis and EMC specification. Appropriate measures shall be explicitly listed and demonstrated in the design review.
- 7.3 The EMC tests shall be included in the interface tests and additional test provisions shall be provided to simulate various operating conditions such as peak traffic, fault conditions, etc. Test criteria shall be derived from the requirements and constraints listed in the hazard analysis and EMC specification.

8 INTERFACE INSPECTION AND TEST SCHEDULE

Item Ref.	Physical Interface Item Ref.	By TRK_TUS_OHW_TRS Contractor	By CSM Contractor	Purpose of Test / Inspection
8.1	TUS.CSM.S2 OHW&TRS.CSM.1	Ductor test must be jointly performed to ensure that the contact resistance between the main earthing terminal and the earthing conductors will not exceed 10 micro ohms.		Ductor Test

Item Ref.	Physical Interface Item Ref.	By TRK_TUS_OHW_TRS Contractor	By CSM Contractor	Purpose of Test / Inspection
8.2	TUS.CSM.S3 TUS.CSM.S5 TUS.CSM.C2 TUS.CSM.T1 TUS.CSM.T3 TUS.CSM.T5 OHW&TRS.CSM.2 OHW&TRS.CSM.5 OHW&TRS.CSM.6 OHW&TRS.CSM.7	Acceptance of civil and cable containment works completed by the CSM Contractor.	Provide access and attendance to the TRK_TUS_OHW_TRS Contractor for joint inspection of the civil and cable containment works	Joint inspection of the civil and cable containment works completed by the CSM Contractor
8.3	NA	Provide the CSM Contractor with relevant form (if required) to cover individual part of fixed electrical installation completed by the TRK_TUS_OHW_TRS Contractor	NA	NA
8.4	OHW&TRS.CSM.10	Acceptance of station linings, walls and soffit surfaces completed by the CSM Contractor.	Provide access and attendance to the TRK_TUS_OHW_TRS Contractor for joint inspection of the station linings, soffits and walls for the installation of OHW supports	Joint inspection of station linings, walls and soffits for the installation of OHW supports

Item Ref.	Physical Interface Item Ref.	By TRK_TUS_OHW_TRS Contractor	By CSM Contractor	Purpose of Test / Inspection
8.5	OHW&TRS.CSM.2 OHW&TRS.CSM.4 OHW&TRS.CSM.5 OHW&TRS.CSM.6	Acceptance of cable containment works completed by the CSM Contractor.	Provide access and attendance to the TRK_TUS_OHW_TRS Contractor for joint inspection of the cable containment works	Joint inspection of the cable containment works completed by the CSM Contractor

9 EXCHANGE OF DESIGN INFORMATION SCHEDULE

For Track & Tunnel Services:

Item Ref.	Physical Interface Item Ref.	By TRK_TUS_OHW_TRS Contractor	By CSM Contractor	Purpose of Information Exchange
9.1	TUS.CSM.S1	Provide information on electrical requirements	Verify and confirm the electrical requirements provided by the TRK_TUS_OHW_TRS Contractor	Confirm the electrical provision are adequate to trackside electrical and mechanical and systemwide equipment
9.2	TUS.CSM.S1 to S5	Provide the TRK_TUS_OHW_TRS Contractor's trackside CSD drawings to show trackside equipment layout, equipment room layout of trackside LV switch room, etc. Verify and confirm the information provided by the CSM Contractor.	Provide the CSM Contractor's station CSD drawings to show station equipment layout, MIV cabinet layout, etc. Verify and confirm the information provided by the TRK_TUS_OHW_TRS Contractor	Confirm the layout for building services and trackside installations

Item Ref.	Physical Interface Item Ref.	By TRK_TUS_OHW_TRS Contractor	By CSM Contractor	Purpose of Information Exchange
9.3	TUS.CSM.S4	<p>Verify and confirm the information provided by the CSM Contractor.</p> <p>Provide power requirement of trackside fire services pumps and the proposed fire services pipe routing from fire services pump room and fire services inlet to tracksides.</p>	<p>Provide information on Interface location and connection details.</p> <p>Verify and confirm the information provided by the TRK_TUS_OHW_TRS Contractor</p>	Confirm the power requirement and pipe routings of the trackside fire hydrant system
9.4	TUS.CSM.C2, TUS.CSM.C4, TUS.CSM.T1, TUS.CSM.T2, TUS.CSM.T4, TUS.CSM.T5	Provide information on openings, recess, niche, pipe trench and cable duct in the TRK_TUS_OHW_TRS Contractor's CSD and SEM drawings	Review and verify the information provided by the TRK_TUS_OHW_TRS Contractor	Trackside equipment installation
9.5	TUS.CSM.C2, TUS.CSM.C3, TUS.CSM.C6, TUS.CSM.T1, TUS.CSM.T3	<p>Provide information on openings, cable duct and hoisting facilities in CSD and SEM drawings.</p> <p>Provide information on the size of trackside fire services pumps and tanks</p>	Check and verify the information provided by the TRK_TUS_OHW_TRS Contractor	Slab/wall penetration, electrical and mechanical equipment delivery. Provision of concrete plinths and tank for trackside fire services pumps and tank system
9.6	TUS.CSM.T5	Provide information on bracket details including fixing accessories and cable containment in CSD and SEM drawings	Check and verify the information provided by the TRK_TUS_OHW_TRS Contractor	Bracket and cable containment installation in tunnel and trackside area

Item Ref.	Physical Interface Item Ref.	By TRK_TUS_OHW_TRS Contractor	By CSM Contractor	Purpose of Information Exchange
9.7	TUS.CSM.C5	Specify sump size and other details of pumping system interfacing with sump pits (e.g. cast-in duct, hoisting hook etc.) for tunnel drainage sumps at stations.	Incorporate the pumping system information from the TRK_TUS_OHW Contractor into the civil drawings	Interface of the tunnel drainage and station sump pits.
9.8	TUS.CSM.C6	Specify sump pit interfacing details and issue shop drawings of pumping system.	Provide TRK_TUS_OHW_TRS Contractor with working drawings to show the provided sump sizes, locations, and other details of sump pits.	Interface of the tunnel drainage on the station planning /sump pits.
9.9	TUS.CSM.C7	Measure the inflow rate into the sumps and check against the maximum inflow rate provided by CSM Contractor.	Provide TRK_TUS_OHW_TRS Contractor of the anticipated maximum inflow rate into the sumps collecting station groundwater inflow and station seepage.	Interface of the tunnel drainage on the station planning /sump pits.
9.10	N.A.	Provide the TRK_TUS_OHW_TRS Contractor's CSD incorporating the monitoring facilities location and setting out of the stray current corrosion control system	Provide information about the monitoring facilities location and setting out of the stray current corrosion control system; Check and verify the CSD provided by the TRK_TUS_OHW_TRS Contractor	Stray current corrosion control system equipment installation

Item Ref.	Physical Interface Item Ref.	By TRK_TUS_OHW_TRS Contractor	By CSM Contractor	Purpose of Information Exchange
9.11	TRK-CSM.T1 TRK-CSM.T2	Provide the necessary trackwork detailed drawings with the information on the location, dimensions and spatial requirements of the trackwork items required to be installed in the tunnel	Review and confirm acceptance of the location, dimensions, spatial requirements indicated on the trackwork detail drawings	Trackwork installation
9.12	TRK-CSM.T3 TRK-CSM.T4 TRK-CSM.T5 TRK-CSM.T6	Review and confirm acceptance of the location, dimensions and details of accesses, drainage manholes, drainage pipes, concrete access, concrete access, box-outs for concrete pipes, staging area	Provide the necessary detail drawings showing the locations, dimensions and details of accesses, manholes, drainage pipes, concrete access, box-outs for concrete pipes, staging area	Trackwork design

For Overhead Wiring and Traction Supply:

Ref	Physical Interface Item Ref.	By CSM Contractor	By TRK_TUS_OHW_TRS Contractor	Purpose of information exchange
9.13	OHW&TRS.CSM.2 OHW&TRS.CSM.4 OHW&TRS.CSM.5 OHW&TRS.CSM.6	To provide the cable routing with mounting level of cables with the consideration of cable bending radius.	Advise the size and quantity of cable containment as well as bending radius requirement. Comment on the cable routings.	To ensure the cable containment provided by the CSM Contractor incorporates the requirements of the TRK_TUS_OHW_TRS Contractor.
9.14	OHW&TRS.CSM.3	Provide drawings of LV distribution boards or distribution board schedules	Inform the rating and number of LV distribution board power supply for traction power supply auxiliary equipment	Determine the rating and way numbers of distribution boards in traction power supply and PSD equipment room in station.
9.15	OHW&TRS.CSM.7	Provide CSD and SEM drawings, incorporating information from the TRK_TUS_OHW_TRS Contractor, showing the location and size of SEM openings	Provide information on the locations and sizes of SEM openings.	Cables routes for the TRK_TUS_OHW_TRS Contractor's cables
9.16	OHW&TRS.CSM.8	Provide CSD and SEM drawings, incorporating information from the TRK_TUS_OHW_TRS Contractor, showing the layout and size of cable trenches	Provide information on the layout and size of cable trenches.	Construction of cable trenches
9.17	OHW&TRS.CSM.9	Confirm the shapes of cable trench covers	Provide information on the shapes of cable trench covers	Cutting cable trench covers to the required shapes

Ref	Physical Interface Item Ref.	By CSM Contractor	By TRK_TUS_OHW_TRS Contractor	Purpose of information exchange
9.18	OHW&TRS.CSM.10	<p>Provide arrangement / cross sectional drawings of the tunnel and station structures and any cross sectional drawings for specific locations as required by the TRK_TUS_OHW_TRS Contractor</p> <p>Provide as-built data of structural elements at OHW equipment locations</p>	<p>Provide information on the locations, setting out and loading of OHW equipment</p>	<p>Detailed design of OHW equipment, including design of OHW equipment supports and arrangements at the support locations</p>
9.19	OHW&TRS.CSM.10	<p>Review information provided by the TRK_TUS_OHW_TRS Contractor and confirm acceptance of the location, setting out, design loading and the mounting details of OHW equipment.</p> <p>Provide as-built data of structural elements at OHW equipment locations.</p>	<p>Provide location, setting out, loading of OHW equipment.</p> <p>Provide location and the mounting details of OHW support.</p> <p>Design all supporting brackets and fixings for OHW equipment</p>	<p>Checking suitability of station structures for mounting the OHW equipment</p>

Ref	Physical Interface Item Ref.	By CSM Contractor	By TRK_TUS_OHW_TRS Contractor	Purpose of information exchange
9.20	OHW&TRS.CSM.1 1	Provide drawings showing the location and loading limit of the lifting facilities for traction power supply equipment.	Provide information and comments on the locations, loading limits and setting out of lifting facilities for the traction supply equipment	Facilitate the delivery and installation works for traction supply equipment
9.21	OHW&TRS.CSM.1 2	Provide drawings showing the delivery route dimensions	Provide information on the equipment delivery size and weight of the traction power supply equipment	Provision of delivery route for traction power supply equipment.
9.22	N/A	Provide drawings showing the dimensions of floor area for traction power supply equipment installation and structural loadings	Provide information on the setting out, the maximum weight and size of traction power supply equipment and equipment foundation details	Installation of traction power supply equipment
9.23	N/A	Provide a layout, which incorporates the layout of traction power supply equipment, showing the building services equipment (including cable containment system, lighting, LV power distribution boards and socket outlets and ventilation equipment) within the equipment room.	Provide layout of traction supply equipment in equipment rooms.	Coordination of layout of building services provisions and traction power supply equipment in equipment rooms.

Ref	Physical Interface Item Ref.	By CSM Contractor	By TRK_TUS_OHW_TRS Contractor	Purpose of information exchange
9. 24	N/A	Provide ventilation system design to meet the temperature rise limits, fire services requirements and safety and health requirements in traction power supply equipment rooms.	Provide heat dissipation of traction power equipment to the CSM Contractor for ventilation design	The CSM Contractor's ventilation design for equipment rooms
9.25	N/A	Provide SEM drawings which include locations, dimensions and quantities of cut-outs and openings, plinths and access panels/doors provisions required to facilitate the TRK_TUS_OHW_TRS Contractor's installation works	Provide information of cut-outs / openings, plinths and access panels for overhead line and traction power supply requirements.	To confirm the civil provisions for works by the TRK_TUS_OHW_TRS Contractor.

10 WALK THROUGH

10.1 Not Used

11 NAMING CONVENTION

11.1 The TRK_TUS_OHW_TRS Contractor and the CSM Contractor must adopt the Operator's equipment identification procedure for equipment labelling in all documentation.

12 ATTACHMENT

12.1 Not Used

**Sydney Metro
City and Southwest Project
Interface Requirements Specification**

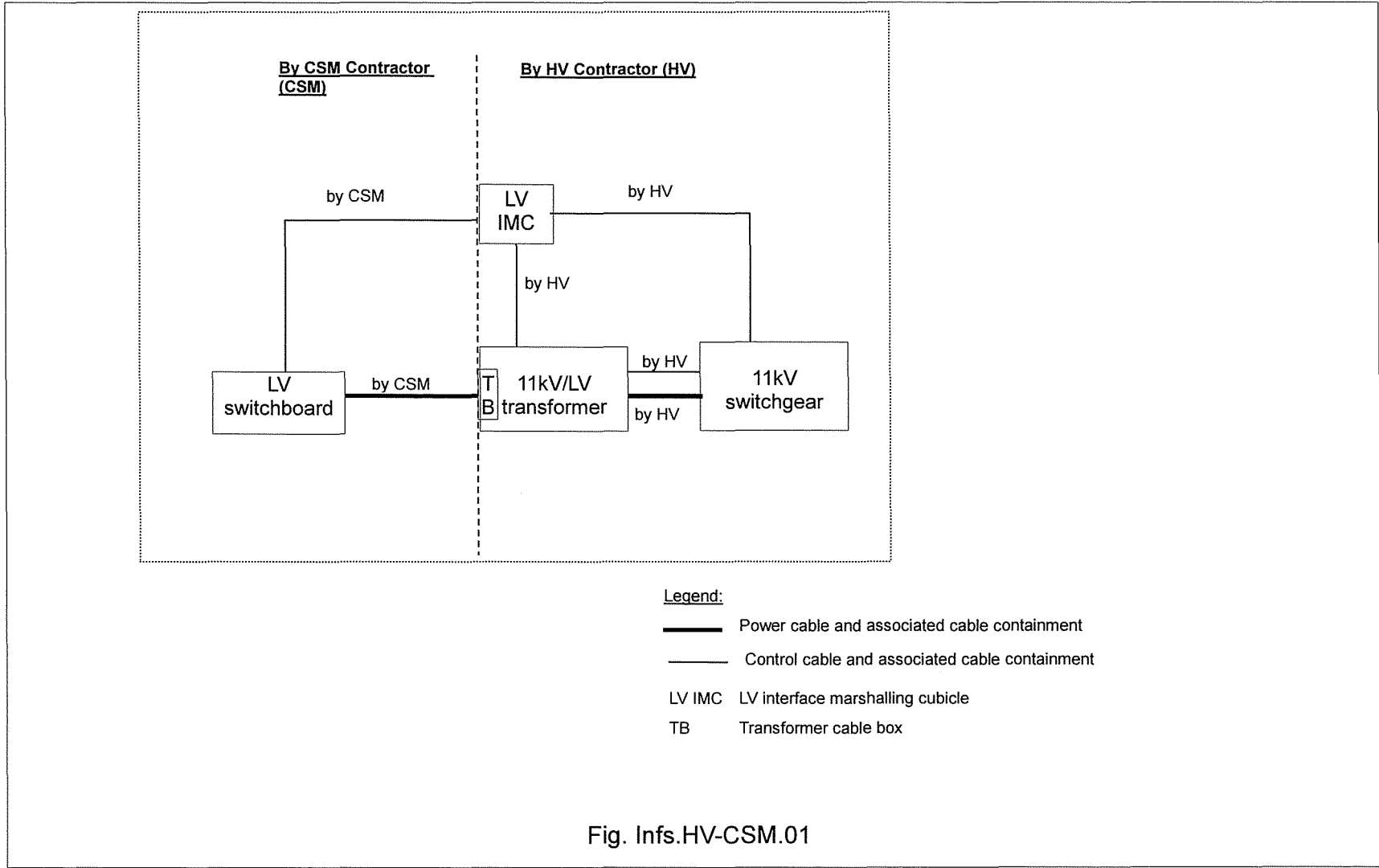
**High Voltage Power Supply (HV Contractor)
and
Central Station Main Works (CSM Contractor)**

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1 INTERFACE DEMARCATION DIAGRAMS

- 1.1. The general physical demarcation and interfaces between the works by the HV Contractor and the works by the CSM Contractor are shown in the interface demarcation diagrams Fig.Infs.HV-CSM.01 to Fig.Infs.HV-CSM.03.



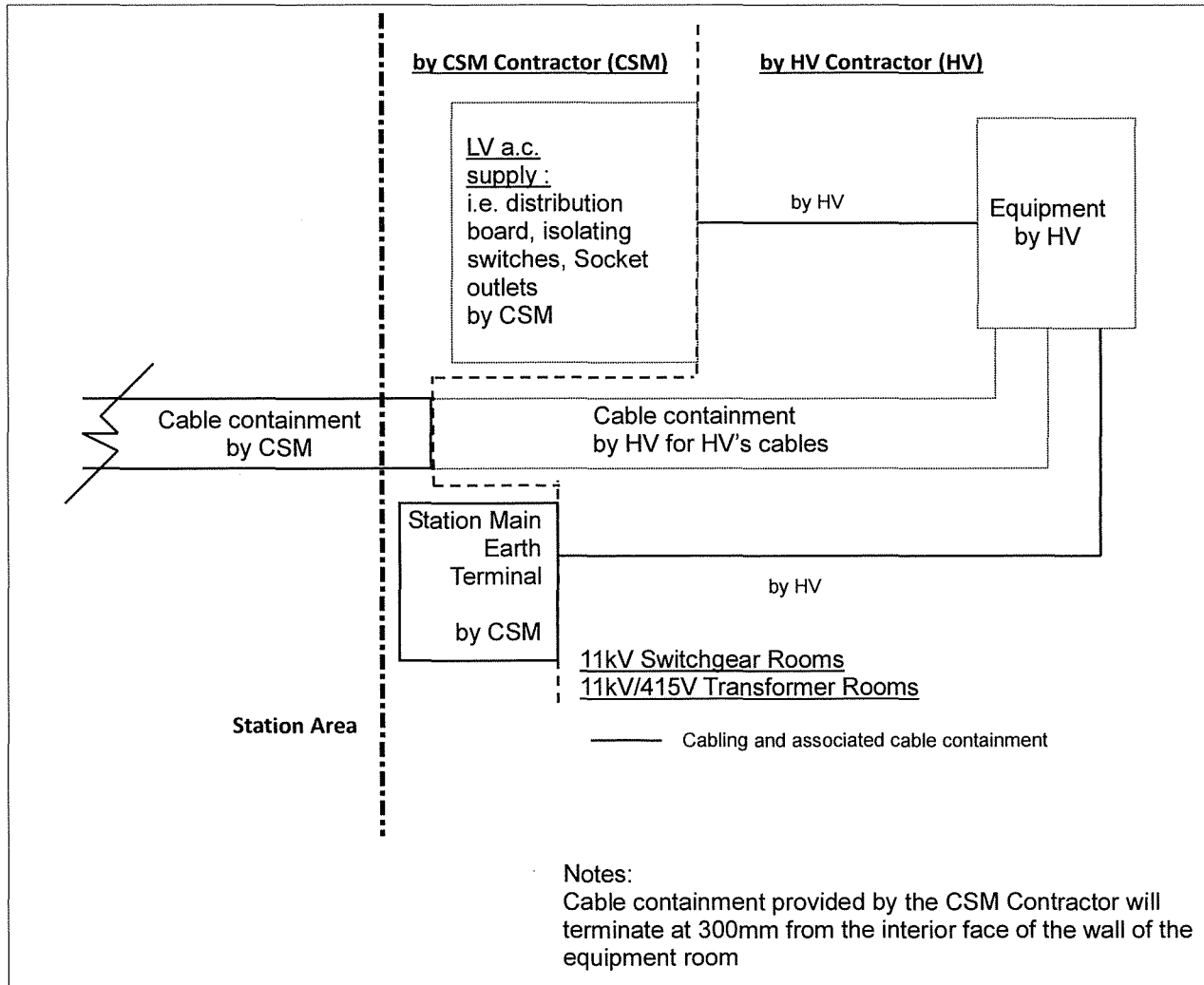


Fig. Infs.HV-CSM.02

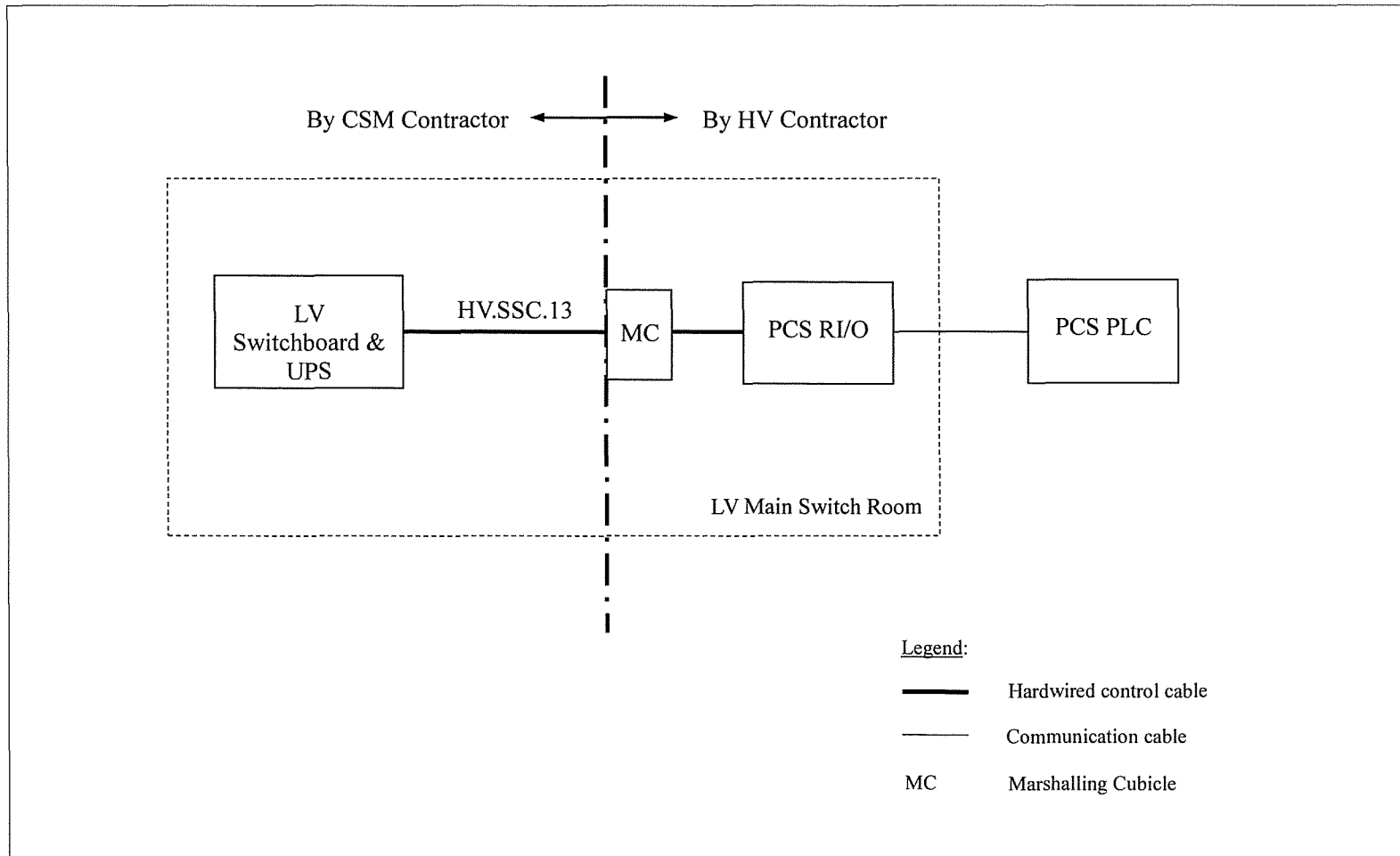


Fig. Infs.HV-CSM.03

PHYSICAL INTERFACE SCHEDULE

Physical Interface Item Ref.	Works by CSM Contractor	Works by HV Contractor	Location of Interface	Purpose of Interface
HV.CSM.1	Provide main earth terminals	Provide downstream earthing conductors and terminate earthing tape/cable onto the main earth terminal	11kV switchgear rooms, 11kV/415V transformer rooms	Earthing of HV power equipment
HV.CSM.2	Provide dedicated LV distribution boards connected with isolating switches for the HV Contractor.	Provide and connect cables from the distribution boards to HV power equipment to obtain low voltage power	11kV switchgear rooms	Auxiliary power supply for HV power equipment
HV.CSM.3	Provide cable containment system outside the equipment rooms and terminate at 300mm away from the interior face of the wall of the inside of the equipment rooms	Provide cable containment inside HV power equipment rooms for power and control cables. Provide equipotential bonding between the cable containments provided by the CSM Contractor and the HV Contractor.	11kV switchgear rooms 11kV/415V transformer rooms	Cable containment for HV power supply equipment
HV.CSM.4	Provide cable containment system connected from the 11kV Switchgear Rooms in the Station to the trackside of Up Track and Down Track	Provide and install HV power cables and control cables to Up Track and Down Track.	11kV switchgear rooms	Cable containment for HV power cables and control cables to trackside of Up Track and Down Track

Physical Interface Item Ref.	Works by CSM Contractor	Works by HV Contractor	Location of Interface	Purpose of Interface
HV.CSM.5	Provide and terminate LV power cables between 11kV/415V transformer terminals and LV switchboards including all cable accessories including cable glands, cable lugs, washers, tightening bolts/nuts, etc.	Provide terminals and gland plate on LV cable termination box of the 11kV/415V transformers (See Note 1 below)	11kV/415V transformer rooms	Incoming power connections to LV switchboards
HV.CSM.6	Provide and terminate control cables connection between LV switchboard and the LV interface marshalling cubicle	Provide LV interface marshalling cubicle	11kV/415V transformer rooms	Intertripping and interlocking between HV and LV breakers
HV.CSM.7	Provide the LV isolating switch for the battery charger	Provide power cables from the battery charger and terminate cables at the isolating switch provided by the CSM Contractor	11kV switchgear rooms	Power supply to the 125V d.c. battery charger installed in the 11kV switchgear rooms
HV.CSM.8	Undertake the sealing works of the cross section between the protective enclosures (sleeves, etc) and the wall/floor/ceiling openings.	Supply and install the protective enclosures (such as galvanized metal sleeve) and undertake the sealing within the protective enclosures for the cables and the cable containments.	Wall and slab openings as indicated on the CSM Contractor's CSD/SEM drawings	Cable protection
HV.CSM.9	Form concrete cable trenches with covers	HV cabling	In station as indicated on the CSM Contractor's CSD/SEM drawings	Cable protection

Physical Interface Item Ref.	Works by CSM Contractor	Works by HV Contractor	Location of Interface	Purpose of Interface
HV.CSM.10	Cut cable trench cover to the shape required by the HV Contractor and install in position.	Provide the CSM Contractor with requirements for cable trench cover shape for the HV Contractor's equipment installation.	Cable trenches for equipment installed by the HV Contractor	Cable protection
HV.CSM.11	SEM civil provisions and lifting facilities	Deliver and install equipment and supporting framework	In station as indicated on the CSM Contractor's CSD/SEM drawings	Facilitate the delivery and installation works
HV.CSM.12	Provide adequate access route and temporary storage area for equipment delivery and storage.	Deliver HV equipment to plantrooms or temporary storage area if plantrooms not ready for delivery	Access route of equipment delivery and storage area	HV power supply equipment delivery and storage
HV.CSM.13	Provide and terminate control cables between LV switchboard and the marshalling cubicle for PCS	Provide marshalling cubicle for PCS	LV Main Switch Room	Remote control & monitoring of LV equipment via PCS
HV.CSM.14	Provide fused connection unit and cabling with cable containment from UPS	Provide power cable from PCS equipment and terminate at fused connection unit	Locations as specified on the Drawings	UPS power supply for PCS equipment

Note 1: The CSM Contractor must provide cable support and cleats at approximately 300mm distance from the gland plate of the LV cable box in order to reduce the mechanical stress on the LV cable box / terminals.

3 FUNCTIONAL INTERFACE SCHEDULE

Function Interface Ref.	Physical Interface Item Ref.	Work by HV Contractor	Work by CSM Contractor	Purpose of Interface
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Function Interface Ref.	Physical Interface Item Ref.	Work by HV Contractor	Work by CSM Contractor	Purpose of Interface
3.1	HV.CSM.6	Perform tripping (with/without lockout) the corresponding 11kV circuit breaker on receiving signals from LV side.	Send intertrip and lockout signals from LV switchboard to 11kV switchboard for tripping the corresponding 11kV circuit breaker.	Intertripping requirements between HV & LV.
3.2	HV.CSM.6	Send intertrip and lockout signals from 11kV switchboard to LV switchboard for tripping the LV corresponding circuit breakers (with or without lockout).	Perform tripping (with/without lockout) the corresponding circuit breakers on receiving signals from 11kV side.	Intertripping requirements between HV & LV.
3.3	HV.CSM.6	Perform tripping of the corresponding 11kV circuit breaker.	Send direct trip signal from the undervoltage relay 27L (at LV switchboard) to 11kV switchboard for tripping the 11kV circuit breaker.	Intertripping requirements between HV & LV due to loss of incoming supply
3.4	HV.CSM.6	Perform control and interlocking functions of the corresponding 11kV circuit breaker.	Send signals from the LV switchboard to 11kV switchboard for control and interlocking functions.	Control and Interlocking between HV & LV
3.5	HV.CSM.6	Send signals from the 11kV switchgear to LV switchboard for control and interlocking functions.	Perform control and interlocking functions of the corresponding LV circuit breakers.	Control and Interlocking between HV & LV
3.6	HV.CSM.12	Provide drawings showing dimensions of delivery route and temporary storage area	Provide requirement of deliver route, temporary storage area and schedule. Provide information on the equipment delivery size and weight, equipment deliver and storage schedule	Provision of delivery route and equipment storage.

Function Interface Ref.	Physical Interface Item Ref.	Work by HV Contractor	Work by CSM Contractor	Purpose of Interface
3.7	HV.CSM.13	Provide LV equipment status/ alarms and analogue reading to PCS according to the interface point schedule.	Receive the LV equipment status & alarm signals, display at the PCS VDUs and transmit to CSS.	Remote monitoring of LV equipment status via PCS
3.8	HV.CSM.13	In remote mode, the system must accept and execute the open/close control commands from PCS to control the LV switchboard circuit breakers.	In remote mode, the operator can send an open/close command via PCS to control the LV switchboard circuit breakers.	Remote manual control of LV switchboard circuit breakers via PCS

4 MESSAGE/DATA EXCHANGE

4.1. Not used.

5 DESIGN CONSTRAINT

5.1. Not used.

6 INTERFACE DOCUMENTATION RESPONSIBILITY / COORDINATION REQUIREMENT

6.1. The HV Contractor and the CSM Contractor are responsible for coordinating with each other to ensure all the interface requirements are captured and the interfaces works are designed, installed and tested.

6.2. The division of responsibility between the HV Contractor and the CSM Contractor in preparing those portions of interface documents related to interface must be in accordance with table below:

Ref.	Interface Documents	Responsibilities of HV Contractor	Responsibilities of CSM Contractor
6.2.1	Detailed Interface Specification	As Lead Contractor	As Match Contractor

Ref.	Interface Documents	Responsibilities of HV Contractor	Responsibilities of CSM Contractor
6.2.2	Detailed Interface Test Plan	As Lead Contractor	As Match Contractor
6.2.3	Interface Test Specification	As Lead Contractor	As Match Contractor

7 INTER-SYSTEM ELECTROMAGNETIC COMPATIBILITY

- 7.1. The CSM Contractor and the HV Contractor must exchange all necessary information concerning EMC/EMI in the respective systems to ensure electromagnetic compatibility in the design and operations. The information must include the operating frequencies and associated susceptibility or emission levels of each sub-system in both normal and fault conditions, and their locations.
- 7.2. The cable containment system for the HV Contractor's power cables must maintain at least 900mm separation between power cables and receptor cables.

8 INTERFACE INSPECTION AND TEST SCHEDULE

Ref.	Physical Interface Item Ref.	By CSM Contractor	By HV Contractor	Purpose of Test / Inspection
8.1	HV.CSM.3 HV.CSM.4	Provide access and attendance to the HV Contractor for joint inspection of the cable containment works	Acceptance of cable containment works completed by the CSM Contractor.	Joint inspection of cable containment works completed by the CSM Contractor

9 EXCHANGE OF DESIGN INFORMATION SCHEDULE

Ref	Physical Interface Item Ref.	By CSM Contractor	By HV Contractor	Purpose of information exchange
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Ref	Physical Interface Item Ref.	By CSM Contractor	By HV Contractor	Purpose of information exchange
9.1	HV.CSM.2	Provide drawings of LV distribution boards or distribution board schedules	Inform the rating and number of LV distribution board power supply for HV power supply auxiliary equipment	Determine the rating and way numbers of distribution boards in the station
9.2	HV.CSM.3 HV.CSM.4	Provide the cable routing with mounting level of cables with the consideration of cable bending radius	Advise the size and quantity of cable containment as well as bending radius requirement. Review and comment on the cable routings.	To ensure the cable containment provided by the CSM Contractor incorporates the requirements of the HV Contractor
9.3	HV.CSM.5	Provide cable size, number of cables, type of cables and details of cable termination accessories	Provide details of the cable termination box on the LV side of the 11kV/415V transformer	Transformer LV cable termination
9.4	HV.CSM.6	Provide appropriate drawings such as control schematic and wiring diagram to the HV Contractor for the preparation of cable interconnection schedule	Provide termination details on the LV interface marshalling cubicle and prepare cable interconnection schedule	LV interface marshalling cubicle

Ref	Physical Interface Item Ref.	By CSM Contractor	By HV Contractor	Purpose of information exchange
9. 5	HV.CSM.6	Determine the protection relay setting of LV side by considering the motor starting and short circuit withstand time characteristic of LV side. Inform the HV Contractor about the LV side relay settings. Change the protection relay settings to provide sufficient discrimination by considering the counter proposal from the HV Contractor.	Determine the protection relay setting on 11kV side of transformer to grade with the relay settings on the LV side taking into account the overload characteristic of the transformer. Advise the CSM Contractor the necessary adjustment on relay settings on LV side. Co-ordinate with the CSM Contractor and finalize the protection relay settings on 11kV side.	Protection relay settings of HV & LV
9. 6	HV.CSM.6	Provide intertripping, interlocking and control requirements of LV switchgear according to the specified requirement. Co-ordinate and finalize the associated logic with the HV Contractor.	Provide intertripping, lockout, interlocking and control requirements of 11kV switchgear according to the specified requirements Co-ordinate and finalize the associated logics with the CSM Contractor.	Intertripping, lockout, interlocking and control of HV & LV
9. 7	HV.CSM.7	Provide the information on the type and rating of the isolating switch	Inform the rating and type of isolating switch for the incoming power supply to the battery charger	Incoming power supply for battery charger

Ref	Physical Interface Item Ref.	By CSM Contractor	By HV Contractor	Purpose of information exchange
9. 9	HV.CSM.8	Provide CSD and SEM drawings showing the location and size of SEM openings	Provide information on the locations and sizes of SEM openings	Cables routes for the HV Contractor's cables
9. 10	HV.CSM.9	Provide CSD and SEM drawings showing the layout and size of cable trenches	Provide information on the layout and size of cable trenches	Construction of cable trenches
9. 11	HV.CSM.10	Confirm the shapes of cable trench covers	Provide information on the shapes of cable trench covers	Cutting cable trench covers to the required shapes
9. 12	HV.CSM.11	Provide drawings showing the location and loading limit of the lifting facilities for HV power supply equipment.	Provide information and comments on the locations, loading limits and setting out of lifting facilities for HV power supply equipment.	Facilitate the delivery and installation works for HV power supply equipment
9.13	HV.CSM.12	Provide drawings showing dimensions of delivery route and temporary storage area	Provide information on the equipment delivery size and weight, equipment deliver and storage schedule	Provision of delivery route and equipment storage.
9.14	HV.CSM.13	Provide the detailed interface I/O schedule of all interface signals	Design and configure the PCS for the interfacing signals based on the detailed interface I/O schedules	Detailed interface I/O schedule and cable termination details
9.15	HV.CSM.13	Provide information such as cable schedule to achieve double ferrule system on the interface cables	Provide termination schedule on the marshalling cubicle and the ferrule numbers	Termination details of PCS Marshalling Cubicle and double ferrule numbering for interface cables

Ref	Physical Interface Item Ref.	By CSM Contractor	By HV Contractor	Purpose of information exchange
9.16	N/A	Provide drawings showing the dimensions of floor area for power supply equipment installation and structural loadings	Provide information on the setting out, the maximum weight and size of power supply equipment and equipment foundation details	Installation of power supply equipment
9.17	N/A	Provide total electrical and mechanical loadings for the new station	Review the adequacy of information to carry out the HV power load flow study	Detailed design of HV power supply system
9.18	N/A	Provide a layout, which incorporates the layout of high voltage power supply equipment, showing the building services equipment (including lightings, socket outlets and ventilation equipment) within the equipment room	Provide layout of high voltage power supply equipment	Coordinating the layout of building services provisions and high voltage equipment within the high voltage equipment rooms.
9.19	N/A	Provide ventilation system design to meet the temperature rise limits, fire services requirements and safety and health requirements in HV power supply rooms	Provide heat dissipation of HV power equipment to the CSM Contractor for ventilation design	Ventilation design

Ref	Physical Interface Item Ref.	By CSM Contractor	By HV Contractor	Purpose of information exchange
9.20	N/A	Provide procedures and forms for LV and 11kV switchboard integrated test and commissioning. Revise the procedures and forms according to the comments from the HV Contractor.	Comment on the integrated test and commissioning procedures and forms. Review and agree with the CSM Contractor on the final procedures and forms	Integrated test and commissioning procedures and forms
9.21	N/A	Provide soil resistivity data. Construction of the earth grid (earth mat or group of vertical earth electrode) after receiving the confirmed earth grid design provided by the HV Contractor,	Design of the earth grid (earth mat or group of vertical earth electrodes) based on the soil resistivity provided by the CSM Contractor. Determine the rise of earth potential, touch potential and step potential are compliance with the relevant standard requirements.	Design and construction of the earth grid (earth mat or group of vertical earth electrodes)

10 WALK THROUGH

10.1. Not Used

11 NAMING CONVENTION

11.1. The HV Contractor and the CSM Contractor must adopt the Operator's equipment identification procedure for equipment labelling in all documentation.

Attachment A – Control and Monitoring Points for Power Control System (PCS)

LV must be the source system of DI, AI and PI signals whereas PCS must be the Interface System. LV must be the Interface System of DO and AO signals whereas PCS must be the Source System.

Interface Location	I/O Interface Type and Quantity	Hardwire to PCS							Remark
	Equipment	DI	DI2	DO	AI	SOE1	SOE2	PI	
LV Main Switch Room	UPS								
	Common Alarm					1			Note 2
	Main Supply Health Status					1			
	Battery Voltage Health Status					1			
	UPS on Bypass					1			
	UPS Maintenance Bypass Switch								
	Static Bypass Input Switch Closed Status					1			
	Battery Switch Closed Status					1			

Interface Location	I/O Interface Type and Quantity	Hardwire to PCS							Remark
	Equipment	DI	DI2	DO	AI	SOE1	SOE2	PI	
	400V Surge Diverter								
	Surge Protection Operated Alarm					1			
	125V Battery Charger								
	Rectifier Fail					1			
	AC Fail					1			
	CB Open					1			
	Earth Fault					1			
	Low DC Voltage					1			
	High DC Voltage					1			
	Battery Temperature					1			
	Controller Fail					1			
	General Alarm					1			
	High Priority Alarm					1			
	Voltage				1				
	Current				1				
	125 V Incoming DC CB								
	Open/ Close						1		
	125V DC Bus Section								
	Open/ Close Status						1		
	Open/ Close			2					
	Power Factor Converter								
	In Service					1			
	Bank Earth Leakage					1			

Interface Location	I/O Interface Type and Quantity	Hardwire to PCS							Remark
	Equipment	DI	DI2	DO	AI	SOE1	SOE2	PI	
	Controller Alarm					1			
	LV Switchboard								
	Protection Unavailable Alarm					1			
	General Priority Alarm					1			
	High Priority Alarm					1			
	Critical Alarm					1			
	Protection General Alarm					1			
	Protection High Priority Alarm					1			
	Protection Critical Alarm					1			
	Protection Operated Alarm					1			
	Control inhibited by PCS					1			
	Control inhibited by IED					1			
	RTU								
	Fail					1			
	Offline					1			
	Main Isolator								
	Open/Close						1		
	LV Automatic Changeover Circuit								
	Fail					1			
	Manual Mode					1			
	Incomer ACB								
	Open/Close						1		

Interface Location	I/O Interface Type and Quantity	Hardwire to PCS							Remark
	Equipment	DI	DI2	DO	AI	SOE1	SOE2	PI	
	Trip					1			
	Current-L1				1				
	Current-L2				1				
	Current-L3				1				
	Voltage-L1-N				1				
	Power Factor-L1				1				
	kVA				1				
	kWh							1	
	Local/Auto						1		
	Open/Close			2					
	Duty Control Supply Health Status					1			
	Supply Health Status					1			
	Spring Charged Status					1			
	Trip Unit Fault Status					1			
	Tripped Bell Alarm					1			
	Carriage in Withdrawn Position					1			
	Carriage in test Position					1			
	Carriage in Service Position					1			
	Ready to Close Status					1			
	Outgoing ACB/MCCB								
	Open/Close						1		
	Trip					1			
	Emergency Push Button								
	Operated					1			

Notes:

- 1) The UPS Common Alarm must include alarms such as Supply 1 Failed, Supply 2 Failed, Battery Discharge, Manual Bypass, Battery Low and Fan Failed.
- 2) LV must latch the signal in the relay panel for pulse typed control output signal from PCS.
- 3) Relay panels and contactor boxes must be provided by LV to perform all the control function and monitoring signals.
- 4) LV device and switchboard must have no exclusive control by default.
- 5) For PCS, there must only be one control location eligible to issue commands at any one time. Once obtained exclusive control right of the LV equipment at one of the locations, the operator must be able to perform all controls and selections assigned to the operator at that particular location.
- 6) When the local tag of a LV device or switchboard is activated locally, the control of the PCS or CCS for that particular switchboard would be inhibited. The local control status must be passed to PCS and CCS for HMI display.

**Sydney Metro
City and Southwest Project
Interface Requirements Specification**

**Tunnel Ventilation System (TVS Contractor)
and
Central Station Main Works (CSM Contractor)**

CONTENTS

1. INTERFACE DEMARCATION DIAGRAMS
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12. ATTACHMENT

1. INTERFACE DEMARCATION DIAGRAMS

1.1 The general physical demarcation and interfaces between the works by the TVS Contractor and the works by the CSM Contractor are shown in the interface demarcation diagrams Fig.Infs.TVS-CSM.01 and Fig.Infs.TVS-CSM.02.

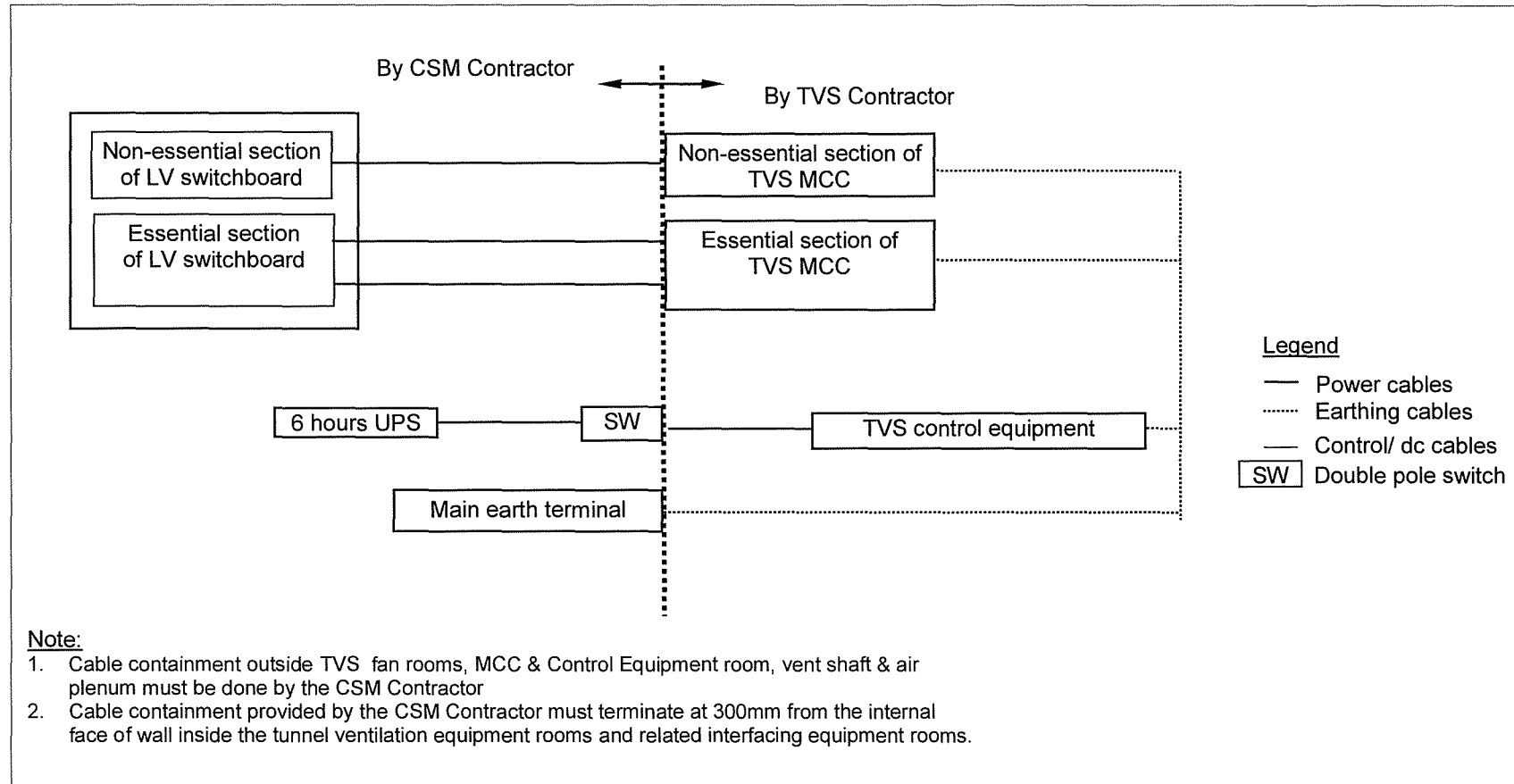


Fig.infs.TVS-CSM.01

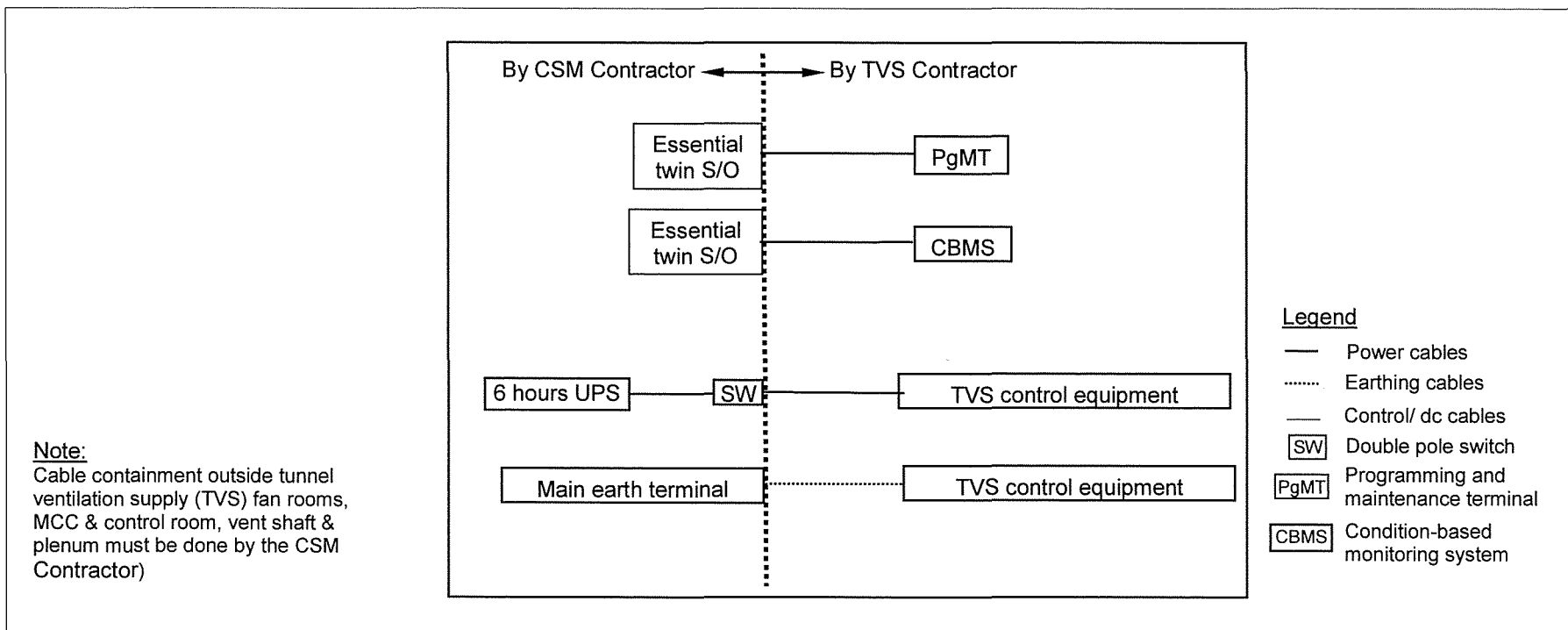


Fig.infs.TVS-CSM.02

2. PHYSICAL INTERFACE SCHEDULE

Physical Interface Item Ref.	Works by CSM Contractor	Works by TVS Contractor	Location of Interface	Purpose of Interface
TVS.CSM.1	Provide lifting points or beams, fix and test the hoisting facilities; verify the loading and to be examined and certified by a competent examiner. Provide adequate access route for equipment delivery, including access hatches, access platforms and barrier railings.	Provide and deliver equipment	Access route of equipment delivery and areas for tunnel ventilation fan room, tunnel ventilation fan niches, tunnel air handling unit niches, air compressor and receiver room.	Delivery of tunnel ventilation equipment
TVS.CSM.2	Construct concrete plinths and concrete ducts. Provide space allocation for plant.	Provide tunnel ventilation equipment Fixings of items of plant not requiring special civil foundation work, such as ground bolts	Tunnel ventilation fan rooms, tunnel ventilation fan niches, tunnel air handling unit niches, air compressor and receiver rooms	TVS plant mounting
TVS.CSM.3	<ul style="list-style-type: none"> - Provide the protective enclosures (such as galvanised metal sleeve) for cables and cable containment - Undertake the sealing works of the cross section between the protective enclosures (sleeves, & etc.) and the wall/floor/ceiling openings. 	Undertake the sealing within the protective enclosures for the cables and cable containment.	All areas as specified on the CSM Contractor's SEM/CSD drawings.	Cable/ pipe protection and fire or water barrier security

Physical Interface Item Ref.	Works by CSM Contractor	Works by TVS Contractor	Location of Interface	Purpose of Interface
TVS.CSM.4	Provide cable trough and cable ducts with draw wires within and up to 100mm above track support slab, draw pits if required.	Undertake the sealing within the cable duct for the tunnel ventilation system cables and containment	As indicated on the CSM Contractor's SEM / CSD drawings	Cable/pipe protection and fire or water barrier security
TVS.CSM.5	Provide upstand/ kerb around floor openings for installation of dampers, cables and pipes.	Supply and install dampers, pipes and cables	As indicated on the CSM Contractor's SEM drawings	Water barrier
TVS.CSM.6	Provide SEM civil provisions	Provide air-side accessories of motorized fire damper and air duct, cable containment / equipment/ access requirement/ routings	As indicated on the CSM Contractor's SEM drawings	Fixing of tunnel ventilation plant/ equipment and accessories
TVS.CSM.7	Provide floor drain with grating	Equipment drains	Air compressor and receiver rooms	Drain from tunnel ventilation system equipment, etc.
TVS.CSM.8	1. Provide external louvers 2. Make good deficiency if external louvers do not meet acoustic performance data and specifications.	Provide silencer for tunnel ventilation system equipment to comply with the statutory requirement.	Tunnel ventilation system intake and exhaust louvre	Compliance of noise requirement
TVS.CSM.9	Form nozzles if required	Check the adequacy of concrete nozzles.	As indicated on the CSM Contractor's SEM drawings	Form nozzles for tunnel ventilation system.

Physical Interface Item Ref.	Works by CSM Contractor	Works by TVS Contractor	Location of Interface	Purpose of Interface
TVS.CSM.10	Provide cable containment system up to the internal face of walls of tunnel ventilation system plantrooms and related interfacing plantrooms / equipment rooms, vent shaft and terminate it at 300mm from these walls	Provide cable containment system inside tunnel ventilation equipment rooms for tunnel ventilation system power, control and monitoring cables, and pneumatic pipes for dampers Provide equipotential bonding between cable containments by the TVS Contractor and the CSM Contractor.	Inside tunnel ventilation equipment rooms, vent shaft and vent duct	Support for tunnel ventilation system power, control & monitoring cables and pneumatic pipes for dampers inside plenum and at remote locations
TVS.CSM.11	Provide LV cables from LV switchboard and its cable termination work at tunnel ventilation system MCC incomer terminals, together with the necessary cable containment system	Provide tunnel ventilation system MCC incomer terminals	MCC and control equipment rooms at each end	Provide power supply to tunnel ventilation system equipment
TVS.CSM.12	Provide UPS power supply with one no. of isolating switch terminated at MCC and control equipment rooms at each end	Provide power cables and cable termination from isolating switches to tunnel ventilation system control equipment	MCC and control equipment rooms at each end	Provide 6 hours UPS power supply to TVS control equipment
TVS.CSM.13	Provide main earth terminal	Provide termination of earthing cables onto main earth terminal and earthing cables from earth terminal to tunnel ventilation system's equipment	MCC and control equipment rooms at each end	Earthing for tunnel ventilation system equipment

Physical Interface Item Ref.	Works by CSM Contractor	Works by TVS Contractor	Location of Interface	Purpose of Interface
TVS.CSM.14	Provide two nos. 240 V, 13 A twin socket outlets fed from essential supply for PgMT, printer and CBMS computer, and provide UPS power supply with one no. of isolating switch for tunnel ventilation system control equipment	Provide plugs and cables from the socket outlets to PgMT, printer and CBMS computer	Station computer room	Provide essential power supply for PgMT, printer and CBMS computer, and provide 6 hours UPS power supply to TVS control equipment
TVS.CSM.15	Not used	Not used	Not used	Not used
TVS.CSM.16	<ol style="list-style-type: none"> 1. Drawings showing the SEM Civil provisions for TVS. 2. Provide the protective enclosures (such as galvanised metal sleeve) for cables and cable containment 3. Undertake the sealing works of the cross section between the protective enclosures (sleeves, & etc.) and the wall/floor/ceiling openings. 	<ol style="list-style-type: none"> 1. Install power supply cable, equipment and support framework; 2. Undertake the sealing within the protective enclosures for the cables and cable containment. 	All areas as specified on the CSM Contractor's SEM / CSD drawings	Fixing of tunnel ventilation system cable and equipment by the TVS Contractor
TVS.CSM.17	Provide protective hoarding or barrier to prevent water or debris from any ongoing construction work above or inside the plenum from affecting the installed tunnel ventilation system equipment and its workers.	Installation of tunnel ventilation system equipment and cabling	Areas of installed tunnel ventilation system equipment	Protection of tunnel ventilation system equipment and the TVS Contractor's personnel

Physical Interface Item Ref.	Works by CSM Contractor	Works by TVS Contractor	Location of Interface	Purpose of Interface
TVS.CSM.18	Provide adequate access route and temporary storage area for equipment delivery and storage	Deliver TVS equipment to plantrooms or temporary storage area if plantrooms not ready for delivery	Access route of equipment delivery and storage area	TVS equipment delivery and storage

3. FUNCTIONAL INTERFACE SCHEDULE

3.1 Not used.

4. MESSAGE/DATA EXCHANGE

4.1 Not used.

5. DESIGN CONSTRAINT

5.1 Not used.

6. INTERFACE DOCUMENTATION RESPONSIBILITY

6.1 The TVS Contractor and the CSM Contractor are responsible for coordinating with each other to ensure all the interface requirements are captured and the interfaces works are designed, installed and tested.

6.2 The division of responsibility between the TVS Contractor and the CSM Contractor in preparing those portions of interface documents related to interface must be in accordance with table below:

Ref.	Interface Documents	Responsibilities of the TVS Contractor	Responsibilities of the CSM Contractor
6.2.1	Detailed Interface Specification	As Lead Contractor	As Match Contractor
6.2.2	Detailed Interface Test Plan	As Lead Contractor	As Match Contractor
6.2.3	Interface Test Specification	As Lead Contractor	As Match Contractor

7. INTER-SYSTEM ELECTROMAGNETIC COMPATIBILITY

- 7.1 The TVS Contractor and the CSM Contractor must exchange all necessary information concerning EMC/EMI in the respective systems to ensure electromagnetic compatibility in the design and operations. The information must include, but not be limited to, the operating frequencies and associated susceptibility or emission levels of each subsystem in both normal and fault conditions and their locations.
- 7.2 The information must be properly addressed in the EMI hazard analysis and EMC specification. Appropriate measures must be explicitly listed and demonstrated in the design review.
- 7.3 The EMC tests must be included in the interface tests and additional test provisions must be provided to simulate various operating conditions such as peak traffic, fault conditions, etc. Test criteria must be derived from the requirements and constraints listed in the hazard analysis and EMC specification.

8. INTERFACE INSPECTION AND TEST SCHEDULE

Ref.	By CSM Contractor	By TVS Contractor	Purpose of Test / Inspection
8.1	Provide access and attendance to the TVS Contractor for joint inspection of the civil works	Acceptance of civil works completed by the CSM Contractor.	Joint inspection of the civil works completed by the CSM Contractor
8.2	Provide access and attendance to the TVS Contractor for joint inspection of the building services works	Acceptance of building services works completed by the CSM Contractor.	Joint inspection of the building services works completed by the CSM Contractor
8.3	Carry out tests or inspection by a competent professional engineer of the corresponding discipline (such as mechanical or building services discipline, etc), in accordance with the requirements of relevant authorities.	Provide final operating pressures of all tunnel ventilation system ductworks and vent shafts	Confirm that the vent ducts constructed by the CSM Contractor for tunnel ventilation system meet the air-tightness requirement

9. EXCHANGE OF DESIGN INFORMATION SCHEDULE

Item Ref.	Physical Interface Item Ref.	By CSM Contractor	By TVS Contractor	Purpose of Information Exchange
9.1	TVS.CSM.1	Check and verify the loading of the lifting facilities (with valid certificates) and SEM provisions	Provide tunnel ventilation system equipment weights, and identify locations of lifting facilities required	Lifting and installation of tunnel ventilation system equipment
9.2	TVS.CSM.2 to TVS.CSM.7 and TVS.CSM.9	Provide SEM drawings indicating locations, dimensions and quantities of slots / cut-outs / openings through slabs, plinths, access panels/doors provisions, nozzles, structural concrete and clockwork walls . required to facilitate tunnel ventilation system installation works.	Provide information for cut-outs / openings, plinths, access panels, nozzles, etc. for tunnel ventilation system requirements. Review the SEMs and confirm in writing the acceptability of the provisions shown on the SEMs.	To confirm the civil provisions for tunnel ventilation system.
9.3	TVS.CSM.3 and TVS.CSM.4	Collate and submit the schedule of materials in accordance with the requirement of local and international codes on fire compartmentation and insulation	Provide valid certificate by an accredited laboratory on the sealing material supplied and installed by the TVS Contractor	Certificate submission to authority

Item Ref.	Physical Interface Item Ref.	By CSM Contractor	By TVS Contractor	Purpose of Information Exchange
9.4	TVS.CSM.9	Provide acoustic performance data and equipment specifications of the selected air louvres. Provide types and pressure drop of louvres and/or wire mesh for tunnel and trackway ventilation shafts.	Take into account of the louvres' acoustic data into the tunnel ventilation system design and overall noise calculations. Review and incorporate information provided by the CSM Contractor (including the pressure losses across the louvers) in its design.	To confirm the civil provisions for tunnel ventilation system
9.5	TVS.CSM.10	Provide information related to cable containment system outside the tunnel ventilation system plant and equipment room, vent shaft and plenum, and air compressors and receivers rooms (if they are not located inside tunnel ventilation fan rooms)	Verify the cable containment system provided by the CSM Contractor	Provision of cable containments for tunnel ventilation system
9.6	TVS.CSM.10	Provide information related to cable containment system outside the tunnel ventilation system plant and equipment room.	Provide information of pneumatic air pipe size, quantity and routes and verify the cable containment system provided by the CSM Contractor for installation of pneumatic system.	Provision of pneumatic supply for tunnel ventilation system
9.7	Not used	Not used	Not used	Not used

Item Ref.	Physical Interface Item Ref.	By CSM Contractor	By TVS Contractor	Purpose of Information Exchange
9.8	TVS.CSM.11	Determine the relay settings and rating of the circuit breaker on LV switchboard feeding the tunnel ventilation system MCC through coordination with the CSM Contractor.	Provide the following information for protection grading co-ordination between tunnel ventilation system MCC and upstream LV switchboard: 1. Fan motor characteristics including rated voltage, rated current, rated power, starting method, starting current/time, 2. Starting sequence of tunnel ventilation system fans in the operation modes, 3. Motor protection relay and short circuit protective device settings.	Provision of power supply for tunnel ventilation system
9.9	TVS.CSM.11	<ol style="list-style-type: none"> 1. Provide cable size, number of cables, type of cables and details of cable termination accessories. 2. Review cable termination details and identify any modification required to suit the installation of LV cables (if necessary). 	Provide installation details for the cable termination on incomer terminal of the tunnel ventilation system MCCs with gland plate details.	Provision of power supply for tunnel ventilation system
9.10	N/A	Provide installation program to TVS Contractor.	Coordinate with the CSM Contractor on working sequence / procedure based on the CSM Contractor's installation program.	Program interface

Item Ref.	Physical Interface Item Ref.	By CSM Contractor	By TVS Contractor	Purpose of Information Exchange
9.11	N/A	Provide and complete integrated test procedures and forms incorporating the requirement of tunnel ventilation system.	Propose integrated test procedures between the tunnel ventilation system MCC and building services LV switchboard and comment on the integrated test procedures and forms prepared by the CSM Contractor.	Testing and commissioning
9.12	N/A	<ol style="list-style-type: none"> 1. Provide work completion certificates, duly signed as required by local utility companies or authorities 2. Where the downstream LV installation is not provided/inspected/tested by the CSM Contractor, the CSM Contractor must obtain the completion certificate from the TVS Contractor. A single certificate must be issued to cover the LV installation by the CSM Contractor and all downstream LV installations as required in codes or standards from local utility companies or authorities 	Provide work completion certificate with duly signed as required by any local utility companies or authorities by the CSM Contractor.	Preparation and submission of work completion certificate from local utility companies or authorities
9.13	TVS.CSM.11, 12	Provide power supply to the requirement of tunnel ventilation system equipment	Provide information on the power consumption of the tunnel ventilation system equipment	Provision of power supply for tunnel ventilation system

Item Ref.	Physical Interface Item Ref.	By CSM Contractor	By TVS Contractor	Purpose of Information Exchange
9.14	N/A	Provide environmental control system layouts of MCC and control equipment rooms.	<ol style="list-style-type: none"> 1. Provide heat dissipation rates of tunnel ventilation equipment inside MCC and control equipment rooms 2. Provide tunnel ventilation system equipment layouts of MCC and control equipment rooms. 	Provision of environmental control system for MCC and control equipment rooms
9.15	N/A	Check the provided infiltration and exfiltration rates and incorporate them into the sizing of station environmental control system plant.	Provide the infiltration and exfiltration rates from/into tunnels through the platform screen doors.	Minimize the impact of infiltration / exfiltration on station thermal condition.
9.16	TVS.CSM.18	Provide drawings showing dimensions of delivery route and temporary storage area	Provide information on the equipment delivery size and weight, equipment deliver and storage schedule	Provision of delivery route and equipment storage.

10. WALK THROUGH

10.1 Not Used

11. NAMING CONVENTION

11.1 The CSM Contractor and the TVS Contractor must adopt the Operator's equipment identification procedure for equipment labelling in all documentation.

12. ATTACHMENT

12.1 Not Used

**Sydney Metro
City and Southwest Project
Interface Requirements Specification**

**Platform Screen Door (PSD Contractor)
and
Central Station Main Works (CSM Contractor)**

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7. INTER-SYSTEM ELECTROMAGNETIC COMPATIBILITY
8. INTERFACE INSPECTION AND TEST SCHEDULE
9. EXCHANGE OF DESIGN INFORMATION SCHEDULE
10. WALK THROUGH
11. NAMING CONVENTION
12. ATTACHMENT

1 INTERFACE DEMARCATION DRAWINGS

- 1.1 The general physical demarcation and interfaces between the works of PSD Contractor and the works of the CSM Contractor are shown in the interface demarcation diagrams Fig.Infs.PSD-CSM.01 to Fig.Infs.PSD-CSM.04.

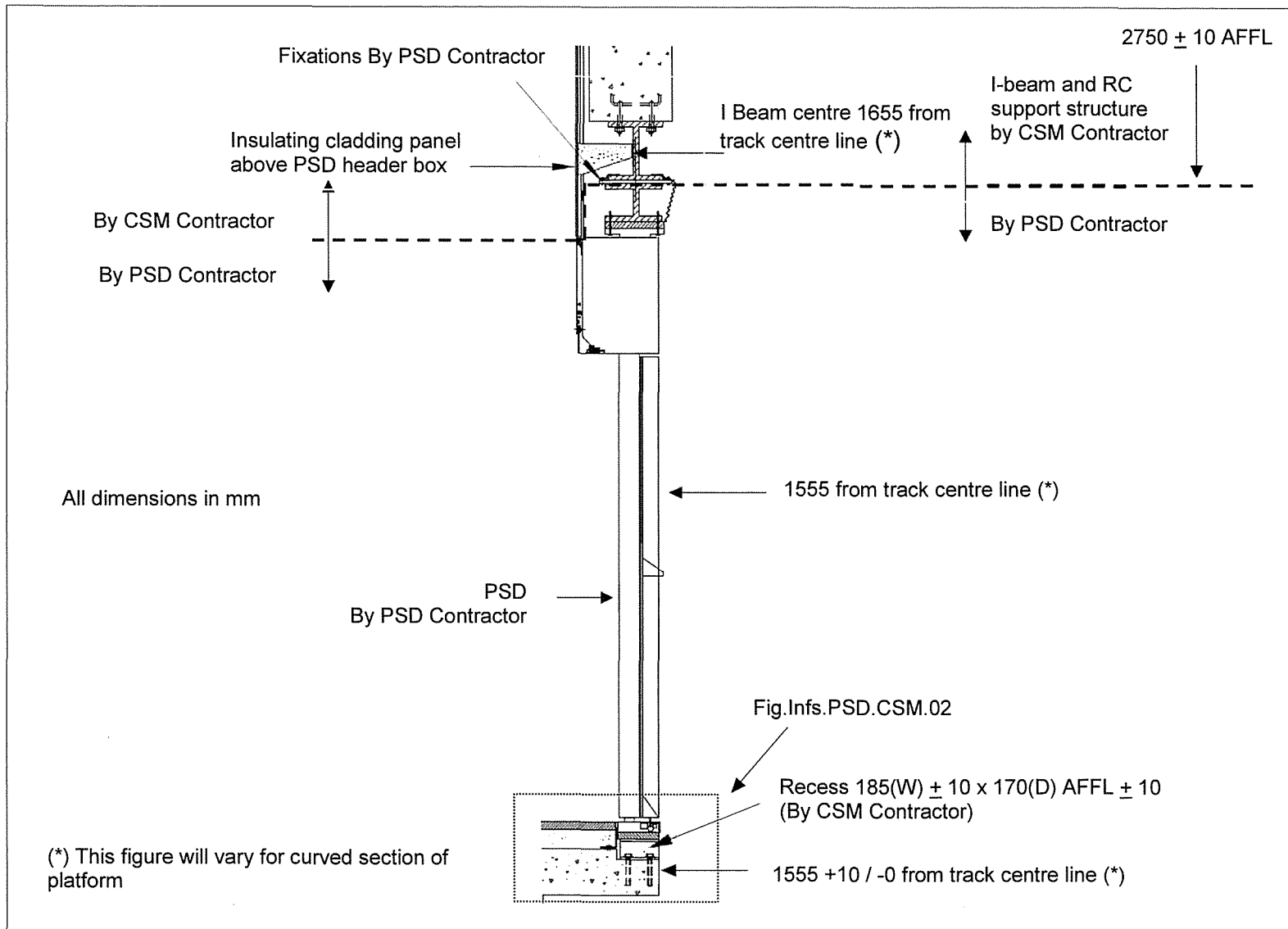


Fig.Infs.PSD-CSM.01

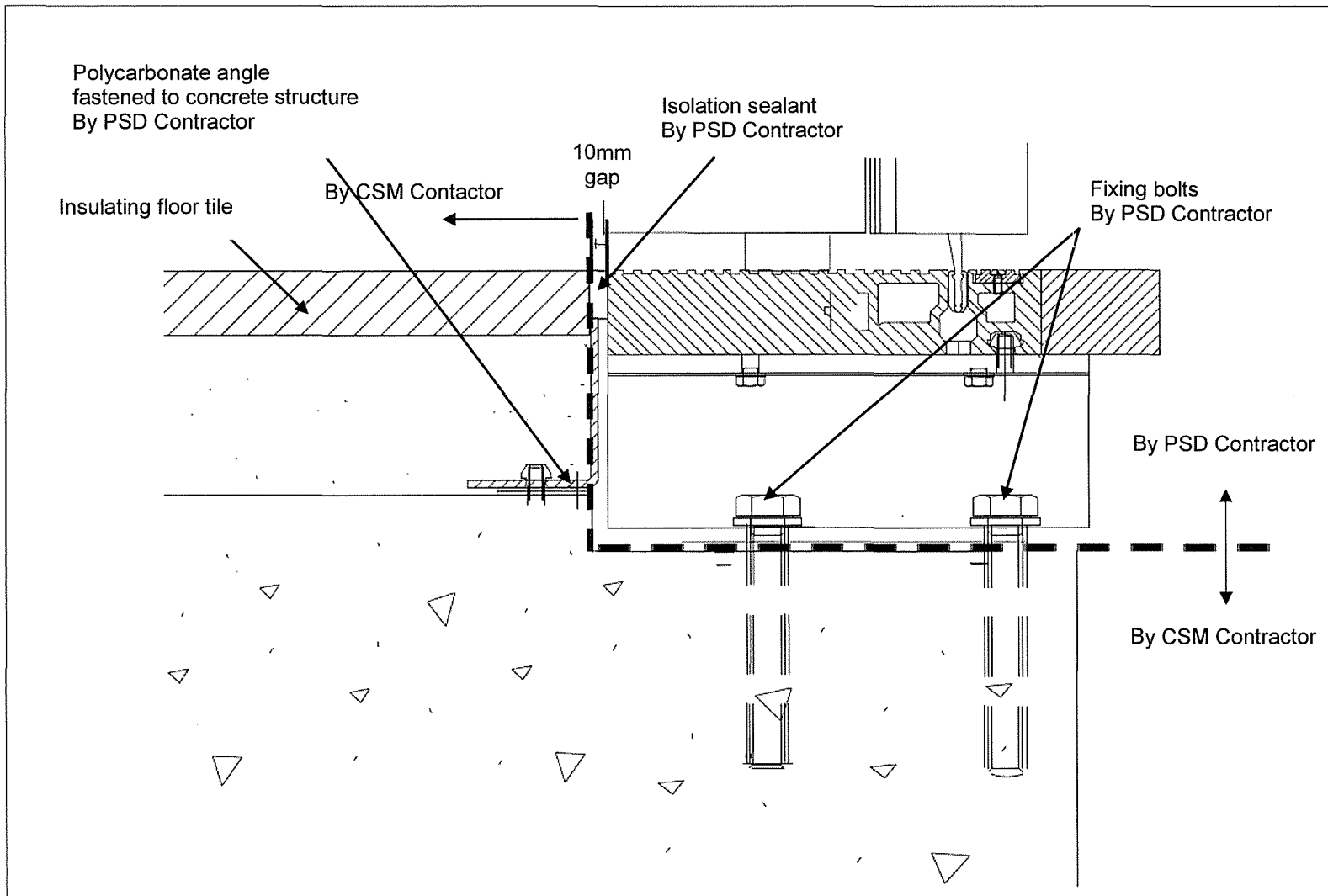


Fig.Infs.PSD-CSM.02

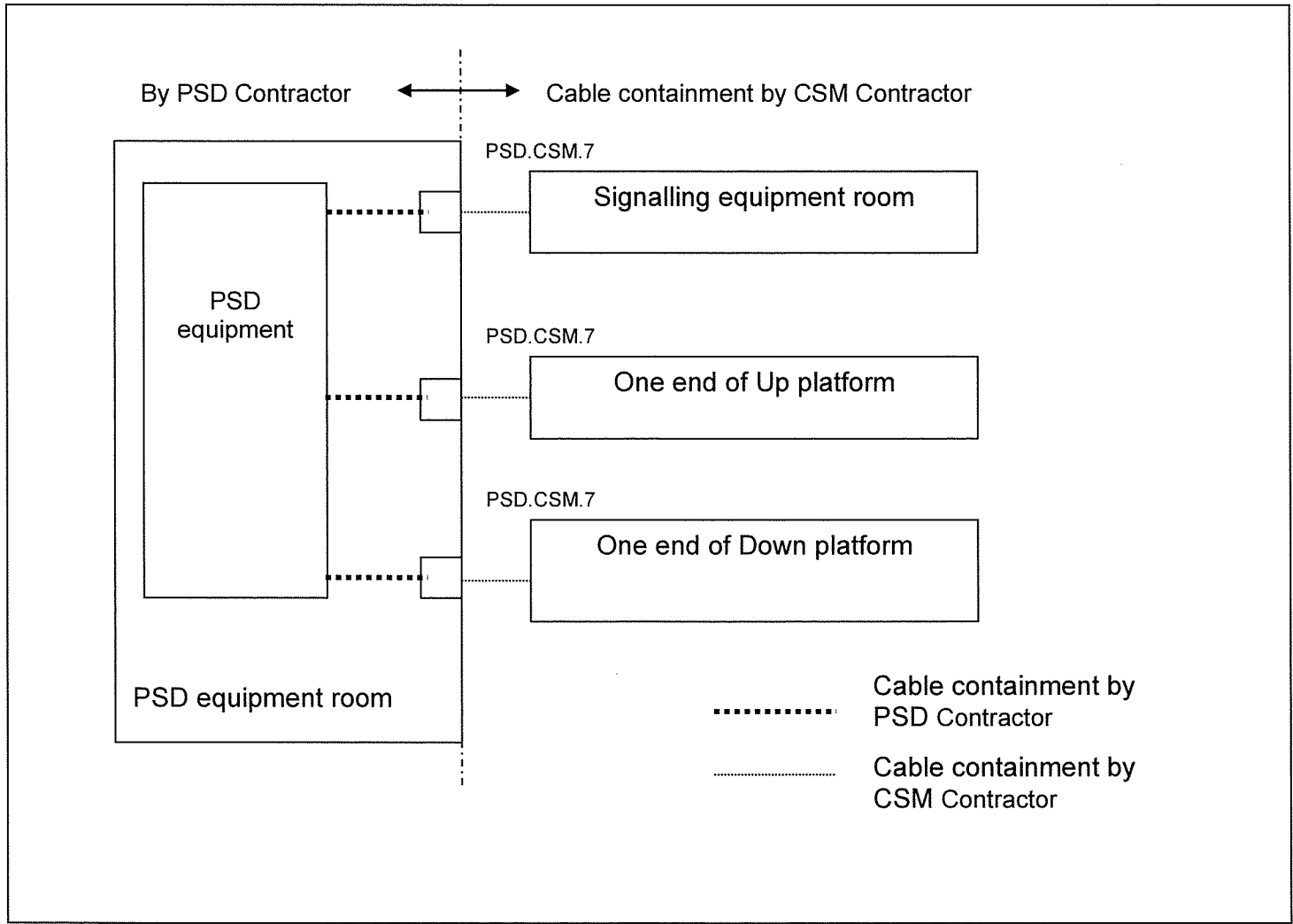


Fig.Infs.PSD-CSM.03

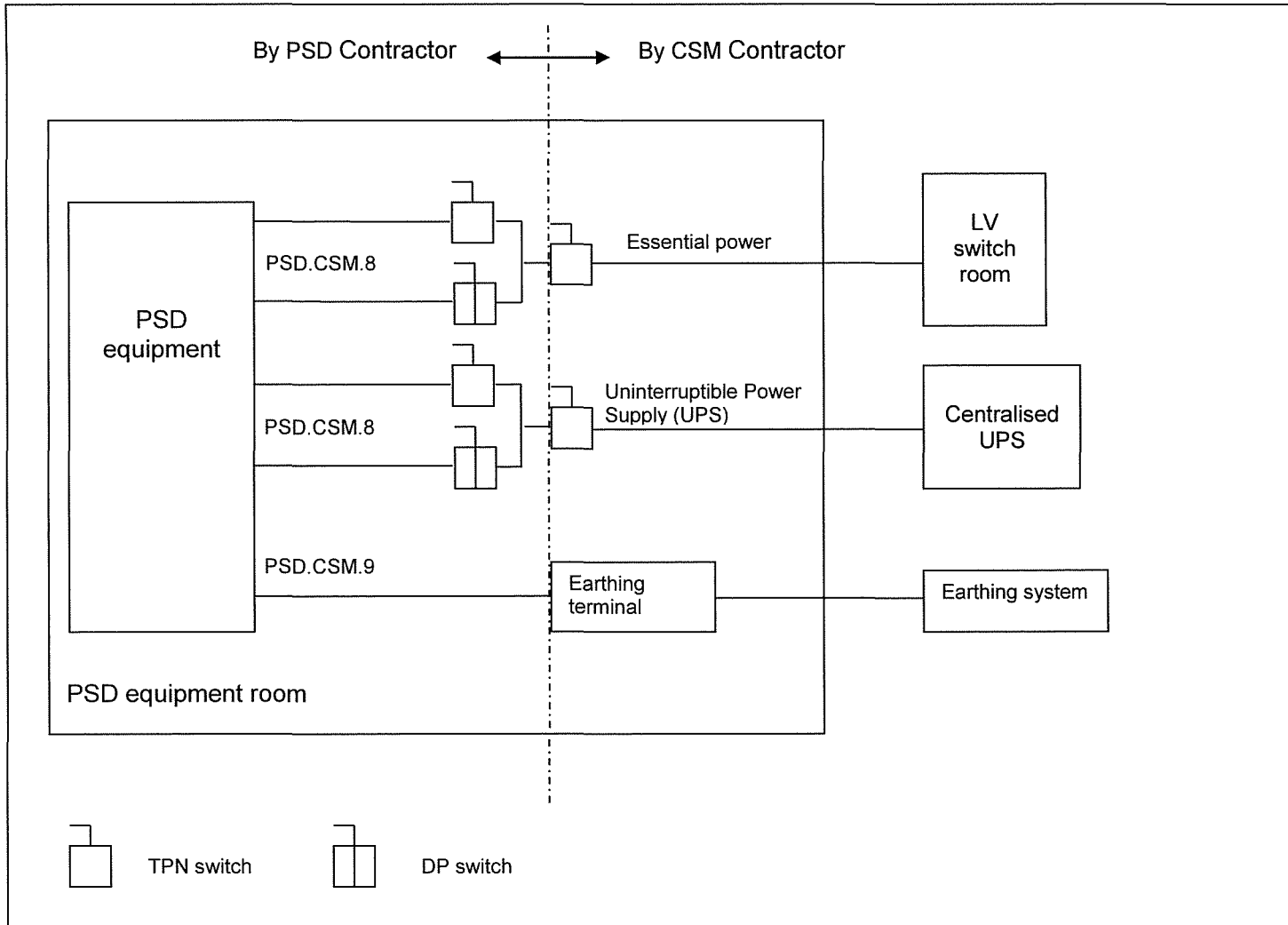


Fig.Infs.PSD-CSM.04

PHYSICAL INTERFACES SCHEDULE

Physical Interface Item Ref.	Works by CSM Contractor	Works by PSD Contractor	Location of Interface	Purpose of Interface
PSD.CSM.1	<ol style="list-style-type: none"> 1. Construct full length platform edge recess including end return panel/ end walking door (ERP/EWD) area on each platform with common survey control points. The construction tolerance for the platform edge recess must be within $\pm 10\text{mm}$ of the specified alignment and level respectively. 2. Level and smooth out the platform edge slab of level difference not more than (+10mm, -0mm) along the platform length for PSD installation 3. Establish datum levels and grid line references to enable the PSD Contractor to set out the PSD equipment. 	<ol style="list-style-type: none"> 1. Provide support structure and anchor at the bottom of the PSD 2. The platform threshold plate brackets must have slotted holes with 20mm tolerance to prevent the anchor from hitting the re-bar 	Along the platform edge including ERP/EWD	To provide the recess for PSD threshold plate, support brackets and bottom support posts

Physical Interface Item Ref.	Works by CSM Contractor	Works by PSD Contractor	Location of Interface	Purpose of Interface
PSD.CSM.2	Provide I-beam / down-stand beam along the platform and ERP/EWD of level difference not more than $\pm 10\text{mm}$ for PSD installation	1. Provide support structure with fixations to I-beam/ down-stand beam with fixings to accommodate the tolerance	Along the platform including ERP/EWD	To provide the top hang support for the header box
PSD.CSM.3	<ol style="list-style-type: none"> 1. Provide insulating platform wall finishes for the ERP/EWD 2. Provide insulating cladding panels above PSD header box 3. Provide insulating floor tile after installation of the interfacing polycarbonate angle by the PSD Contractor along the platform edge 	<ol style="list-style-type: none"> 1. Provide PSD equipment, including all doors, fixed panels, ERP and EWD and bottom supports along the platform edges 2. Provide continuous polycarbonate angle and fasten onto the concrete structure floor to allow a 10mm gap between the floor tile and the PSD threshold plate 3. The height of the polycarbonate angle must be at 15mm below the finished floor 4. Seal up the gaps between the platform wall/floor finishes and the PSD equipment with isolation sealant 	Along the platform including ERP/EWD	To fill up the gap between PSD equipment and surrounding walls, and between floor tiles and PSD for insulation of PSD from earth and structure

Physical Interface Item Ref.	Works by CSM Contractor	Works by PSD Contractor	Location of Interface	Purpose of Interface
PSD.CSM.4	<ol style="list-style-type: none"> 1. Provide the wall/floor/ceiling openings for the cable containment from PSD equipment room to the platform end 2. Provide the protective enclosures (such as galvanised metal sleeve) for cables and cable containment 3. Provide the sealing works of the cross section between the protective enclosures and the wall/floor/ceiling openings 	<ol style="list-style-type: none"> 1. Install PSD cable, equipment and support framework; 2. Undertake the sealing within the protective enclosures for the cables and cable containment. 	From PSD Equipment Room to the platform end	To provide cable protection
PSD.CSM.5	<ol style="list-style-type: none"> 1. Allocate a 2m wide strip / hoardings with access door along platform edge during the period of installation of PSD 2. Allocate an area of 40m² minimum at platform for storage of PSD materials. 	Provide quantity, loading and dimensional information (The storage loadings must not exceed the design loading of the platform slab, i.e. 6kPa live load).	Along the platform	Provide temporary storage for PSD installation

Physical Interface Item Ref.	Works by CSM Contractor	Works by PSD Contractor	Location of Interface	Purpose of Interface
PSD.CSM.6	<p>Allocate temporary site storage for equipment delivery. The CSM Contractor may re-assign, but not more than twice, other storage areas for used by the PSD Contractor suit the site progress.</p> <p>Provide adequate access route for PSD Contractor's equipment delivery</p>	<p>Unloading, delivery and hoisting of PSD equipment to their respective final positions (including all lifting equipment).</p> <p>Co-ordinate and agree with the CSM Contractor on the exact delivery routes, locations, fixing methods of hoisting apparatus and loading on the structure.</p> <p>Where required to relocate the equipment from the storage area in the laydown area, complete the relocation to the new storage area within 3 days upon receipt of the notice from the CSM Contractor.</p> <p>Deliver PSD equipment to PSD equipment room and the platforms.</p>	Laydown area, PSD equipment room, and platforms	Delivery of PSD and PSD equipment

Physical Interface Item Ref.	Works by CSM Contractor	Works by PSD Contractor	Location of Interface	Purpose of Interface
PSD.CSM.7	<ol style="list-style-type: none"> 1. Provide cable containments from PSD equipment room to the signalling equipment room and one end of platform end above ceiling at high level at 3000 AFFL minimum 2. The cable containments provided by the CSM Contractor must extend to 50mm away from the interior face of the wall inside the PSD equipment room and signalling equipment room. 	<ol style="list-style-type: none"> 1. Provide cables from PSD equipment room to signalling equipment room and the PSD equipment at the platform. 2. Provide equipotential bonding between the cable containments provided by the PSD Contractor and the CSM Contractor. 	PSD equipment room, signalling equipment room and platform end at trackside	To install power and control cables for PSD system.
PSD.CSM.8	Provide two TPN switches derived from essential busbars and centralised UPS respectively for PSD equipment in PSD equipment room	Provide power cables from PSD equipment and terminate cables at the switches provided by the CSM Contractor	PSD equipment room	To provide power supply (400V) for PSD system
PSD.CSM.9	Provide main earthing terminal inside the PSD equipment room	Provide downstream earthing conductors and terminate earthing tape/cable onto the main earth terminal	PSD equipment room	To provide earthing for PSD equipment

3 FUNCTIONAL INTERFACE SCHEDULE

3.1 Not used.

4 MESSAGE/DATA EXCHANGE

4.1 Not used.

5 DESIGN CONSTRAINT

5.1 The PSD Contractor and the CSM Contractor must comply with the respective design constraints of the corresponding design requirements in accordance with Tab.Infs.PSD.CSM.02 below.

Clause	Description of Design Requirements	By CSM Contractor	By PSD Contractor
5.1	Operation of PSD must not be affected by power failure of not more than 30 minutes	To ensure that the centralised UPS must be rated to provide a minimum of 30 minute PSD operation	To ensure that operation of PSD is not affected by power failure within 30 minutes for train service with a maximum headway of 2 minutes
5.2	The insulation value between the platform floor / adjacent wall finishes / claddings and PSD after completion of PSD installation (including sealant) must be greater than 0.3M Ohm	To ensure that the platform floor / wall finishes / claddings and corresponding grout within 2m from PSD must be provided with high volume resistivity	<ol style="list-style-type: none"> 1. To ensure that sufficient gap is allowed between the PSD and the adjacent platform floor / wall finishes / claddings before application of sealant 2. To ensure that the sealant must be provided with high volume resistivity

Tab.Infs.PSD.CSM.02

6 INTERFACE DOCUMENTATION RESPONSIBILITY / COORDINATION REQUIREMENT

- 6.1 The PSD Contractor and the CSM Contractor are responsible for coordinating with each other to ensure all the interface requirements are captured and the interfaces works are designed, installed and tested.
- 6.2 The division of responsibility between the PSD Contractor and the CSM Contractor in preparing those portions of interface documents related to interface must be in accordance with table below:

Ref.	Interface Documents	Responsibilities of the PSD Contractor	Responsibilities of the CSM Contractor
6.1	Detailed Interface Specification	As Lead Contractor	As Match Contractor
6.2	Detailed Interface Test Plan	As Lead Contractor	As Match Contractor
6.3	Interface Test Specification	As Lead Contractor	As Match Contractor

7 INTER-SYSTEM ELECTROMAGNETIC COMPATIBILITY

- 7.1 The PSD Contractor and the CSM Contractor must exchange all necessary information concerning EMC/EMI in the respective systems to ensure electromagnetic compatibility in the design and operations. The information must include, but not be limited to, the operating frequencies and associated susceptibility or emission levels of each subsystem in both normal and fault conditions, and their locations.
- 7.2 The information must be properly addressed in the EMI hazard analysis and EMC specification. Appropriate measures must be explicitly listed and demonstrated in the design review.
- 7.3 The EMC tests must be included in the interface tests and additional test provisions must be provided to simulate various operating conditions such as peak traffic, fault conditions, etc. Test criteria must be derived from the requirements and constraints listed in the hazard analysis and EMC specification.

INTERFACE INSPECTION AND TEST SCHEDULE

Ref.	Physical Interface Item Ref.	By CSM Contractor	By PSD Contractor	Purpose of Test / Inspection
8.1	PSD.CSM.1, PSD.CSM.2	Provide access and attendance to the PSD Contractor for joint survey of the civil provision works and rectification of any non-compliance identified from the survey	Agree outstanding remedial works and acceptance of civil provision works completed by CSM Contractor.	<p>Joint survey and inspection of the civil provision works completed by the CSM Contractor for the PSD installation work</p> <p>The joint survey will be completed at least two weeks prior to the date of site access for the PSD Contractor</p>
8.2	PSD.CSM.1, PSD.CSM.2	Provide access and attendance to the PSD Contractor for joint inspection of the civil provision works and completion of any remedial works	confirm the conditions of the Site Agree outstanding remedial works and acceptance of civil provision works completed by CSM Contractor.	<p>Joint inspection of the civil provision works completed by the CSM Contractor for the PSD installation work</p> <p>The joint inspection will occur on the date of site access for the PSD Contractor</p>

EXCHANGE OF DESIGN INFORMATION SCHEDULE

Ref	Physical Interface Item Ref.	By CSM Contractor	By PSD Contractor	Purpose of information exchange
9.1	PSD.CSM.1, PSD.CSM.2	<ol style="list-style-type: none"> 1. Review and confirm the information from the PSD Contractor for adjustment of platform edge design and rebar layout 2. Provide the movement joint details and location 	<ol style="list-style-type: none"> 1. Provide mounting method, setting out of holes position and minimum dimension from structural edge in the re-bar layout 2. Review the movement joint details and location from CSM Contractor and provide design of the PSD to suit 	Platform edge design, movement joint and rebar layout
9.2	PSD.CSM.2	Provide setting out and web reinforcement (if any) details on the I beam design drawings and fabrication drawings	Review and confirm the setting out in the I-beam fabrication drawings are matched with the design of the header box	I beam design drawings and fabrication drawings
9.3	PSD.CSM.1, PSD.CSM.2	Review and incorporate the loading requirements as required by the PSD Contractor	Provide the interactive loading requirements on the platform edge structure	Loading requirements

Ref	Physical Interface Item Ref.	By CSM Contractor	By PSD Contractor	Purpose of information exchange
9.4	PSD.CSM.1, PSD.CSM.2, PSD.CSM.3	<ol style="list-style-type: none"> 1. Provide civil interface details on I-beam, platform ends and platform edge 2. Review and incorporate the PSD setting out dimension requirements as required by the PSD Contractor 3. Ensure the selected materials for platform floor, wall finishes, grout and claddings are compatible with the interfacing element 	<ol style="list-style-type: none"> 1. Define and agree with CSM Contractor all closure, platform edge recess, trim angle and threshold details 2. Provide interfacing drawings on I-beam, platform ends, platform edge and installation position of polycarbonate angle 3. Provide setting out dimensions of PSD along the platform edge including the ERP/EWD 4. Ensure the selected materials and the detailed attachments, closures and seals are compatible with the interfacing element 	Interfacing requirements

Ref	Physical Interface Item Ref.	By CSM Contractor	By PSD Contractor	Purpose of information exchange
9.5	PSD.CSM.4, PSD.CSM.7	<ol style="list-style-type: none"> 1. Review and confirm PSD's requirements are incorporated into SEM and civil drawings 2. Coordinate and incorporate the PSD Contractor's requirement 3. Provide SEM drawings indicating locations, dimensions and quantities of cut-outs / openings, plinths, access panels/doors provisions, nozzles, etc. required to facilitate the PSD installation works 	<ol style="list-style-type: none"> 1. Provide setting out dimensions of SEM openings at each platforms 2. Advise the size and quantity of the cable containment 3. Provide information for cut-outs / openings, plinths, access panels, nozzles, etc. 	CSD/SEM and cable containment requirements

Ref	Physical Interface Item Ref.	By CSM Contractor	By PSD Contractor	Purpose of information exchange
9.6	PSD.CSM.5, PSD.CSM.6	<ol style="list-style-type: none"> 1. Plan and advise access date, access point, lifting / internal transportation information and delivery route drawings 2. Coordinate and agree with the PSD Contractor for the temporary storage area 3. Provide the following records before the date of site access by the PSD Contractor: <ol style="list-style-type: none"> a. as-built survey records of the platform edges and downstand I-beams; b. outstanding work list and agreed completion dates; and c. sketches showing the extent of the access given to the PSD Contractor. 	Provide weight and dimensions of PSD equipment to plan the delivery route to the platform levels and temporary storage in the station	Access, temporary storage and transportation
9.7	PSD.CSM.8, PSD.CSM.9	<ol style="list-style-type: none"> 1. Review and confirm the hole termination details inside PSD equipment room as required by the PSD Contractor 2. Coordinate and incorporate the PSD Contractor's requirement. 	<ol style="list-style-type: none"> 1. Advise the location, hole size and quantities for earthing termination inside PSD equipment room 2. Advise electrical ratings, earthing requirement for PSD equipment 	Electrical provision and earthing requirement

Ref	Physical Interface Item Ref.	By CSM Contractor	By PSD Contractor	Purpose of information exchange
9.8	N/A	Coordinate and incorporate the room ventilation requirement.	Advise heat dissipation value of the PSD equipment and the hydrogen release rate of the battery in the PSD equipment room	Room ventilation
9.9	N/A	Coordinate and confirm the design of mechanical ventilation and background lighting inside the PSD equipment room.	Provide the PSD equipment room layout	Ventilation and lighting level in the room
9.10	N/A	Provide a layout, which incorporates the layout of PSD equipment, showing the building services equipment (including lightings, socket outlets and ventilation equipment) within the equipment room.	Provide layout of PSD equipment	Coordinating the layout of building services provisions and PSD equipment within the PSD equipment rooms

10 WALK THROUGH

10.1 Not Used

11 NAMING CONVENTION

11.1 The PSD Contractor and the CSM Contractor must adopt the Operator's equipment identification procedure for equipment labelling in all documentation.

12 ATTACHMENT

12.1 Not Used

**Sydney Metro
City and Southwest Project
Interface Requirements Specification**

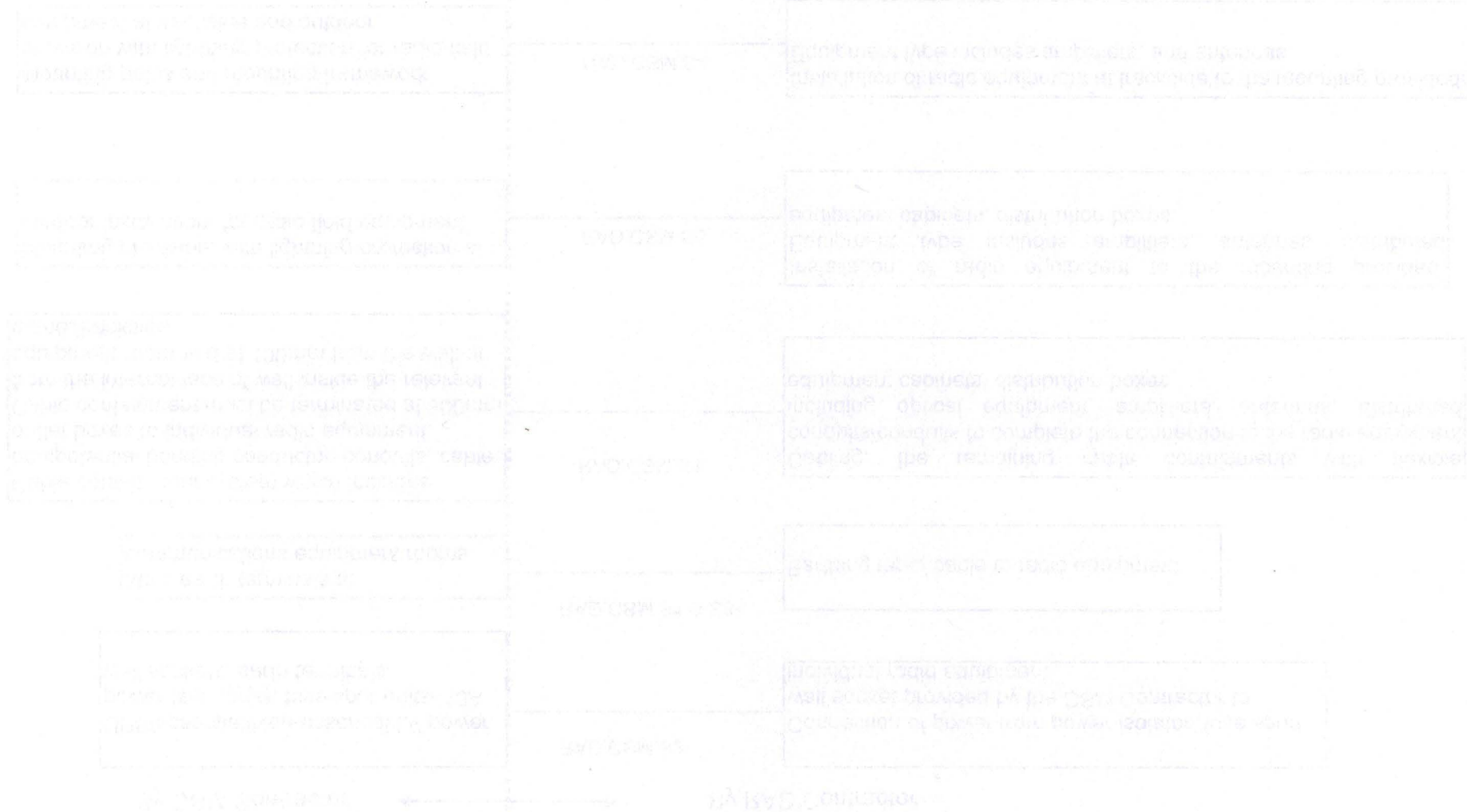
**Radio (RAD Contractor)
and
Central Station Main Works (CSM Contractor)**

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1. INTERFACE DEMARCATION DRAWINGS

1.1 The general physical demarcation and interfaces between the works of the RAD Contractor and the works of the CSM Contractor are shown in the interface demarcation diagram Fig.Infs.RAD-CSM.01.



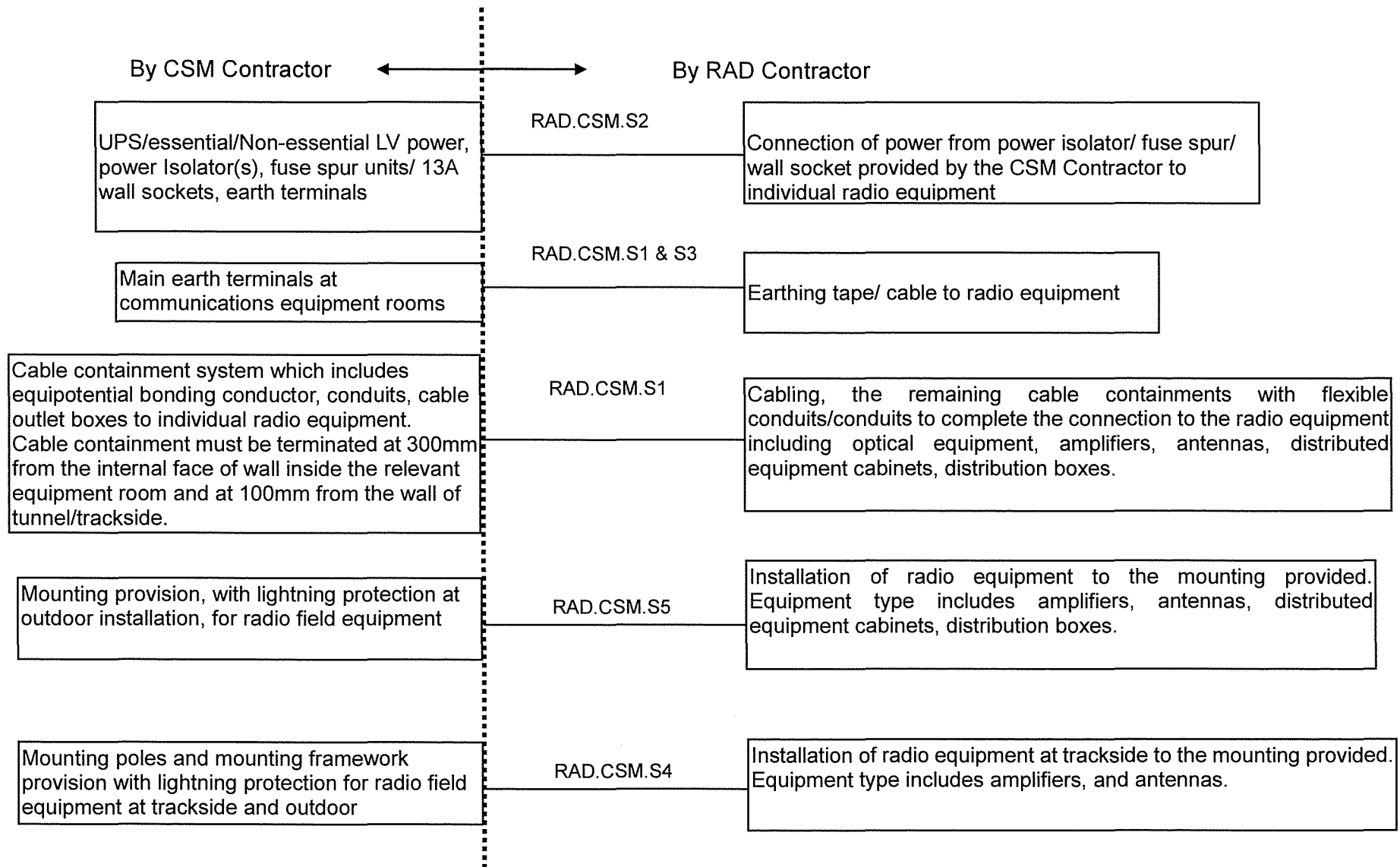


Fig.Infs.RAD.CSM.01

2. PHYSICAL INTERFACES SCHEDULE

Physical Interface Item Ref.	By CSM Contractor	By RAD Contractor	Location of interface	Purpose of interface
RAD.CSM.S1	<ol style="list-style-type: none"> 1. Provide cable containment and equipotential bonding conductor for radio equipment at designated locations/paths, including communications equipment room(s) 2. Provide the protective enclosures (such as galvanised metal sleeve) for cables and cable containment 3. Undertake the sealing works of the cross section between the protective enclosures (sleeves, & etc.) and the wall/floor/ceiling openings. 	<ol style="list-style-type: none"> 1. Provide radio cables with cable fixing/cleats. 2. Provide the remaining cable containments with flexible conduits / conduits to complete the connection to the radio equipment 3. Provide equipotential bonding between the cable containments provided by the RAD Contractor and the CSM Contractor. 4. Undertake the sealing within the protective enclosures for the cables and cable containment 	All areas including equipment room(s) of radio equipment and trackside	Radio cable installation

Physical Interface Item Ref.	By CSM Contractor	By RAD Contractor	Location of interface	Purpose of interface
RAD.CSM.S2	<ol style="list-style-type: none"> 1. Provide cable containment and equipotential bonding conductor, power cables, isolators, distribution boards, MCB, RCCB and any other equipment to extend power connection from LV switchgear and centralized UPS system 2. Provide power points for radio equipment 	Provide power cables with the remaining cable containments from radio equipment and terminate cables at the power points provided by the CSM Contractor.	All areas including radio equipment room(s) of and trackside	Power supply for radio equipment
RAD.CSM.S3	Provide main earth terminal.	Provide downstream earthing conductors and terminate earthing tape/cable onto the main earth terminal.	All areas including radio equipment room(s) of and trackside	Earthing of radio equipment
RAD.CSM.S4	Provide mounting pole and equipment's support frame with lightning protection for installation of radio equipment at trackside and outdoor	Install trackside radio equipment including amplifiers, antennas and the like, provide any lower hanger if necessary	Trackside	Installation of radio equipment at trackside

Physical Interface Item Ref.	By CSM Contractor	By RAD Contractor	Location of interface	Purpose of interface
RAD.CSM.S5	Provide mounting such as openings on ceiling grid, openings on architectural and building works finishes, equipment's support frame (upper hanger if required), poles with lightning protection for antennas and provide sealant of work	Install amplifiers, antennas and the like, provide any lower hanger if necessary	All areas including field equipment locations	Installation of amplifiers, antennas and the like
RAD.CSM.S6	Provide adequate access route and temporary storage area for equipment delivery and storage	Deliver traction supply equipment to the RAD Contractor plantrooms or temporary storage area if plantrooms not ready for delivery	Access route of equipment delivery and storage area	RAD Contractor's equipment delivery and storage

Tab.Infs.RAD-CSM.01

3. FUNCTIONAL INTERFACE SCHEDULE

3.1. Not Used

4. MESSAGE/DATA EXCHANGE

4.1 Not used.

5. DESIGN CONSTRAINTS

5.1. Not used.

6. INTERFACE DOCUMENTATION RESPONSIBILITY/ COORDINATION REQUIREMENT

6.1. The RAD Contractor and the CSM Contractor are responsible for coordinating with each other to ensure all the interface requirements are captured and the interfaces works are designed, installed and tested.

6.2. The division of responsibility between the RAD Contractor and the CSM Contractor in preparing those portions of interface documents related to interface must be in accordance with table below:

Ref.	Interface Documents	Responsibilities of the RAD Contractor	Responsibilities of the CSM Contractor
6.2.1	Detailed Interface Specification	As Lead Contractor	As Match Contractor
6.2.2	Detailed Interface Test Plan	As Lead Contractor	As Match Contractor
6.2.3	Interface Test Specification	As Lead Contractor	As Match Contractor

7. INTER-SYSTEM ELECTROMAGNETIC COMPATIBILITY

7.1. The RAD Contractor and the CSM Contractor must exchange all necessary information concerning EMC/EMI in the respective systems to ensure electromagnetic compatibility in the design and operations. The information must include the

operating frequencies and associated susceptibility or emission levels of each subsystem in both normal and fault conditions, and their locations.

- 7.2. The information must be properly addressed in the EMI hazard analysis and EMC specification. Appropriate measures must be explicitly listed and demonstrated in the design review.
- 7.3. The EMC tests must be included in the interface tests and additional test provisions must be provided to simulate various operating conditions such as peak traffic, fault conditions, etc. Test criteria must be derived from the requirements and constraints listed in the hazard analysis and EMC specification.

8. INTERFACE INSPECTION AND TEST SCHEDULE

Ref.	By CSM Contractor	By RAD Contractor	Purpose of Test / Inspection
8.1	Provide access and attendance to the RAD Contractor for joint inspection of the cable containment works	Acceptance of cable containment works completed by the CSM Contractor.	Joint inspection of cable containment works completed by the CSM Contractor
8.2	Provide access and attendance to the RAD Contractor for joint inspection of the building services works.	Acceptance of building services works completed by the CSM Contractor.	Joint inspection of the building services works completed by the CSM Contractor

9. EXCHANGE OF DESIGN INFORMATION SCHEDULE

Item Ref.	Physical Interface Item Ref.	By CSM Contractor	By RAD Contractor	Purpose of Information Exchange
9.1	RAD.CSM.S1, S4 and S5	Review and confirm the requirements.	Provide equipment location, size, quantity and type of the required cable containment for each radio and radio equipment.	To ensure that the cable containment provided by the CSM Contractor incorporates the requirements of the RAD Contractor prior to installation.

Item Ref.	Physical Interface Item Ref.	By CSM Contractor	By RAD Contractor	Purpose of Information Exchange
9.2	RAD.CSM.S2	Review and confirm the requirements.	Provide electrical ratings, heat dissipation and required type of power provision such as isolator, fused spur/power socket for the required equipment rooms and field equipment locations.	To ensure that electrical installations suit radio equipment.
9.3	RAD.CSM.S1 to S5	Review and confirm the requirements.	Provide equipment room layout and section of radio equipment.	To ensure that building services, radio equipment are well coordinated.
9.4	RAD.CSM.S6	Provide drawings showing dimensions of delivery route and temporary storage area	Provide information on the equipment delivery size and weight, equipment deliver and storage schedule	Provision of delivery route and equipment storage.

10. WALK THROUGH

10.1. Not Used

11. NAMING CONVENTION

11.1. The RAD Contractor and the CSM Contractor must adopt the Operator's equipment identification procedure for equipment labelling in all documentation.

12. ATTACHMENT

12.1. Not Used

**Sydney Metro
City and Southwest Project
Interface Requirements Specification**

**Signalling System (SIG Contractor)
and
Central Station Main Works (CSM Contractor)**

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1 INTERFACE DEMARCATION DRAWINGS

1.1 Not Used.

PHYSICAL INTERFACE SCHEDULE

Physical Interface Item Ref.	By CSM Contractor	By SIG Contractor	Location of interface	Purpose of interface
SIG.CSM.S1	<p>1. SEM civil provisions.</p> <p>2. Provide the protective enclosures (such as galvanised metal sleeve) for cables and cable containment.</p> <p>3. Undertake the sealing works of the cross section between the protective enclosures (sleeves, & etc.) and the wall/floor/ceiling openings.</p>	<p>1. Install signalling system cable, equipment and support framework;</p> <p>2. Undertake the sealing within the protective enclosures for the cables and cable containment.</p>	In the station as indicated on the CSM Contractor's CSD/SEM drawings	Fixing of signalling cable and equipment by the SIG Contractor
SIG.CSM.S2	Provide cable trough and cable ducts with draw wires within and up to 100mm above track support slab, draw pits if required.	<p>1. Install signalling cable.</p> <p>2. Undertake the sealing within the cable duct for the signalling cables and containment</p>	In the station as indicated on the CSM Contractor's CSD/SEM drawings	Cable/pipe protection and fire or water barrier security
SIG.CSM.S3	Supply and install head wall unit / tail wall unit	Supply and install the signalling cable and equipment within head wall unit / tail wall unit	Platform head wall unit / tail wall unit.	Fixing of signalling system cable and equipment by the SIG Contractor

Physical Interface Item Ref.	By CSM Contractor	By SIG Contractor	Location of interface	Purpose of interface
SIG.CSM.S4	Reservation of space at platform for the installation of platform emergency keyswitch as specified in station design	Supply and install the platform emergency keyswitch	Platform	Installation of platform emergency keyswitch
SIG.CSM.S5	Provide 2 of 415V TPN isolating switches (from dual sources).	Provide cables and cable termination from signalling equipment to isolation switches	Signalling equipment room	Essential power supply for signalling equipment
SIG.CSM.S6	Provide a dedicated earth terminal. The dedicated earth terminals must be connected to the principal earth terminals of the main earth mat with two dedicated insulated tape/cables.	Provide earthing tape/cable. Termination of earthing tape/cable onto the dedicated earth terminal	Signalling equipment room	Earthing of signalling equipment
SIG.CSM.S7	Not Used	Not Used	Not Used	Not Used
SIG.CSM.S8	Provide two 32mm conduits with termination box for each platform emergency keyswitch.	Provide cables and terminate cable for each platform emergency keyswitch.	Platform	Installation of platform emergency keyswitches

Physical Interface Item Ref.	By CSM Contractor	By SIG Contractor	Location of interface	Purpose of interface
SIG.CSM.S9	Provide two 32mm conduits with termination box for each keyswitch in headwall/tailwall.	Provide cables and terminate cable for keyswitch.	Headwall / tailwall unit	Installation of keyswitch unit
SIG.CSM.S10	Provide cable containment system and terminate at 300mm from the internal face wall of the equipment room. The cable containments must be connected to the trackside main cable route.	Provide cable containment inside the signalling equipment room and cables.	Station areas as shown on the CSM Contractor's CSD/SEM drawings.	Installation of signalling cables
SIG.CSM.S11	Provide the equipment room with building services provisions.	Provide the signalling equipment.	Signalling equipment room	For the indoor signalling equipment installation
SIG.CSM.S12	Provide adequate access route and temporary storage area for equipment delivery and storage	Deliver SIG equipment to the plantrooms / equipment rooms or temporary storage area if plantrooms / equipment rooms not ready for delivery	Access route of equipment delivery and storage area	SIG equipment delivery and storage

3 FUNCTIONAL INTERFACE SCHEDULE

3.1 Not used.

4 MESSAGE/DATA EXCHANGE

4.1 Not used.

5 DESIGN CONSTRAINTS

5.1 Not used.

6 INTERFACE DOCUMENTATION RESPONSIBILITY / COORDINATION REQUIREMENT

6.1 The SIG Contractor and the CSM Contractor are responsible for coordinating with each other to ensure all the interface requirements are captured and the interfaces works are designed, installed and tested.

6.2 The division of responsibility between the SIG Contractor and the CSM Contractor in preparing those portions of interface documents related to interface must be in accordance with the table below:

Ref.	Interface Documents	Responsibilities of the SIG Contractor	Responsibilities of the CSM Contractor
6.2.1	Detailed Interface Specification	As Lead Contractor	As Match Contractor
6.2.2	Detailed Interface Test Plan	As Lead Contractor	As Match Contractor
6.2.3	Interface Test Specification	As Lead Contractor	As Match Contractor

7 INTER-SYSTEM ELECTROMAGNETIC COMPATIBILITY

- 7.1 The SIG Contractor and the CSM Contractor must exchange all necessary information concerning EMC/EMI in the respective systems to ensure electromagnetic compatibility in the design and operations. The information must include the operating frequencies and associated susceptibility or emission levels of each subsystem in both normal and fault conditions, and their locations.
- 7.2 The information must be properly addressed in the EMI hazard analysis and EMC specification. Appropriate measures must be explicitly listed and demonstrated in the design review.
- 7.3 The EMC tests must be included in the interface tests and additional test provisions must be provided to simulate various operating conditions such as peak traffic, fault conditions, etc. Test criteria must be derived from the requirements and constraints listed in the hazard analysis and EMC specification.

8 INTERFACE INSPECTION AND TEST SCHEDULE

Ref.	Physical Interface Item Ref.	By CSM Contractor	By SIG Contractor	Purpose of Test / Inspection
8.1	SIG- CSM.S1,S2,S 10	Provide access and attendance to the SIG Contractor for joint inspection of the cable containment works	Acceptance of cable containment works completed by the CSM Contractor.	Joint inspection of the cable containment works completed by the CSM Contractor
8.2	SIG- CSM.S3~S9, S11	Provide access and attendance to the SIG Contractor for joint inspection of the building services works.	Acceptance of building services works completed by the CSM Contractor.	Joint inspection of the building services works completed by the CSM Contractor

9 EXCHANGE OF DESIGN INFORMATION SCHEDULE

Item Ref	Physical Interface Item Ref.	By CSM Contractor	By SIG Contractor	Purpose of Information Exchange
9.1	SIG-CSM.S1-S4	Review and confirm method statement is acceptable	Provide the method statement of equipment mounting.	Confirmation of installation's provision
9.2	SIG-CSM.S1-S4	Advise the "drill and no-drill zone".	Follow the requirements of the drilling zones.	Confirmation of installation's provision
9.3	SIG-CSM.S1-S4	Review information provided by the SIG Contractor and confirm acceptance of the location, setting out and loading of signalling equipment.	Provide the location, setting out and loading of signalling equipment to be installed by drill and fix method.	Confirmation of installation's provision
9.4	SIG-CSM.S1-S4	Provide cut-outs / openings / cable ducts based on the SIG Contractor's requirements	Provide locations, dimensions and quantities of cut-outs / openings / cable ducts required to facilitate signalling installation works	Confirmation of installation's provision
9.5	SIG-CSM.S5	Coordinate the ratings and location of isolating switches in accordance with the power loading requirement.	1. Provide the total AC power loading of the signalling equipment 2. Provide room layout 3. Agreed with the CSM Contractor the ratings and location of the isolators.	Confirmation of building service's provision
9.6	SIG-CSM.S7	Not Used	Not Used	Not Used
9.7	SIG.CSM.S8-S9	Coordinate the platform emergency keyswitch and keyswitch locations for the cable containment/conduit and termination box provision.	To provide the platform emergency keyswitch and keyswitch installation design and platform layout design.	Confirmation of building service's provision
9.8	SIG.CSM.S10	Coordinate and incorporate SIG's requirements	Confirm the size and quantity of the cable containment and cable bending radius	Confirmation of installation's provision

Item Ref	Physical Interface Item Ref.	By CSM Contractor	By SIG Contractor	Purpose of Information Exchange
9.9	SIG.CSM.S11	Coordinate the location of four 10A maintenance socket outlets (essential) inside signalling equipment room.	Review and confirm the locations of four 10A maintenance socket outlets (essential) inside signalling equipment room are acceptable.	Confirmation of building service's provision
9.10	SIG.CSM.S11	Coordinate the building services provisions based on signalling equipment room layout provided by the SIG Contractor. The building services provisions should include the following: (i) fluorescent lighting (essential and emergency lighting); (ii) smoke detector; (iii) gas flooding system; (iv) portable fire extinguisher; and (v) ventilation (vi) raised floor earthing	Provide equipment layout and battery type & size inside signalling equipment room and confirm the location of all building services provisions is acceptable.	Confirmation of building service's provision
9.11	SIG.CSM.S11	Provide duty/standby air-conditioning system in accordance with the heat loading requirement.	Provide equipment heat loading.	Confirmation of building service's provision
9.12	SIG.CSM.S12	Provide drawings showing dimensions of delivery route and temporary storage area	Provide information on the equipment delivery size and weight, equipment delivery and storage schedule	Confirmation of delivery route and temporary storage provisions

10 WALK THROUGH

10.1 Not Used

11 NAMING CONVENTION

11.1 The SIG Contractor and the CSM Contractor must adopt the Operator's equipment identification procedure for equipment labelling in all documentation.

12 ATTACHMENT

12.1 Not Used

**Sydney Metro
City and Southwest Project
Interface Requirements Specification**

**Central Control System (CCS Contractor)
and
Central Station Main Works (CSM Contractor)**

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1. INTERFACE DEMARCATION DIAGRAM

- 1.1 The general physical demarcation and interfaces between the works of the CSM Contractor and the works of the CCS Contractor are shown in the interface demarcation diagram Fig.Infs.CSM-CCS.01.

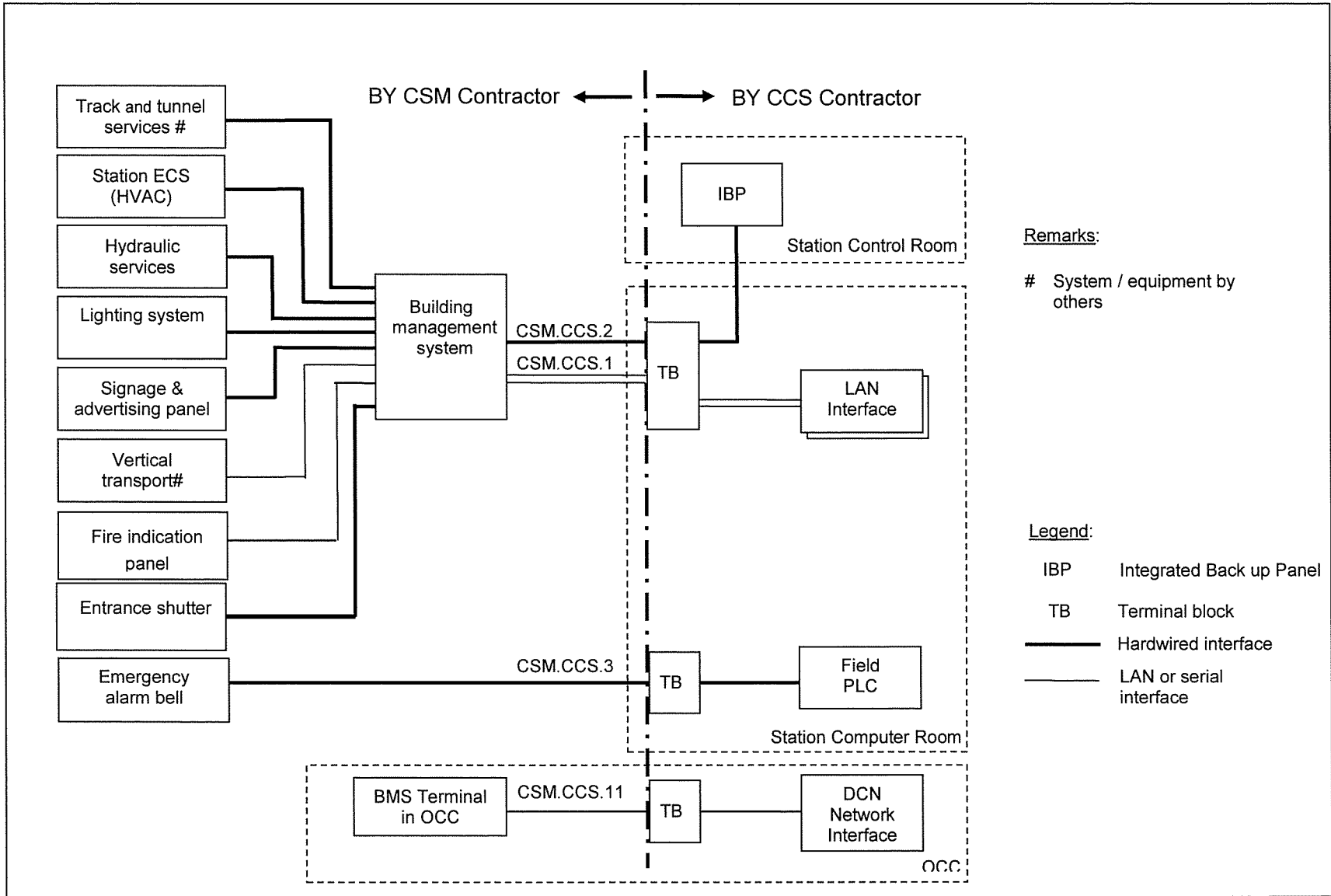


Fig.Infs.CSM-CCS.01

2. PHYSICAL INTERFACE SCHEDULE

Physical Interface Item Ref.	Works by CSM Contractor	Works by CCS Contractor	Interface Type	Location of Interface	Purpose of Interface
CSM.CCS.01	Provide cables with cable identification and termination from building management services equipment to the terminal block provided by the CCS Contractor	Provide terminal block and cabling to CCS	LAN interface	Station Computer Room	Control and monitoring of station building management services equipment; Provision of communication network for BMS
CSM.CCS.02	Provide cables with cable identification and termination from BMS to the terminal block provided by the CCS Contractor	Provide terminal block and cabling to IBP	Hardwired interface	Station Computer Room	Execution of station evacuation function for lift and signage
CSM.CCS.03	Provide alarm bell and cables with cable identification and termination from alarm bell to the terminal block provided by the CCS Contractor	Provide terminal block and cabling to CCS PLC	Hardwired interface	Station Computer Room	Monitoring of emergency alarm bell inside disable toilet, female toilet and parent room
CSM.CCS.04	Not used	Not used	Not used	Not used	Not used
CSM.CCS.05	Provision of isolator / fused connection unit and cabling with cable containment from UPS as per interfacing locations in relevant drawings	Power distribution cabling / wiring to CCS equipment	N/A	Refer to the CSM Contractor's drawings	UPS power supply for CCS equipment

Physical Interface Item Ref.	Works by CSM Contractor	Works by CCS Contractor	Interface Type	Location of Interface	Purpose of Interface
CSM.CCS.06	Cable containment system including cable tray / trunking / conduit, which must terminate at 300mm away from the internal face of wall inside the equipment room	Cabling for CCS equipment	N/A	Refer to the CSM Contractor's CSM/SED drawings	Provision of cable containment for CCS cables
CSM.CCS.07	Provision of junction box and associated conduit (20mm diameter size) connecting to CCS main cable containment Provide junction box and cable containment for the following LAN sockets: 4 in Station Control Room; 2 in the Station Computer Room; 1 in staff meal room; 4 in maintenance office equipment room	LAN cabling and front cover plate with socket (twin RJ-45 outlets)	N/A	Refer to the CSM Contractor's drawings	Provision of OA LAN sockets for information technology data network
CSM.CCS.08	Main earth tape terminals	Earthing connection cabling to CCS equipment	N/A	Refer to the CSM Contractor's drawings	Power & signal earthing

Physical Interface Item Ref.	Works by CSM Contractor	Works by CCS Contractor	Interface Type	Location of Interface	Purpose of Interface
CSM.CCS.09	<ol style="list-style-type: none"> 1. Provision of cable trunking system under raised floor in Station Control Room and Station Computer Room 2. Provision of common cable tray and trunking to connect this cable trunking system to cable containment entering Station Control Room and Station Computer Room for various electrical and mechanical systems (vertical links must include three of 200mm x 100mm trunking in Station Computer Room and one of 100mm x 100mm trunking in Station Control Room) 	Coordinate with the CSM Contractor on the route and layout of cable trunking system	N/A	Station Control Room and Station Computer Room	Provision of cable trunking in Station Control Room and Station Computer Room
CSM.CCS.10	<ol style="list-style-type: none"> 1. SEM civil provisions; 2. Provide the protective enclosures (such as galvanised metal sleeve) for cables and cable containment 3. Undertake the sealing works of the cross section between the protective enclosures (such as galvanised sleeves.) and the wall/floor/ceiling openings. 	<ol style="list-style-type: none"> 1. Install CCS cable, equipment and support framework; 2. Undertake the sealing within the protective enclosures for the cables and cable containment. 	N/A	All areas as specified on the CSM Contractor's SEM drawings	Fixing of CCS cable and equipment by the CCS Contractor

Physical Interface Item Ref.	Works by CSM Contractor	Works by CCS Contractor	Interface Type	Location of Interface	Purpose of Interface
CSM.CCS.11	Provide cables with cable identification and termination from BMS Terminal to the terminal block provided by the CCS Contractor	Provide terminal block and cabling to DCN	LAN interface	OCC	Provision of communication network for BMS

3. FUNCTIONAL INTERFACE SCHEDULE

Clause	Functional Description	Physical Interface Item Ref.	Works by CSM Contractor	Works by CCS Contractor
3.1 General Requirements				
3.1.1	Time synchronisation	CSM.CCS.01	BMS must time synchronise with CCS through the network interface.	CCS must time synchronise with BMS through the network interface.
3.1.2	Health status monitoring	CSM.CCS.01	BMS must send common fault alarms to CCS for monitoring.	CCS must receive common fault alarms from BMS for alarm reporting.
3.1.3	Anti-virus definition update	CSM.CCS.01	Provide anti-virus software in computer equipment in consultation with the CCS Contractor. Manual/automatic update of virus pattern must be undertaken via the network interface with the centralised virus definition server provided by CCS. The system functions and performance must not be affected during update.	Provide centralised virus definition server for update by BMS.
3.2 Station ECS (HVAC)				
3.2.1	Monitoring of station ECS equipment status/ alarms	CSM.CCS.01	BMS must receive all real time data from the connected station ECS equipment and transmit to CCS.	Receive alarm/status of station ECS equipment from BMS and display on CCS VDUs in both text and graphic format.
3.2.2	Control of station ECS equipment	CSM.CCS.01	BMS must receive control command from CCS and execute the command after checking any conflict and control priority which is specified in Attachment B.	Issue command for individual, group or mode control of station ECS equipment from CCS VDU to BMS.

Clause	Functional Description	Physical Interface Item Ref.	Works by CSM Contractor	Works by CCS Contractor
3.2.3	Auto/manual setting for station ECS mode	CSM.CCS.01	Based on the auto/manual control selection, perform station ECS control according to the required logic.	Provide auto/manual selection for station ECS mode control (if any). The auto/manual control selection must be passed to BMS.
3.2.4	Remote / auto and remote / manual setting of individual or group of equipment	CSM.CCS.01	Set the individual or group of equipment to auto or manual operation accordingly.	Pass remote/auto and remote/manual selection for individual or group of equipment to BMS.
3.2.5	Monitoring of remote / auto and remote / manual setting of individual or group of equipment	CSM.CCS.01	Report the current remote/auto and remote/manual setting of individual or group of equipment to CCS on request and during initialisation.	Receive the current remote/auto and remote/manual setting of individual or group of equipment from BMS and display on CCS VDU. During initialisation of the link between CCS and BMS, CCS must read the current setting from BMS.
3.2.6	Setting/resetting of individual equipment permit-to-work (PTW) tag at the CCS VDU	CSM.CCS.01	Upon receipt of the permit-to-work (PTW) setting command, BMS must inhibit the automatic/manual operation of that equipment until the PTW tag has been reset.	Allow operator to assign PTW tag for an equipment item and then pass the PTW tag setting/resetting command to BMS.
3.2.7	Monitoring of individual equipment PTW tag at the CCS VDU	CSM.CCS.01	Report the current PTW tag setting of each equipment item to CCS on request and during initialisation.	Receive the current PTW setting of each equipment item from BMS and display on CCS VDU. During initialisation of the link between CCS and BMS, the CCS must read the current tag setting from BMS.

Clause	Functional Description	Physical Interface Item Ref.	Works by CSM Contractor	Works by CCS Contractor
3.2.8	Monitoring of operation time table setting from CCS VDU	CSM.CCS.01	Report the current setting of operation time table to CCS on request and during initialisation.	Receive the current setting of operation time table from BMS and display on CCS VDU. During initialisation of the link between CCS and BMS, the CCS must read the current setting from BMS.
3.2.9	Setting of operation time table from CCS VDU	CSM.CCS.01	Receive the time table setting from CCS and set the time table for execution accordingly.	Allow the operator to edit the time table setting from CCS VDU and transmit the setting to BMS.
3.2.10	Station temperature monitoring	CSM.CCS.01	BMS must send the air temperature readings to CCS.	Provide tabular display for viewing the maximum and minimum temperature limits and the temperature readings.
3.2.11	Station ECS parameter setting from CCS VDU	CSM.CCS.01	Receive setting of station ECS equipment parameters from CCS and report the current values to CCS.	Provide facilities for the operator to set and view parameters from CCS VDU.
3.3 Fire System				
3.3.1	Monitoring of fire system status and alarms	CSM.CCS.01	Provide alarm/status of the fire services equipment and fire zone alarms to CCS.	Receive alarm/status of the fire services equipment and fire zone alarms and display in both text and graphic format.
3.4 Hydraulic Services				
3.4.1	Remote manual control of hydraulic services equipment	CSM.CCS.01	In LMCP remote mode, the system must accept and execute the start command from CCS via BMS. In LMCP local mode, the system must not accept any commands from CCS to control the hydraulic services equipment.	In LMCP remote mode, the CCS must be able to send a command to BMS to start hydraulic services equipment manually. In LMCP local mode, the CCS must not allow operator to send command to control the hydraulic services equipment.

Clause	Functional Description	Physical Interface Item Ref.	Works by CSM Contractor	Works by CCS Contractor
3.4.2	Monitoring of hydraulic services equipment status /alarm at CCS VDU	CSM.CCS.01	Provide hydraulic services equipment status and alarm signals to CCS according to the I/O point schedule.	Collect hydraulic services equipment status & alarm signals from BMS and display at CCS VDU for operation and maintenance.
3.5 Lighting System				
3.5.1	Monitoring of lighting system	CSM.CCS.01	Provide group lighting equipment status signals to CCS according to the I/O point schedule.	Collect the group lighting equipment status signals from lighting system and display at CCS VDUs for operation.
3.5.2	Control of lighting system	CSM.CCS.01	Accept commands from CCS and perform the switching of lighting system on group basis.	Send command to BMS for on / off control of lighting system. For public area lighting, CCS must also send command to BMS for lighting level selection (e.g. 50%/100% if available) for each public lighting zone.
3.5.3	Enable / disable photosensor control for outdoor and perimeter lighting	CSM.CCS.01	Outdoor and perimeter lighting system must use photo-sensing device to determine the lighting level and select the corresponding lighting switching. Photosensor control must take effect only when it is enabled and an ON command is received from CCS. The photosensor must be able to be manually disabled by CCS.	Send command to BMS to enable/disable photosensor control.
3.6 Signage and Advertising Panel				
3.6.1	Monitoring of signage status	CSM.CCS.01	Perform necessary grouping on some type of signage according to the interface point schedule and then pass to CCS.	Collect the signage status signals (in groups and by individual according to the interface point schedule) from BMS and display at CCS VDU.

Clause	Functional Description	Physical Interface Item Ref.	Works by CSM Contractor	Works by CCS Contractor
3.6.2	Control of signage	CSM.CCS.01	Accept the command from CCS and perform the control of signage.	Provide scheduled control and remote manual override control by CCS VDU on the switching of signage to on/off and appropriate aspect.
3.6.3	Monitoring of advertising panel status	CSM.CCS.01	Perform necessary grouping for advertising panels by monitoring the grouped status of the power supply circuits on per concourse and per platform according to the interface point schedule and then pass to CCS.	Collect the advertising panel status signals (in groups) and display at CCS VDU.
3.6.4	Control of advertising panel	CSM.CCS.01	Accept the command from CCS and perform the control of all advertising panel.	Provide scheduled control and remote manual override control by CCS VDU.
3.7 Vertical Transport				
3.7.1	Monitoring of Vertical Transport status/ alarm	CSM.CCS.01	BMS must receive status/alarm from Vertical Transport and transmit to CCS.	Receive status/alarm of Vertical Transport from BMS and display on CCS VDU in both text and graphic format.
3.7.2	Remote control of Vertical Transport	CSM.CCS.01	BMS must receive control command from CCS and issue the command to the respective Vertical Transport accordingly.	Issue command for Vertical Transport from CCS VDU to BMS.
3.8 Entrance Shutters (if applicable)				
3.8.1	Monitoring of security shutter status	CSM.CCS.01	Provide status of entrance security shutter to CCS.	Receive status of entrance security shutter and display on CCS VDU.
3.8.2	Remote control of security shutter (if remote control available)	CSM.CCS.01	Receive control command from CCS and operate the respective security shutter accordingly.	Issue command to security shutter from CCS VDU.

Clause	Functional Description	Physical Interface Item Ref.	Works by CSM Contractor	Works by CCS Contractor
3.9 Track and Tunnel Services				
3.9.1	Monitoring of trackside facilities (including trackside sump pit and sump pump, trackside lighting, trackside advertising panel, portal lighting)	CSM.CCS.01	BMS must receive status/alarm from trackside facilities and transmit to CCS.	Receive status/alarm of trackside facilities from BMS and display on CCS VDU in both text and graphic format.
3.9.2	Remote control of trackside facilities (including trackside sump pit and sump pump, trackside lighting, trackside advertising panel, portal lighting)	CSM.CCS.01	BMS must receive control command from CCS and issue the command to the respective trackside facilities accordingly.	Issue command for trackside facilities from CCS VDU to BMS.
3.10 Emergency Alarm Bell (if applicable)				
3.10.1	Monitoring of emergency alarm bell inside disable toilet, female toilet and parent room	CSM.CCS.03	Provide status of emergency alarm bell to CCS.	Receive status of alarm bell and generate alarm to alert the operator when activated.
3.11 Station Evacuation				
3.11.1	Execution of station evacuation function for lift and signage	CSM.CCS.01 CSM.CCS.02	Receive station evacuation command and execute the following: 1) Display and announcement of "Emergency Evacuation..." warning message in lift car (if applicable) 2) Activate all emergency signs	Issue station evacuation command to activate lift evacuation message and emergency signs via BMS.

4. MESSAGE/DATA EXCHANGE

4.1 Communication Protocol

For Interface Ref. CSM.CCS.1, MODBUS communication protocol over TCP/IP network must be employed. Other open protocol may be proposed for this interface subject to approval.

4.2 Communication Redundancy

For Interface Ref. CSM.CCS.1, the CCS must establish redundant communication links with BMS. In the event of the duty link failure, switchover to the standby link must be accomplished automatically without loss of data or affecting the interfacing functions. Both BMS and CCS must monitor the health status of the duty and standby links. An alarm must be generated in the BMS and CCS in the event of switchover to the standby link or upon detection of any communication link failure.

4.3 Control and Monitoring Points

The typical control and monitoring points for the BMS and CCS interface are specified in Attachment A. BMS must be the source system of DI signal whereas CCS must be the interfacing system.

5. DESIGN CONSTRAINT

Ref	Design Requirements Description	By CSM Contractor	By CCS Contractor
5.1	Response time requirement of status update from BMS to CCS	When any change of equipment status/alarm is detected by BMS, the respective signal must be transmitted to the CCS within 2 seconds.	CCS must reflect the change of status/alarm on the CCS VDU within 2 seconds upon receipt of the signal.
5.2	Response time requirement of control from CCS to BMS	When a control operation command from CCS is received by BMS, it must execute the respective control operation within 2 seconds.	When a control command is initiated from the CCS, the command must be despatched to the interfacing point within 2 seconds.

6. INTERFACE DOCUMENTATION RESPONSIBILITY / COORDINATION REQUIREMENT

- 6.1 The CCS Contractor and the CSM Contractor are responsible for coordinating with each other to ensure all the interface requirements are captured and the interfaces works are designed, installed and tested.
- 6.2 The division of responsibility between the CCS Contractor and the CSM Contractor in preparing those portions of interface documents related to interface must be in accordance with table below:

Ref.	Interface Documents	Responsibilities of the CCS Contractor	Responsibilities of the CSM Contractor
6.2.1	Detailed Interface Specification	As Lead Contractor	As Match Contractor
6.2.2	Detailed Interface Test Plan	As Lead Contractor	As Match Contractor
6.2.3	Interface Test Specification	As Lead Contractor	As Match Contractor

7. INTER-SYSTEM ELECTROMAGNETIC COMPATIBILITY

- 7.1 The CCS Contractor and the CSM Contractor must exchange all necessary information concerning EMC/EMI in the respective systems to ensure electromagnetic compatibility in the design and operations. The information must include the operating frequencies and associated susceptibility or emission levels of each subsystem in both normal and fault conditions, and their locations.
- 7.2 The information must be properly addressed in the EMI hazard analysis and EMC specification. Appropriate measures must be explicitly listed and demonstrated in the design review.
- 7.3 The EMC tests must be included in the interface tests and additional test provisions must be provided to simulate various operating conditions such as peak traffic, fault conditions, etc. Test criteria must be derived from the requirements and constraints listed in the hazard analysis and EMC specification.

8. INTERFACE INSPECTION AND TEST SCHEDULE

Clause	Details	By CSM Contractor	By CCS Contractor
8.1	Software Interface Protocol Tests	The data protocol on both sides of the CCS/BMS data interface must be measured and checked for compliance with the Detailed Interface Specification prior to site installation.	
8.2	Software proofing platform test	<p>100% point-to-point software interface tests and functional pre-tests must be jointly performed prior to site installation in order to:</p> <p>(1) ensure the correct input/output (I/O) point address mapping between CCS and BMS</p> <p>(2) pre-test all interface functions and response time which are possible to be carried out in the Software Proofing Platform Test</p> <p>The CSM Contractor must assemble a reduced configuration of BMS using actual equipment which must eventually be delivered to site. The BMS test configuration must represent closely the final configuration at site.</p>	
8.3	Point-to-Point Tests	100% point-to-point tests for all the hardwired and software interface I/O points must be jointly performed at site to verify the correct mapping between CCS and BMS.	
8.4	End-To-End Tests	At least 20% end-to-end tests for the hardwired and software interface I/O points must be jointly performed at site to ensure that CCS can monitor and control each BMS connected equipment item from the HMI. The tests must cover 100% control points and all types of I/O points.	
8.5	Functional Tests	Full functional tests between CCS and BMS must be jointly performed at site to confirm that the functional requirements are fulfilled.	

9. EXCHANGE OF DESIGN INFORMATION SCHEDULE

Ref	Physical Interface Item Ref.	By CSM Contractor	By CCS Contractor	Purpose of Information Exchange
9.1	CSM.CCS.1	Provide mode table and associated schematic and data elaborating the operating requirement including forward/reverse, on/off, close/open for each station ECS equipment for each mode.	Receive detailed ECS mode information from the CSM Contractor and to implement CCS graphical/ data presentation accordingly.	Table of mode of operation
9.2	CSM.CCS.1	Provide formula and algorithm to assist the CCS Contractor to deduce report data.	CCS must use system status to perform calculation including accumulation of running time, addition, subtraction, multiplication and division as required in producing required reports.	Indication, logging and reporting
9.3	CSM.CCS.1 CSM.CCS.2 CSM.CCS.3	Provide the detailed data interface schedules of all interface signals to CCS for configuring the database, which must include all detailed information such as memory/register addresses and register definitions. Both the hardcopy and softcopy (in Microsoft Excel 2007 or above) of the detailed data interface schedules must be submitted.	Design and configure the CCS database for all interfacing signals with station ECS based on the detailed data interface schedules provided by the CSM Contractor.	Detailed data interface schedule
9.4	CSM.CCS.1	Provide BMS HMI and related detailed information to the CCS Contractor for the design of the CCS HMI.	Make reference to the information provided by the CSM Contractor and configure the CCS HMI.	Design information for CCS HMI
9.5	CSM.CCS.1 CSM.CCS.11	Configure the equipment provided by the CCS Contractor as per the IP address scheme.	Provide the IP address scheme for equipment to be provided by the CSM Contractor.	IP address scheme

Ref	Physical Interface Item Ref.	By CSM Contractor	By CCS Contractor	Purpose of Information Exchange
9.6	CSM.CCS.6 CSM.CCS.7 CSM.CCS.9	<ol style="list-style-type: none"> 1. Review and confirm CCS requirements are incorporated into SEM and civil drawings 2. Coordinate and incorporate the CCS Contractor's requirement 3. Provide SEM drawings indicating locations, dimensions and quantities of cut-outs / openings required to facilitate the CCS installation works 	<ol style="list-style-type: none"> 1. Provide setting out dimensions of SEM openings at each platforms 2. Advise the size and quantity of the cable containment 3. Provide information for cut-outs / openings etc. 	CSD/SEM and cable containment requirements
9.7	CSM.CCS.5 CSM.CCS.7 CSM.CCS.11	Provide details on the exact location of LAN sockets, power sockets, fused connection units and isolating switches prior to site installation.	Review and confirm requirements	Location of LAN sockets, power sockets, fused connection units and isolating switches

10. WALK THROUGH

10.1 Not Used

11. NAMING CONVENTION

11.1 The CCS Contractor and the CSM Contractor must adopt the Operator's equipment identification procedure for equipment labelling in all documentation.

12. ATTACHMENT

Attachment A – Control and Monitoring Point Definition (Typical)

Attachment B – Particular Requirements for Station ECS (Subject to Design)

ATTACHMENT A – CONTROL AND MONITORING POINT DEFINITION (TYPICAL)

A.1 Station ECS (HVAC) Interface Points

Equipment Designation	Equipment Item	Control & Monitoring Requirement	Link to CCS via Ethernet						Remark
			DI	DI2	DO	AI	AO	PI	
CHI	Water Cooled Chiller	Stop / Run Status	1						
		Master Trip / Normal	1						
		Local / Remote Status	1						
		Run / Stop Control			2				
		kWH Monitoring				1			
ARF	Auto Roll Filter	End of Roll	1						
AHU / PAU	Air Handling Unit / Primary Air Unit	Stop / Run Status	1						
		Master Trip / Normal	1						
		Local / Remote Status	1						
		Run / Stop Control			2				
CHP	Chilled Water Pump	Stop / Run Status	1						
		Master Trip / Normal	1						
		Local / Remote Status	1						
		Run / Stop Control			2				
CWP	Condensing Water Pump	Stop / Run Status	1						
		Master Trip / Normal	1						
		Local / Remote Status	1						
		Run / Stop Control			2				
COT	Cooling Tower	Stop / Run Status	1						
		Run / Stop Control			2				
		Local / Remote Status	1						
		High Level Alarm	1						
MWP	Make-up Water Pump	Stop / Run Status	1						
		Master Trip / Normal	1						
		Local / Remote Status	1						
		Run / Stop Control			2				
MWT	Make-up Water Tank	High Level Alarm	1						
		Low Level Alarm	1						

Equipment Designation	Equipment Item	Control & Monitoring Requirement	Link to CCS via Ethernet						Remark
			DI	DI2	DO	AI	AO	PI	
FET	Feed and Expansion Tank	High Level Alarm	1						
		Low Level Alarm	1						
CDU	Chemical Dosing Unit	Fault / Normal	1						
INF / EXF / FAF	Intake Air Fan / Exhaust Air Fan / Fresh Air Fan	Stop / Run Status	1						
		Master Trip / Normal	1						
		Local / Remote Status	1						
		Run / Stop Control			2				
FCF	Free Cooling Fan	Stop / Run Status	1						
		Master Trip / Normal	1						
		Local / Remote Status	1						
		Run / Stop Control			2				
TSN	Temperature Sensor (Chilled Water)	Temperature Monitoring				1			
FCU (for Equipment Room)	Fan Coil Unit	Stop / Run Status	1						
		Master Trip / Normal	1						
STR	Strainer (Air)	Pressure High Alarm	1						
STR	Strainer (Water)	Pressure High Alarm	1						
		Backwash Status	1						Subject to final design
		Backwash Control			2				
RSF	Flow Switch	Flow / No Flow	1						
FSN	Flow Meter	Flow Rate Measurement				1			
RSH	Space Relative Humidity Sensor	Relative Humidity Monitoring				1			
MOD	Motorised Operated Damper	Open / Close Status		1					
		Open / Close Control (for Public Area only)			2				
MOV	Motorised Operated Valve	Open / Close Status		1					
		Open / Close Control			2				

Equipment Designation	Equipment Item	Control & Monitoring Requirement	Link to CCS via Ethernet						Remark
			DI	DI2	DO	AI	AO	PI	
MFD	Motorised Smoke and Fire Damper	Open / Close Status		1					
		Open / Close Control			2				
SEF	Smoke Extraction Fan	Stop / Run Status	1						
		Master Trip / Normal	1						
		Local / Remote Status	1						
		Run / Stop Control			2				
SPF	Staircase Pressurisation Fan	Stop / Run Status	1						
		Master Trip / Normal	1						
		Local / Remote Status	1						
		Run / Stop Control			2				
TSN	Space Temperature Sensor	Temperature Monitoring				1			
RST	Room Temperature Sensor	High Temperature Alarm	1						
LCP	Local control Panel	Local / Remote Status	1						
--	BMS PLC	Failure / Health Status	1						
--	Other BMS Component	Failure / Health Status	N*						N* depends on BMS system configuration
--	CCS A/M Selection & Indication	Auto / Manual Selection			2				
		Auto / Manual Indication	1						
--	Normal Mode	On / Off Control			2				
		Mode Successful	1						
		Mode Unsuccessful	1						
		Mode In Progress	1						
		Mode Stop	1						
--	Smoke Extraction Mode	On / Off Control							Controlled by FIP
		Mode Successful	1						
		Mode Unsuccessful	1						
		Mode In Progress	1						
		Mode Stop	1						

Equipment Designation	Equipment Item	Control & Monitoring Requirement	Link to CCS via Ethernet						Remark
			DI	DI2	DO	AI	AO	PI	
--	Staircase Pressurisation Mode (if applicable)	On / Off Control			2				Controlled by FIP
		Mode Successful	1						
		Mode Unsuccessful	1						
--	V/AC Manual Override Zone Control (if applicable)	Override Control							Controlled by FIP
		Override ON Status	1						
--	Equipment Group Control	Equipment Group Control			2N*				N* depends on ECS System Configuration
		Equipment Group Activated	N*						

Notes:

- 1) DI - Digital Input Single Bit Point, DI 2 - Digital Input Double Bit Point, DO - Digital Output Point (Dry Contact)
- 2) AI - Analogue Input Point, AO - Analogue Output Point (4-20mA or 0-10V)
- 3) PI - Pulse Input Point
- 4) Monitoring of the emergency stop button must be grouped with equipment fault to become a master trip alarm for each equipment.
- 5) The CSM Contractor and the CCS Contractor must provide all the necessary field equipment including current transformers, transducer etc. to perform all the monitoring signals and control function as specified.
- 6) Mode Stop refers to Mode Ready / Mode Not In Operation.
- 7) Auto / Manual Status indication represents the actual operating status of ECS control system (per equipment / group).

A.2 Fire Services System Interface Points

Interface Location	I/O Interface Type and Quantity	Link to CCS via Ethernet					Remark
	Equipment	DI	DI2	DO	AI	PI	
BMS via Ethernet	FS Pumps						2 pumps/set
	Run/Stop Status	2					1 per pump
	Common Fault Alarm (Overload and Power Supply Failure)	1					1 per pump pair
	Motorised Isolating Valve						
	Open/Close Status		1				1 per valve
	Trackside Fire Hydrant Pumps						
	Run/Stop Status	2					1 per pump
	Common Fault Alarm (Overload and Power Supply Failure)	1					1 per pump pair
	Sprinkler System						
	Sprinkler Pumps						2 pumps/set
	Run/Stop Status	2					1 per pump
	Common Fault Alarm (Overload and Power Supply Failure)	1					1 per pump pair
	Flow Switch	1					1 per flow switch, excluding those for Pre-action Spr. System
	Water Tanks						
	Common High/Low Level Alarm	1					1 for both Sprinkler and FS Water Tanks
	Trackside F.S. Tank						
	Common High/Low Level Alarm	1					
	Subsidiary Valves						
	Sprinkler System Isolated Alarm (Open/Close Status)	1					1 for all valves including those for Pre-action Sprinkler System

Interface Location	I/O Interface Type and Quantity	Link to CCS via Ethernet					Remark
	Equipment	DI	DI2	DO	AI	PI	
	Pre-action Sprinkler System						
	Fire Alarm by Recycling Thermal Heat Detector	1					1 per each system
	Common Fault Alarm for Low Air Pressure and Power Failure	1					1 for all systems
	Pressure Switch	1					1 per each system
	PRV Set						
	High Pressure Alarm	1					1 per PRV set
	FIP						
	Smoke/Heat Detectors						
	Breakglass						
	Zone Fire Alarm	1					1 per Zone (Note 3 & 4)
	FM200 System						
	Fire Pre-alarm	1					1 per system
	Fire Alarm	1					1 per system
	Trouble Alarm	1					1 per system
	Auto/Manual Status	1					1 per system
	Discharge	1					1 per system
	Other Alarm Sources						
	Linear heat detector fire Alarm	1					1 per system
	Misc. Panel Indications						
	Fire Link	1					
	Fire Link Fault	1					
	Common Isolated Alarm	1					Note 1
	Common Trouble Alarm	1					Note 2

Notes:

- 1) The common isolated alarm must include alarm from the isolation of addressable loop, fire zone, smoke detector, heat detector and linear heat detector and linear detector.
- 2) The common trouble alarm must include all detector trouble alarms and station FIP power supply failure alarm.
- 3) Fire alarm for breakglass unit is absorbed in the corresponding detection zoning
- 4) Zone fire alarms must be sent to the CCS in accordance with the CSM Contractor's fire zone drawings.

A.3 Hydraulic Services Interface Points

Interface Location	I/O Interface Type and Quantity	Link to CCS via Ethernet					Hardwire to IBP		Remark
	Equipment	DI	DI2	DO	AI	PI	DI	DO	
BMS via Ethernet	Potable Water Pump								2 Pumps /set
	Overload Alarm	2							1 per pump
	Cleansing Water Pump								2 Pumps /set
	Overload Alarm	2							1 per pump
	Flushing Water Pump								2 Pumps /set
	Overload Alarm	2							1 per pump
	Potable Water Tank								
	High Level Alarm	1							
	Low Level Alarm	1							
	Cleansing Water Tank								
	High Level Alarm	1							
	Low Level Alarm	1							
	Flushing Water Tank								
	High Level Alarm	1							
	Low Level Alarm	1							
	Station Sump Pump (2 or 3 Pumps / Sump)								
	Overload Alarm	2							1 per pump
	Auto /Manual	1							1 per system
	Run/Stop	2							1 per pump
	Start control				1				1 per system
	Stop control				1				1 per system
	Station Sump Pit								
	High Level Alarm	1							1 per sump pit
	Ejector Pump								2 Pumps /set
	Overload Alarm	2							1 per pump
	Sewage Holding Tank								
	High Level Alarm	1							
	Irrigation Water Pump								2 Pumps /set
	Overload Alarm	2							1 per pump
	Irrigation Water Tank								
	High Level Alarm	1							

A.4 Lighting System Interface Points

Interface Location	I/O Interface Type and Quantity Equipment	Link to CCS via Ethernet					Hardwire to IBP		Remark
		DI	DI2	DO	AI	PI	DI	DO	
BMS via Ethernet	Emergency Lighting								
	On/Off Status	1							1 common status for station
	Public Area Lighting								
	50%/100% Selection Status	1							Grouping according to Public Lighting Zoning
	On/Off Status	1							
	On Control			1					
	Off Control			1					
	50% Level Selection			1					
	100% Level Selection			1					
	Outdoor Lighting								
	On/Off Status	1							1 per Station
	On Control			1					
	Off Control			1					
	Photosensor								
	Enable/Disable Status	1							1 per Station
	Enable Control			1					
	Disable Control			1					

Notes:

- 1) The CSM Contractor must provide all the necessary field equipment including relays, current transformers, transducer etc. to perform all the monitoring signals and control function as specified.
- 2) The BMS must perform all the logic and implement the group lighting control when the lighting control command from CCS is received.

A.5 Signage and Advertising Panel Interface Points

Interface Location	I/O Interface Type and Quantity	Link to CCS via Ethernet					Hardwire to IBP		Remark
	Equipment	DI	DI2	DO	AI	PI	DI	DO	
BMS via Ethernet	Signage								
	Identity Information Signs (IDT)								
	On/Off Status	1							1 per Station
	On/Off Control			2					1 per Station
	Identity Information Sign for Super Logo								
	On/Off Status	1							1 per Station
	On/Off Control			2					1 per Station
	Directional Signs (DIR)								
	On/Off Status	1							1 per Station
	On/Off Control			2					1 per Station
	ETS Gate O/H Flashing Signs								
	On/Off Status	1							
	Entry/No Entry Display Status	1							
	Flash On/Off Status	1							
	On/Off Control			2					
	Flash On/Off Control			2					
	Entry/No Entry Display Control			2					
	Information Signs (INF)								
	On/Off Status	1							1 per Station
	On/Off Control			2					1 per Station
	Advertising Panels (COM)								
	On/Off Status	1							1 per Platform
	On Control			1					1 per Concourse
	Off Control			1					

A.6 Track and Tunnel Services Interface Points

Interface Location	I/O Interface Type and Quantity	Link to CCS via Ethernet					Hardwire to IBP		Remark
	Equipment	DI	DI2	DO	AI	PI	DI	DO	
BMS via Ethernet	Trackside/Tunnel Drainage								
	Trackside/Tunnel Sump Pump (2 or 3 Pumps / Sump)								
	Overload Alarm	2							1 per pump
	Auto /Manual	1							1 per system
	Run/Stop	2							1 per pump
	Start control				1				1 per system
	Stop control				1				1 per system
	Trackside/Tunnel Sump Pit								
	High Level Alarm	1							1 per sump pit
	General Power & Lighting								
	Trackside/Tunnel Lighting Zone								
	On/Off Status	1							per each section
	Lighting Control Panel Power Failure	1							per control panel
	Lighting Control Switch Status	1							per each switch
	On Control				1				per each section
	Off Control				1				per each section
	Trackside Advertising Panels								
	On/Off Status	1							per platform
	On Control				1				per platform
	Off Control				1				per platform
	Cross Passage Door Exit Signs (if any)								
	Exit Sign On/Off Status	1							per tunnel section
	Strobe Light On/Off Status	1							per tunnel section
	Exit Sign On Control				1				per tunnel section
	Exit Sign Off Control				1				per tunnel section
	Strobe Light On Control				1				per tunnel section
	Strobe Light Off Control				1				per tunnel section
	Portal Lighting								
	On/Off Status	1							per portal
	On Control				1				per portal
	Off Control				1				per portal

A.7 Entrance Security Shutter

Interface Location	I/O Interface Type and Quantity	Link to CCS via Ethernet					Hardwire to IBP		Remark
	Equipment	DI	DI2	DO	AI	PI	DI	DO	
BMS via Ethernet	Entrance Security Shutter								
	Fully Open Status	1							1 per shutter
	Fully Close Status	1							1 per shutter
	Open Control			1					1 per shutter
	Close Control			1					1 per shutter
	Stop Control			1					1 per shutter

A.8 Emergency Alarm Bell

Interface Location	I/O Interface Type and Quantity	Hardwire to CCS					Hardwire to IBP		Remark
	Equipment	DI	DI2	DO	AI	PI	DI	DO	
Station Computer Room	Emergency Alarm Bell								If applicable
	Activated/De-activated	1							1 per alarm bell

A.9 Vertical Transport - Lift

Interface Location	I/O Interface Type and Quantity	Link to CCS via Ethernet					Hardwire to IBP		Remark
	Equipment	DI	DI2	DO	AI	PI	DI	DO	
BMS via Ethernet	Lift In Service / Out of Service Status	1							
	Emergency Alarm (push button inside lift car)	1							
	System failure	1							
	Lift Fault								
	Lift Pit Water Level Warning	1							
	Emergency stop button activation	1							
	Fireman's control activation	1							
	Lift homing in case of fire	1							
	Lift at parked position	1							
	Up & Down Direction	1							
	Lift run time					1			
	Parking / Unparking Control			2					

A.10 Vertical Transport - Escalator

Interface Location	I/O Interface Type and Quantity	Link to CCS via Ethernet					Hardwire to IBP		Remark
	Equipment	DI	DI2	DO	AI	PI	DI	DO	
BMS via Ethernet	Escalator In Service / Out of Service Status	1							
	Escalator Speed Status (0.75m/s, 0.5m/s)		2						
	Escalators Up & Down Direction	1							
	Emergency stop button activation	1							
	System failure	1							
	Escalator Fault	1							
	Escalator Pit Level Alarm	1							
	Escalator Runtime				1				
	Escalator in Energy Saving Mode	1							
	Escalator stop in case of fire	1							
	Escalator speed selection control (0.75m/s, 0.5m/s)			2					
	Remote Stop			1					

ATTACHMENT B – PARTICULAR REQUIREMENTS FOR STATION ECS (Subject to Design)

B.1 Station ECS Control Priority

B.1.1 Station ECS Operator Control Priority

The operator control priority must be location based and must be, starting with the highest priority, as follows:

- P1 - MCC inside LV/MCC Room / LMCP
- P2 - Backup panel in SCR / FCR
- P3 - Local control panel inside LV/MCC equipment room
- P4 - CCS workstation and BMS workstation

There must only be one control location (out of the above four locations) eligible to issue commands at any one time. Once obtained exclusive control right of the station ECS at one of the locations, the operator must be able to perform all controls and selections assigned to the operator at that particular location.

B.1.2 Mode Priority

Mode priority is to be implemented as a system function for ECS interlocking logic and conflict management within the ECS control operation, similar to equipment interlocking. In general, emergency modes have priority over normal modes.

B.2 Non-field Equipment and System-generated Control and Monitoring Points

The CSM Contractor must include in the BMS/CCS detailed data interface schedule, the non-field equipment and system-generated control and monitoring points. The CSM Contractor must provide, but not be limited to, the following:

B.2.1 Status/Alarms/Information

The BMS must send, as a minimum, the following non-field equipment or system-generated status/alarms to CCS:

- ECS normal mode and emergency mode/staircase pressurisation mode/VAC shutdown status (e.g. on, off, in-progress ...etc)
- Control panel soft-switch selection status
- Equipment plant auto/manual, station emergency mode and staircase pressurisation mode auto/manual selection status/feedback
- Common or group equipment status/alarms
- BMS PLC, RI/O and network equipment status/alarms
- Timetable information
- PTW tagging information
- Parameter information
- Other status/alarms/information

B.2.2 Controls

The BMS must, as a minimum, accept the following non-field equipment controls/selections from CCS:

- ECS normal mode and emergency mode/ staircase pressurisation mode/VAC shutdown control
- Equipment plant auto/manual, station emergency mode and staircase pressurisation mode auto/manual selection
- Common or group equipment control command
- Timetable setting / editing
- PTW tag setting
- Parameter setting
- Other controls/selections/information

**Sydney Metro
City and Southwest Project
Interface Requirements Specification**

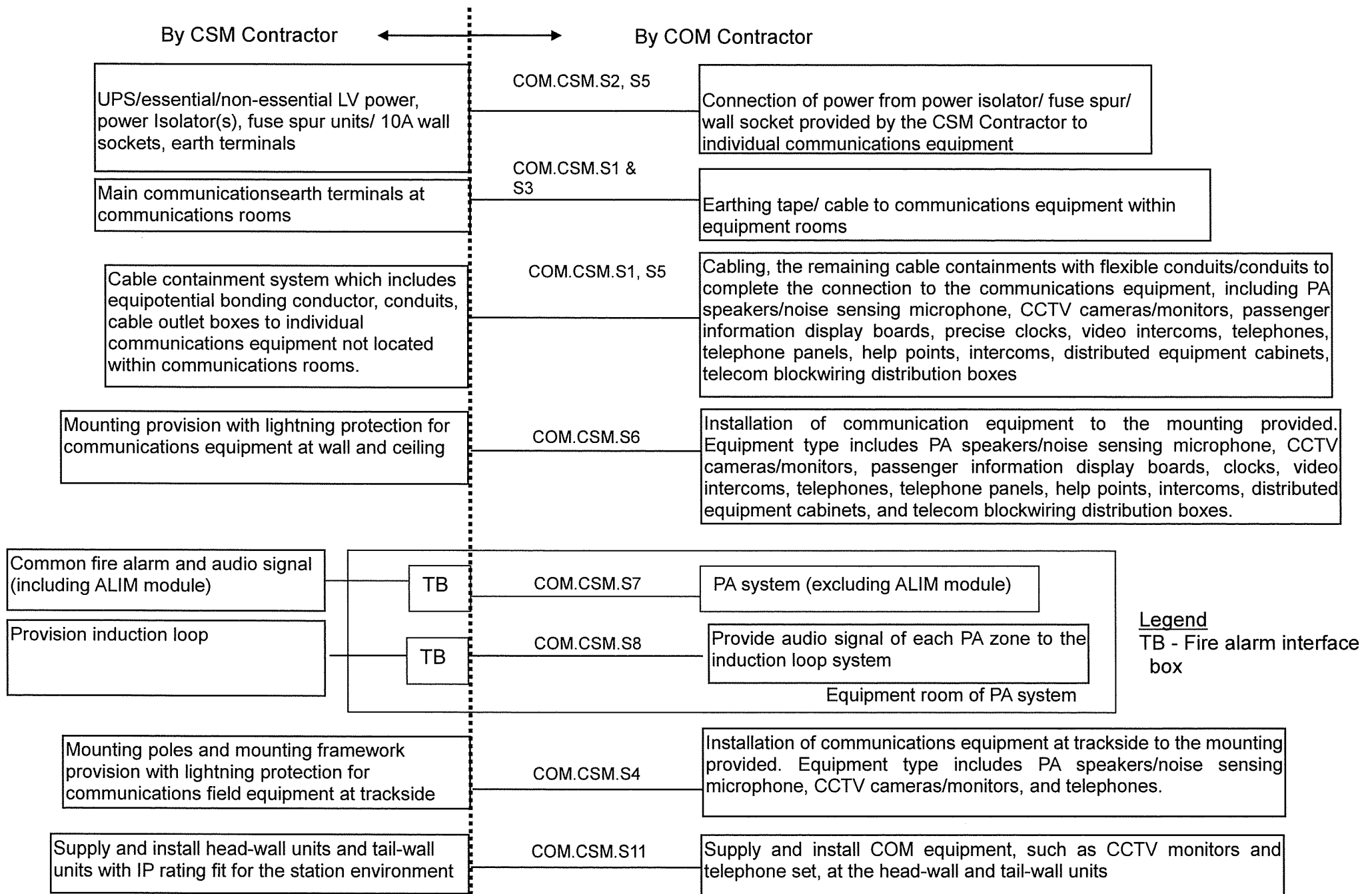
**Communications Systems (COM Contractor)
and
Central Station Main Works (CSM Contractor)**

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1. INTERFACE DEMARCATION DIAGRAMS

- 1.1. The general physical demarcation and interfaces between the works by the COM Contractor and the works by the CSM Contractor are identified in the interface demarcation diagram Fig.Infs.COM-CSM.01, Fig.Infs.COM-CSM.02, Fig.Infs.COM-CSM.03, Fig.Infs.COM-CSM.04 and Fig.Infs.COM-CSM.05.



Legend
TB - Fire alarm interface box

Fig.Infs.COM.CSM.01

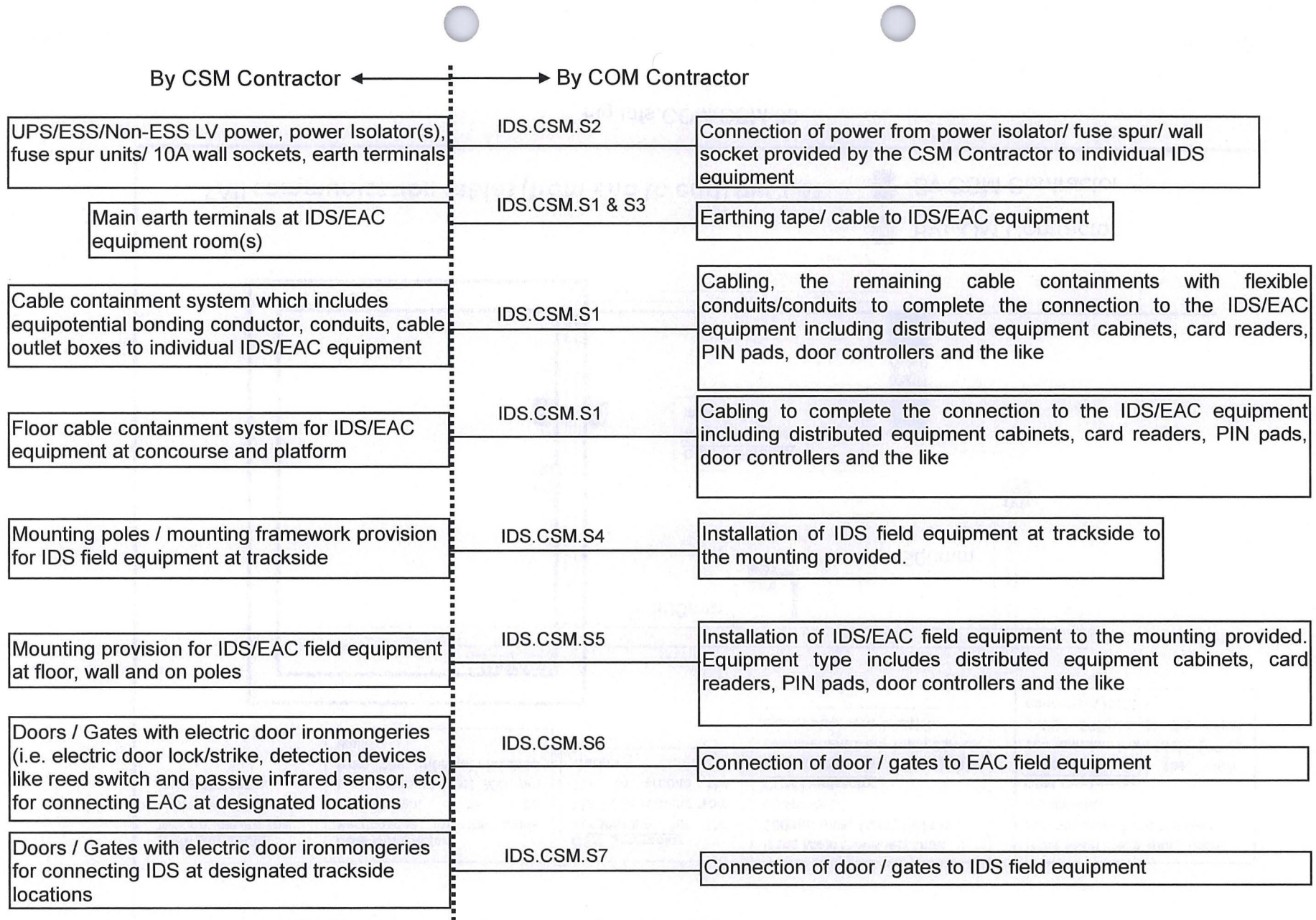


Fig.Infs.COM.CSM.02

Communication Cable Containment Demarcation

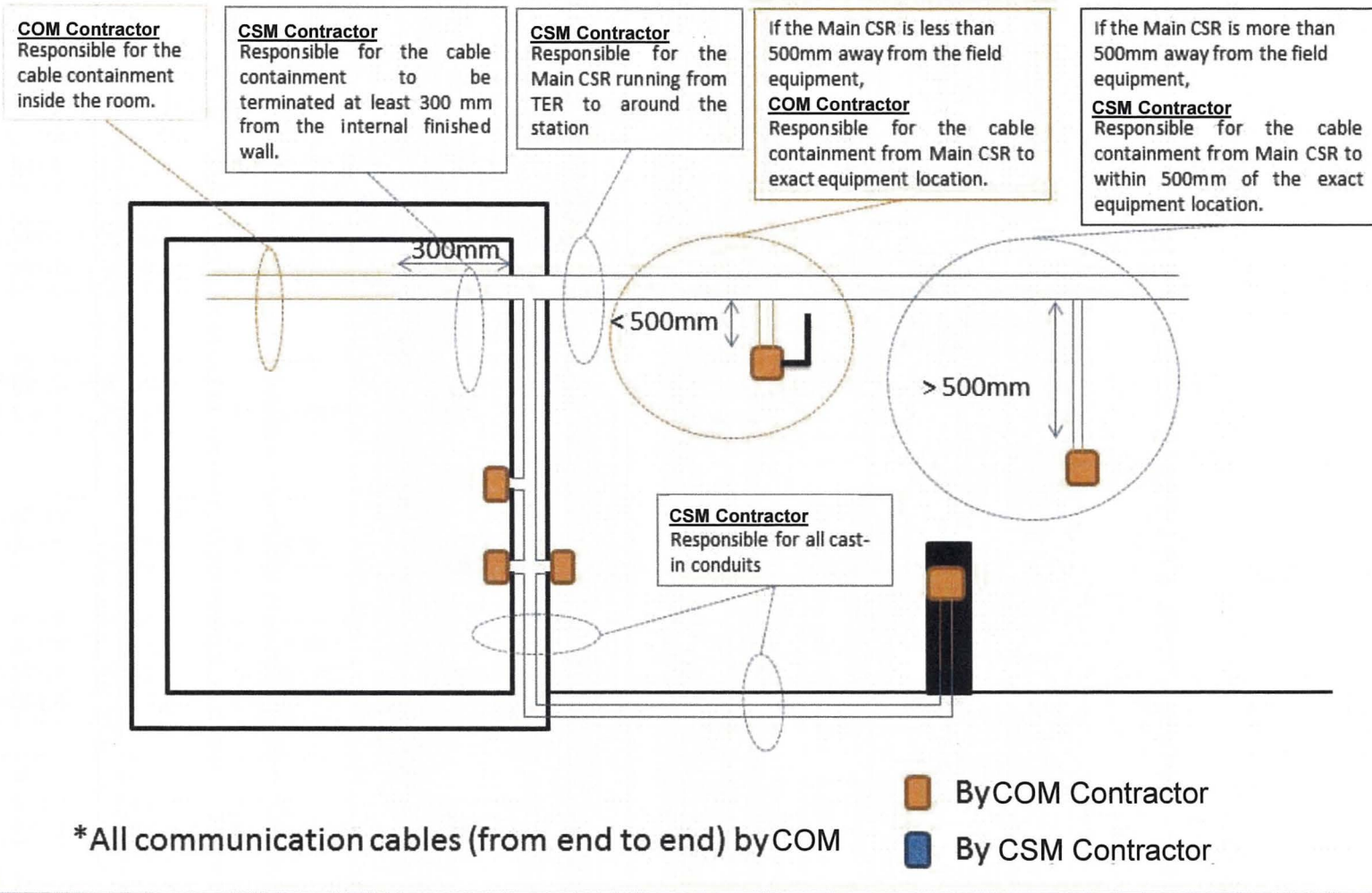
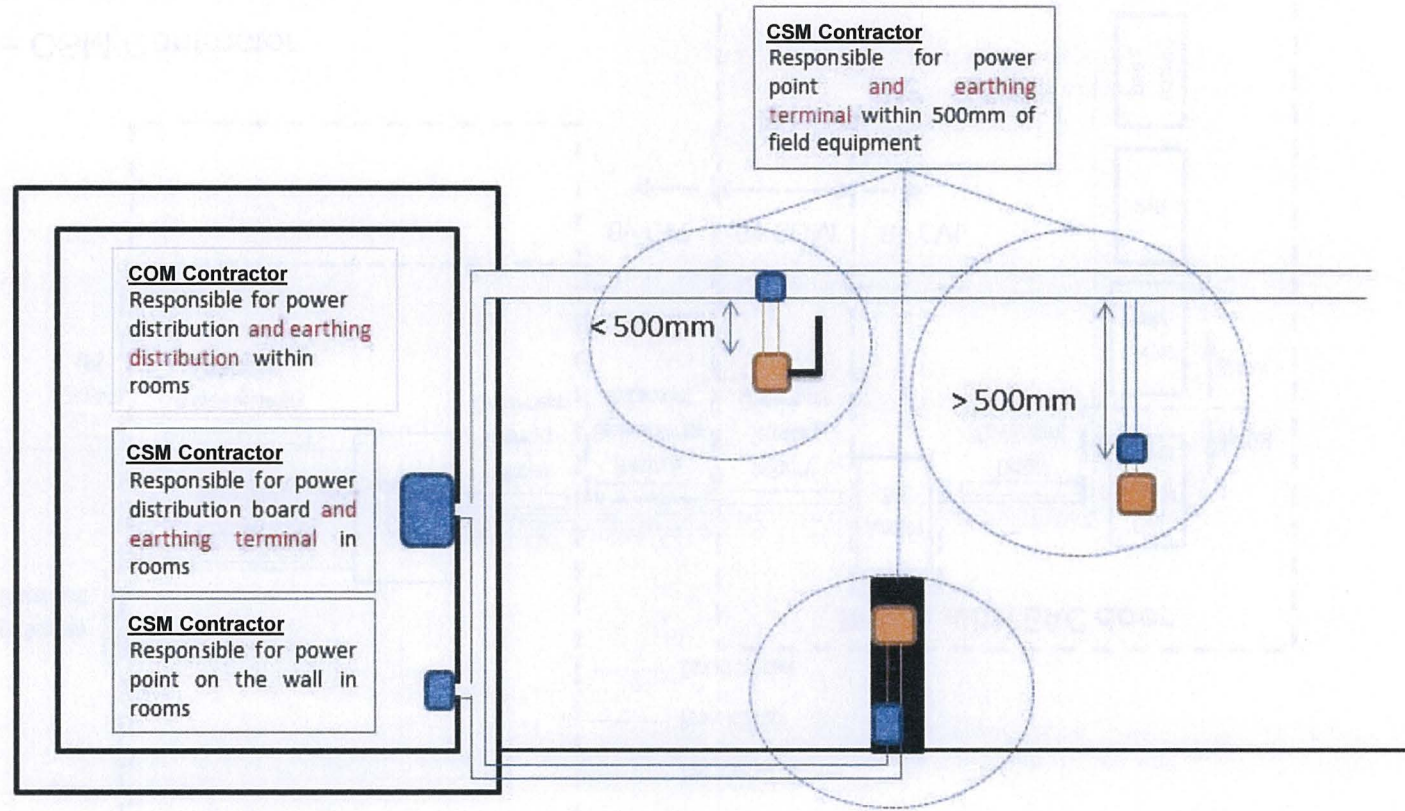


Fig.Infs.COM.CSM.03

Power Supply and Earthing demarcation for Communications Equipment



CSM Contractor
Responsible for power point and earthing terminal within 500mm of field equipment

COM Contractor
Responsible for power distribution and earthing distribution within rooms

CSM Contractor
Responsible for power distribution board and earthing terminal in rooms

CSM Contractor
Responsible for power point on the wall in rooms

*Power cables up to interface point by CSM
*Power cables from interface point to field equipment by COM

By COM Contractor
By CSM Contractor

Fig.Infs.COM.CSM.04

Cable containment and power supply demarcation for EAC doors

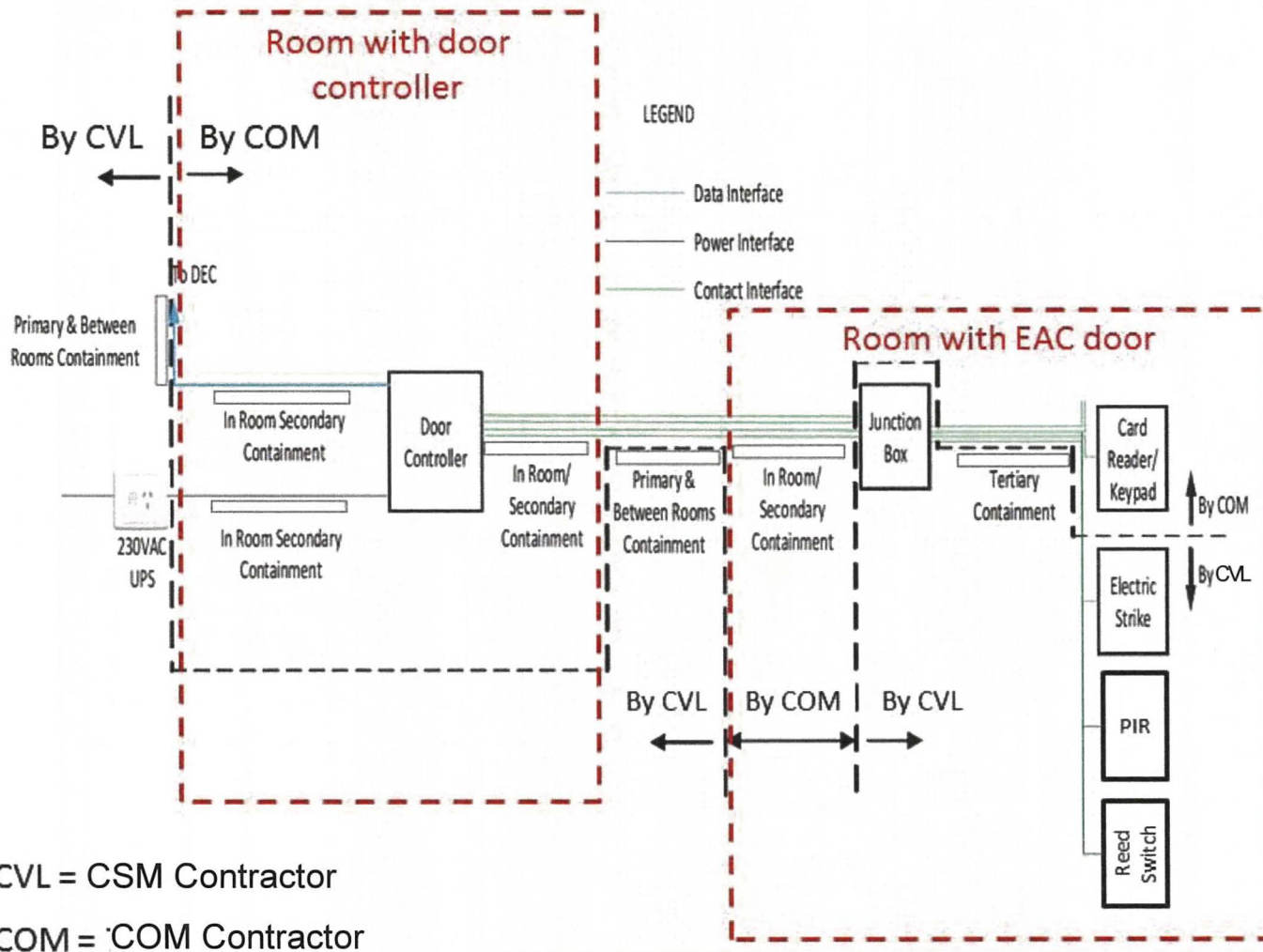


Fig.Infs.COM.CSM.05

2. PHYSICAL INTERFACES SCHEDULE

Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Location of interface	Purpose of interface
COM.CSM.S1	<ol style="list-style-type: none"> 1. Provide cable containment and equipotential bonding conductor for communications equipment at designated locations/paths, including, head-wall units and tail-wall units 2. Cable containment to be terminated at 300mm from the internal face of wall inside the relevant equipment room and at 100mm from the wall of the tunnel/trackside, and within 500mm of the field equipment, or directly to the equipment cast-in conduits / cable containment. 3. Provide the protective enclosures (such as galvanised metal sleeve) for cables and cable containment 4. Undertake the sealing works of the cross section between the protective enclosures (sleeves, & etc.) and the wall/floor/ceiling openings. 	<ol style="list-style-type: none"> 1. Provide cable containment and equipotential bonding conductor for communications equipment at designated communications equipment room(s) 2. Provide communications cables with cable fixing/cleats. 3. Provide the remaining cable containments with flexible conduits / conduits to complete the connection to the communications equipment 4. Provide equipotential bonding between the cable containments provided by the COM Contractor and the CSM Contractor. 5. Undertake the sealing within the protective enclosures for the cables and cable containment. 	All areas including equipment room(s) of communications equipment and trackside	Communications cable installation

Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Location of interface	Purpose of interface
COM.CSM.S2	<ol style="list-style-type: none"> 1. Provide cable containment and equipotential bonding conductor, power cables, isolators, distribution boards, miniature circuit breaker (MCB), RCCB and any other equipment to extend power connection from LV switchgear and the centralized UPS system 2. Provide power distribution board and earthing terminal in rooms 3. Provide power points on the wall in rooms 4. Provide power points and earthing terminal within 500mm of field communications equipment 	<ol style="list-style-type: none"> 1. Provide power cables with the remaining cable containments from communications equipment and terminate cables at the power points provided by the CSM Contractor. 2. Provide and install cabling for power distribution and earthing distribution within rooms. 	All areas including equipment room(s) and trackside where communications equipment will be installed	Power supply for communications equipment
COM.CSM.S3	<ol style="list-style-type: none"> 1. Provide main earth terminal. 2. Provide power distribution board and earthing terminal in rooms 3. Provide power points and earthing terminal within 500mm of field communications equipment 	<ol style="list-style-type: none"> 1. Provide downstream earthing conductors and terminate earthing tape/cable onto the main earth terminal. 2. Provide and install cabling for power distribution and earthing distribution within rooms. 	All areas including equipment room(s) and trackside where communications equipment will be installed	Earthing of communications equipment

Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Location of interface	Purpose of interface
COM.CSM.S4	Provide mounting pole and equipment's support frame with lightning protection for installation of communications equipment at trackside.	Install trackside communications equipment including PA speakers/noise sensing microphone, CCTV cameras, telephone and the like, provide any lower hanger if necessary	Trackside	Installation of communications equipment at trackside
COM.CSM.S5	Provide cable containment system which includes equipotential bonding conductor, conduits, power outlet boxes and cable outlet boxes for DEC/IDF. Provide power points and earthing terminal within 500mm of DEC and IDF	Provide cables from the DEC/IDF and terminate cables at the outlets/ terminals provided by the CSM Contractor.	Station Back of House Areas and ceiling level at public areas	Installation of distributed equipment cabinet (DEC) and intermediate distribution frame (IDF)
COM.CSM.S6	Provide mounting such as openings on ceiling grid, openings on architectural builder's works and finishes, equipment's support frame (upper hanger if required), poles with lightning protection (as required) for CCTV cameras and provide sealant of work	Install PA speakers/noise sensing microphone, CCTV cameras, PID boards, monitors, clocks, telephone/help point and the like, provide any lower hanger if necessary	All areas including field equipment locations	Installation of PA speakers / noise sensing microphones, CCTV cameras, monitors, passenger information display system boards, clocks, video intercom unit, telephones, telephone panels, help points and the like

Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Location of interface	Purpose of interface
COM.CSM.S7	<p>Provide a fire alarm interface box, complete with termination strips located in the designated room.</p> <p>Provide and install cable from the termination box to the ALIM module installed in the PA system cabinet.</p> <p>Provide the ALIM module as a part of the 100V line monitoring. Install, terminate and test the ALIM module within the PA system cabinet..</p>	<p>Provide and install cables from PA system with cable termination at the fire alarm interface box provided by the CSM Contractor.</p> <p>Provide mounting provision within the PA system cabinet for the ALIM module.</p>	Telecom Equipment Room	Transmit a common fire alarm and audio signal from EWIS system to the station PA system, to serve for station evacuation announcement
COM.CSM.S8	<ol style="list-style-type: none"> 1. Provide and install the audio frequency induction loops as designed by the COM Contractor. 2. Coordinate with the COM Contractor for the installation works. 	<ol style="list-style-type: none"> 1. Provide the loop amplifiers as output of the PA system to the induction loops. 2. Design the audio frequency induction loop system and its interface with the PA system. 3. Coordinate with the CSM Contractor for the installation works. 4. The audio frequency induction loop system must meet the hearing augmentation coverage requirements of the BCA 	Telecom Equipment Room	To provide audio frequency induction loop (hearing augmentation) system in public areas at each station to assist hearing impaired people using hearing aids.

Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Location of interface	Purpose of interface
COM.CSM.9	<ol style="list-style-type: none"> 1. Provide architectural and material data required for the COM Contractor's acoustic simulation. 2. For all spaces where PA system coverage is required ensure that the finished surface materials have the appropriate acoustic properties to achieve the required reverberation time (RT) in Section 12.1 	<ol style="list-style-type: none"> 1. Perform acoustic simulations based on the COM Contractor's PA design and architectural data provided by CSM Contractor. 2. Select PA system components, speaker types and speaker positioning as required to achieve a minimum STI of 0.5 throughout the PA system coverage area. 	All public area of station	Speech transmission index (STI) of PA system to be ≥ 0.5
COM.CSM.S10	Provide adequate access route and temporary secured storage area close to telecom equipment room for equipment delivery and storage.	Deliver COM equipment to plantrooms or temporary storage area if plantrooms not ready for delivery	Access route of equipment delivery and storage area	COM Contractor's equipment delivery and storage
COM.CSM.S11	Supply and install head-wall units and tail-wall units with suitable index of protection rating (IP rating in accordance with IEC 60529) at designated locations	Supply and install COM equipment required at head-wall units and tail-wall units	Station platforms	To facilitate train operation by providing head-wall/tail-wall units and the associated COM equipment

Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Location of interface	Purpose of interface
IDS.CSM.S1	<ol style="list-style-type: none"> 1. Provide cable containment and equipotential bonding conductor for IDS equipment at designated locations/paths, including IDS/EAC equipment room(s) 2. Provide draw wires for any concealed cable containment provided. 3. Provide the protective enclosures (such as galvanised metal sleeve) for cables and cable containment. 4. Undertake the sealing works of the cross section between the protective enclosures (sleeves, & etc.) and the wall/floor/ceiling openings. 	<ol style="list-style-type: none"> 1. Provide IDS/EAC cables with cable fixing/cleats. 2. Provide the remaining cable containments with flexible conduits / conduits to complete the connection to the IDS/EAC equipment 3. Provide equipotential bonding between the cable containments provided by IDS/EAC and CSM Contractor. 4. Undertake the sealing within the protective enclosures for the cables and cable containment 	All areas including equipment room(s) and trackside where IDS/EAC equipment will be installed	IDS/EAC cable installation
IDS.CSM.S2	<ol style="list-style-type: none"> 1. Provide cable containment, equipotential bonding conductor, power cables, isolators, distribution boards, miniature circuit breaker (MCB), RCCB and any other equipment to extend power connection from LV switchgear and centralized UPS system. 2. Provide power points within 500mm of field equipment. 	Provide power cables with the remaining cable containments from IDS/EAC equipment, and terminate cables at the power points provided by the CSM Contractor.	All areas including equipment room(s) and trackside where IDS/EAC equipment will be installed	Power supply for IDS/EAC equipment

Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Location of interface	Purpose of interface
IDS.CSM.S3	<ol style="list-style-type: none"> 1. Provide main earth terminal. 2. Provide earthing terminal within 500mm of field equipment. 	Provide downstream earthing conductors and terminate earthing tape/cable onto the main earth terminal.	All areas including equipment room(s) and trackside where IDS/EAC equipment will be installed	Earthing of IDS/EAC equipment
IDS.CSM.S4	<ol style="list-style-type: none"> 1. Provide mounting pole and equipment's support frame with lightning protection for installation of IDS equipment at trackside 2. Provide two termination ports for cable termination of each CSM Contractor's points at terminal block in each interface location and complete cabling from the terminal block to trackside access door and associated reed switches 	<ol style="list-style-type: none"> 1. Install trackside IDS equipment and the like, provide any fixing hanger if necessary. 2. Provide two hardwire cable for each CSM Contractor's point from terminations ports to the terminal block in the PLC cabinet provided by the CCS Contractor in Telecom Equipment Rooms (TERs). 	Trackside	Installation of IDS equipment at trackside
IDS.CSM.S5	Provide mounting such as openings on ABWF finishes, equipment's support frame, mounting pole with lightning protection and provide sealant of work	Install IDS/EAC filed equipment including distributed equipment cabinets, card readers, PIN pads, door controllers and the like, provide any fixing hanger if necessary	All areas including field equipment locations	Installation of IDS/EAC equipment and the like

Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Location of interface	Purpose of interface
IDS.CSM.S6	<ol style="list-style-type: none"> 1. Provide and install doors / gates, gate / door frame, embedded containment inside gate / door or frame and gate / door peripherals with electric door ironmongeries (electric strike, electric lock, detection devices including reed switch and passive infrared (PIR) sensor etc), and provide interface points to connect the electric door ironmongeries to EAC 2. Provide and install provisions in and on the gate/door frame, gate/door and surrounding for mounting of EAC equipment (card reader, card reader PIN pad, door controller, break glass units) including structural support, back boxes, cut-outs and mounting plates. 	<ol style="list-style-type: none"> 1. Supply and install EAC equipment (card reader, card reader PIN pad, door controller, break glass units). 2. Connect the electric door ironmongeries from the interface points to door controllers. 3. Provide surface mounted cable containment for EAC cables where concealed containment are not provided. 	Doors / gates with EAC provision	Connection of EAC doors/gates and equipment

Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Location of interface	Purpose of interface
IDS.CSM.S7	<ol style="list-style-type: none"> 1. Provide doors / gates with electric door ironmongeries, and provide interface points to connect the electric door ironmongeries at trackside to IDS 2. Provide junction boxes and concealed conduits appropriate for wiring connecting junction boxes. 	Connect doors / gates to IDS equipment	Doors / gates with IDS provision	Connection of IDS doors/gates and equipment

Tab.Infs.COM-CSM.01

3. FUNCTIONAL INTERFACE

Clause	Functional Description	Physical Interface Item Ref.	Works by CSM Contractor	Works by COM Contractor
3.1	Fire alarm interface	COM.CSM.S7	<ol style="list-style-type: none"> 1. CSM Contractor's system must transmit a fire warning signal which includes an alert tone and evacuate voice message for fire evacuation to the PA system. 2. The CSM Contractor's system must monitor the health status of the amplified audio line from CSM Contractor's system's output up to the primary winding of the ALIM module. 	<ol style="list-style-type: none"> 1. The COM Contractor must monitor the health status of the 0dB audio line from the ALIM module's secondary winding onwards. 2. The COM Contractor must receive and display an alert of fire alarm activation at PA workstations and prioritize transmission of warning and evacuation tones from EWIS during fire evacuation.
3.2	Trackside intrusion detection	IDS.CSM.S4	Provide the track access door status to the CCS via the physical interface in the form of dry contact.	<p>The COM Contractor must facilitate the CCS Contractor's system to receive the door status from the CSM Contractor's system via the physical interface and perform the following upon receiving:</p> <ul style="list-style-type: none"> - display the door status on the CCS VDU - transmit the relevant door status (treated as intrusion alarm from the trackside intrusion detection system) to the signalling system in coordination with the SIG Contractor.

4. MESSAGE/DATA EXCHANGE

4.1. Not used.

5. DESIGN CONSTRAINTS

5.1. Not used.

6. DOCUMENTATION RESPONSIBILITIES / COORDINATION REQUIREMENT

6.1. The COM Contractor and the CSM Contractor are responsible for coordinating with each other to ensure all the interface requirements are captured and the interfaces works are designed, installed and tested.

6.2. The division of responsibility between the COM Contractor and the CSM Contractor in preparing those portions of interface documents related to interface must be in accordance with table below:

Ref.	Interface Documents	Responsibilities of the COM Contractor	Responsibilities of the CSM Contractor
6.2.1	Detailed Interface Specification	As Lead Contractor	As Match Contractor
6.2.2	Detailed Interface Test Plan	As Lead Contractor	As Match Contractor
6.2.3	Interface Test Specification	As Lead Contractor	As Match Contractor

7. INTER-SYSTEM ELECTROMAGNETIC COMPATIBILITY

- 7.1. The COM Contractor and the CSM Contractor must exchange all necessary information concerning EMC/EMI in the respective systems to ensure electromagnetic compatibility in the design and operations. The information must include the operating frequencies and associated susceptibility or emission levels of each subsystem in both normal and fault conditions, and their locations.
- 7.2. The information must be properly addressed in the EMI hazard analysis and EMC specification. Appropriate measures must be explicitly listed and demonstrated in the design review.
- 7.3. The EMC tests must be included in the interface tests and additional test provisions must be provided to simulate various operating conditions such as peak traffic, fault conditions, etc. Test criteria must be derived from the requirements and constraints listed in the hazard analysis and EMC specification.

8. INTERFACE INSPECTION AND TEST SCHEDULE

Ref.	Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Purpose of Test / Inspection
8.1	COM.CSM.S1, S2, S5, IDS.CSM.S1, S2, S5	Provide access and attendance to the COM Contractor for joint inspection of the cable containment works	Acceptance of cable containment works completed by the CSM Contractor.	Joint inspection of the cable containment works completed by the CSM Contractor
8.2	COM.CSM.S2, S3, S4, S6, IDS.CSM.S2, S3, S4	Provide access and attendance to the COM Contractor for joint inspection of the building services works	Acceptance of building services works completed by the CSM Contractor.	Joint inspection of the building services works completed by the CSM Contractor
8.3	COM.CSM.S8	Provide attendance and the associated rectification works for the joint inspection and test for induction loop system	Acceptance of the portion of Induction Loop System delivered by CSM Contractor	Joint inspection and test for induction loop system

9. EXCHANGE OF DESIGN INFORMATION SCHEDULE

Item Ref.	Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Purpose of Information Exchange
9.1	COM.CSM.S1,S2, S4, S5 and S6	Coordinate and confirm the requirement.	Provide equipment location, size, quantity and type of the required cable containment for each communications equipment.	To ensure that cable containment for communications equipment is adequate prior to installation.
9.2	COM.CSM.S2	Coordinate and confirm the requirement.	Provide electrical ratings, heat dissipation and required type of power provision such as isolator, fused spur/power socket for the required equipment rooms and field equipment locations, the need of UPS/essential power.	To ensure that electrical installations suit the communications equipment.
9.3	COM.CSM.S1 to S6	Coordinate and confirm the requirement.	Provide equipment room layout and section of communications equipment.	To coordinate the location of building services equipment and communications equipment within the communications equipment rooms.
9.4	COM.CSM.S7	Provide a volt-free dry contact and assign cable termination location	Confirm cable termination and the dry contact details	Connectivity for common fire alarm signal
9.5	COM.CSM.S8	Assign cable termination location	Provide the design parameters of the induction loop system.	To ensure each induction loop is correctly associated with PA zone.

Item Ref.	Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Purpose of Information Exchange
9.6	COM.CSM.S9	Coordinate with the COM Contractor on the architectural acoustic details needed for the COM Contractor's acoustic simulations.	Perform the acoustic simulation.	To facilitate the conduction of acoustic simulation.
9.7	COM.CSM.S10	Provide drawings showing dimensions of delivery route and temporary storage area	Provide information on the equipment delivery size and weight, equipment deliver and storage schedule	Provision of delivery route and equipment storage.
9.8	COM.CSM.S11	Coordinate with the COM Contractor for the induction loops to be supplied and installed in the station.	Provide the design of Induction Loop System	To deliver Induction Loop System for station operations
9.9	IDS.CSM.S1, S4 and S5	Coordinate and confirm the requirement.	Provide equipment location, size, quantity and type of the required cable containment for each IDS/EAC equipment.	To ensure that cable containment for IDS/EAC equipment is adequate prior to installation.
9.10	IDS.CSM.S2	Coordinate and confirm the requirement.	Provide electrical ratings, heat dissipation and required type of power provision such as isolator, fused spur/power socket for the required equipment rooms and field equipment locations.	To ensure that electrical installations suit IDS/EAC equipment.

Item Ref.	Physical Interface Item Ref.	By CSM Contractor	By COM Contractor	Purpose of Information Exchange
9.11	IDS.CSM.S1 to S5	Coordinate and confirm the requirement.	Provide equipment room layout and section of IDS/EAC equipment.	To ensure that building services, IDS/EAC equipment are well coordinated.
9.12	IDS.CSM.S6 to S7	Provide specifications of electric door ironmongeries, and provide the interface points for EAC connection	Coordinate and confirm the interfacing requirement.	To ensure that designed EAC doors are well controlled and monitored.

10. WALK THROUGH

10.1. Not Used

11. NAMING CONVENTION

11.1. The COM Contractor and the CSM Contractor must adopt the Operator's equipment identification procedure for equipment labelling in all documentation.

12. ATTACHMENT

12.1. Required Reverberation Time

Octave Band Centre Frequency (Hz)	Reverberation time (RT) (seconds)
125	2.0
250	2.0
500	1.7
1,000	1.7
2,000	1.6
4,000	1.5
8,000	1.4

12.2. Requirements on EACS Security Level and Telephones for Rooms and Stairs

12.2 Requirements on EACS Security Level and Telephones for Rooms and Stairs

Version: 22-Aug-17

Room Number	Room Name / Location	EACS Door Security Level	Telephones				
			PBX	DLTS	Citiline	Intercom	Terminal
100A	Signaling Equipment Room	H	1				
100B	PSD Equipment Room	H	1				
200	Telecom Equipment Room 1	H	1				
201	Telecom Equipment Room 2	H					
203	Common Telecom Equipment Room	H	1				
205	Station Computer Room	H					
306A	DC Isolating Links Room 1 (1500V)	M					
306B	DC Isolating Links Room 2 (1500V)	M					
400A	11kV Switchboard & Transformer Room 1	M	1	1			
400B	11kV Switchboard & Transformer Room 2	M	1	1			
400C	11kV Switchboard & Transformer Room 3	M					
400D	11kV Switchboard & Transformer Room 4	M					
402A	LV Main Switch Room (415V DBs)	M	1				
402B	LV Main Switch Room (415V DBs)	M	1				
402C	LV Main Switch Room (415V DBs)	M	1				
402D	LV Main Switch Room (415V DBs)	M	1				
420A	Centralized UPS Room 1	M	1				
420B	Centralized UPS Room 2	M					
500A	Fire Staircase Pressurisation Plant Room	-					
500B	Fire Staircase Pressurisation Plant Room	-					
503	Watercooled VRV Plant Room	M					
504C	Cooling Tower Water Pump and Tanks	M					
505	Signalling/Telecoms Critical Cooling systems Plant Room #1	M					
506A	Signalling/Telecoms Critical Cooling systems Plant Room #2	M					
506B	Equipment Cooling systems Plant Room	M					
506C	Equipment Cooling systems Plant Room	M					
507AA	Plantroom Supply Ventilation Fan Room	M					
507AB	Plantroom Supply Ventilation Fan Room	M					
507BA	Plantroom Exhaust Ventilation Fan Room	M					
507BB	Plantroom Exhaust Ventilation Fan Room	M					
507CA	AHU Outside Air Fan Room	M					
507CB	AHU Outside Air Fan Room	M					
508	E&M Systems MCC and Control Equipment Room #1	H					
509A	E&M Systems MCC and Control Equipment Room #2	H					
509B	E&M Systems MCC and Control Equipment Room #3	H					
601A	Tunnel Ventilation Nozzle Room 1	M	1				
601B	Tunnel Ventilation Nozzle Room 2	M	1				
602A	Tunnel Ventilation Fan (TVF) Room 1	M	1				
602B	Tunnel Ventilation Fan (TVF) Room 2	M	1				
602C	Tunnel Ventilation Fan (TVF) Room 3	M					
602D	Tunnel Ventilation Fan (TVF) Room 4	M					
605A	Tunnel Exhaust Fan (TEF) Room 1	M	1				
613A	TVS Air Compressor and Receiver Room 1	M	1				
613B	TVS Air Compressor and Receiver Room 2	M	1				
614A	Trackside LV switch room 1	M	1				
614B	Trackside LV switch room 2	M	1				
7C1	Fire Brigade Booster - Tunnel Hydrants	-	1				
700A	Gas Suppression Equipment Room	M					
702	Trackside FS Pump Room 1	M					
702A	Fire Pump Room #1	M					
704	Fire Control Room	M	1	1			
705	Fire Water Storage Tank Room	M					
706A	Emergency Trolley Room	M					

12.2 Requirements on EACS Security Level and Telephones for Rooms and Stairs

Version: 22-Aug-17

Room Number	Room Name / Location	EACS Door Security Level	Telephones				
			PBX	DLTS	Citiline	Intercom	Terminal
706B	Emergency Trolley Room	M					
801	WaterTreatment plant Room	M					
802	Primary Tunnel Water Sump	M					
802S	Primary Tunnel Water Sump Subfloor	M					
803	Secondary Tunnel Water Sump	M					
803S	Secondary Tunnel Water Sump Subfloor	M					
804A	Sewage Ejector Pump Room	M					
808B	Hot Water Plant	M					
1002A	Staff Locker Room 1 (Male / Female)	M					
1002B	Staff Locker Room 2(Male / Female)	M					
1003	Multipurpose Room	-	1				
1004A	Refuse Room	M					
1004B	Bin Room	-					
1005A	Chemical Store Room 1	M					
1006	Platform Cleaning Machine Room	M					
1006A	Presentation Store Room	M					
1007A	Cleaners store 1	M	1				
1007B	Cleaners store 2	M					
1008A	Station Staff (Concourse W.C 1)	M					
1008B	Station Staff (Concourse W.C 2)	M					
1009	Station Control Room	H	1		1	1	1
1016	Store Room	M					
1017A	Maintenance office	M	2				
1017E	Maintenance store room	M	1				
1025	Emergency track trolley room	M					
1030	Cable Termination Room 1	M					
1031	Cable Termination Room 2	M					
N/A	Communications Cupboard 1	L					
N/A	Communications Cupboard 2	L					
N/A	Communications Cupboard 3	L					
N/A	Communications Cupboard 4	L					
N/A	Communications Cupboard 5	L					
N/A	Communications Cupboard 6	L					
N/A	Fire Control Room Pressurisation Plant Room	-					
N/A	AHU Plant Room Standard	M					
N/A	AHU Plant Room Large	M					
N/A	Trackway Exhaust System Fan Plant Room	M					
N/A	CBD Incident Control Room	M					
N/A	Fire Alarm Equipment Room	M					
N/A	MEWP Store	M					
N/A	Backup Control Room (BCR)	H	3	1	3	1	2
N/A	Access door to Back of House Areas	M					
N/A	Access door to Egress Stair	L					
N/A	Access door to Egress Stair for Station services access	M					
N/A	Platform end Gate (not PSD WED)	L					



**Transport
for NSW**

Sydney Metro City & Southwest

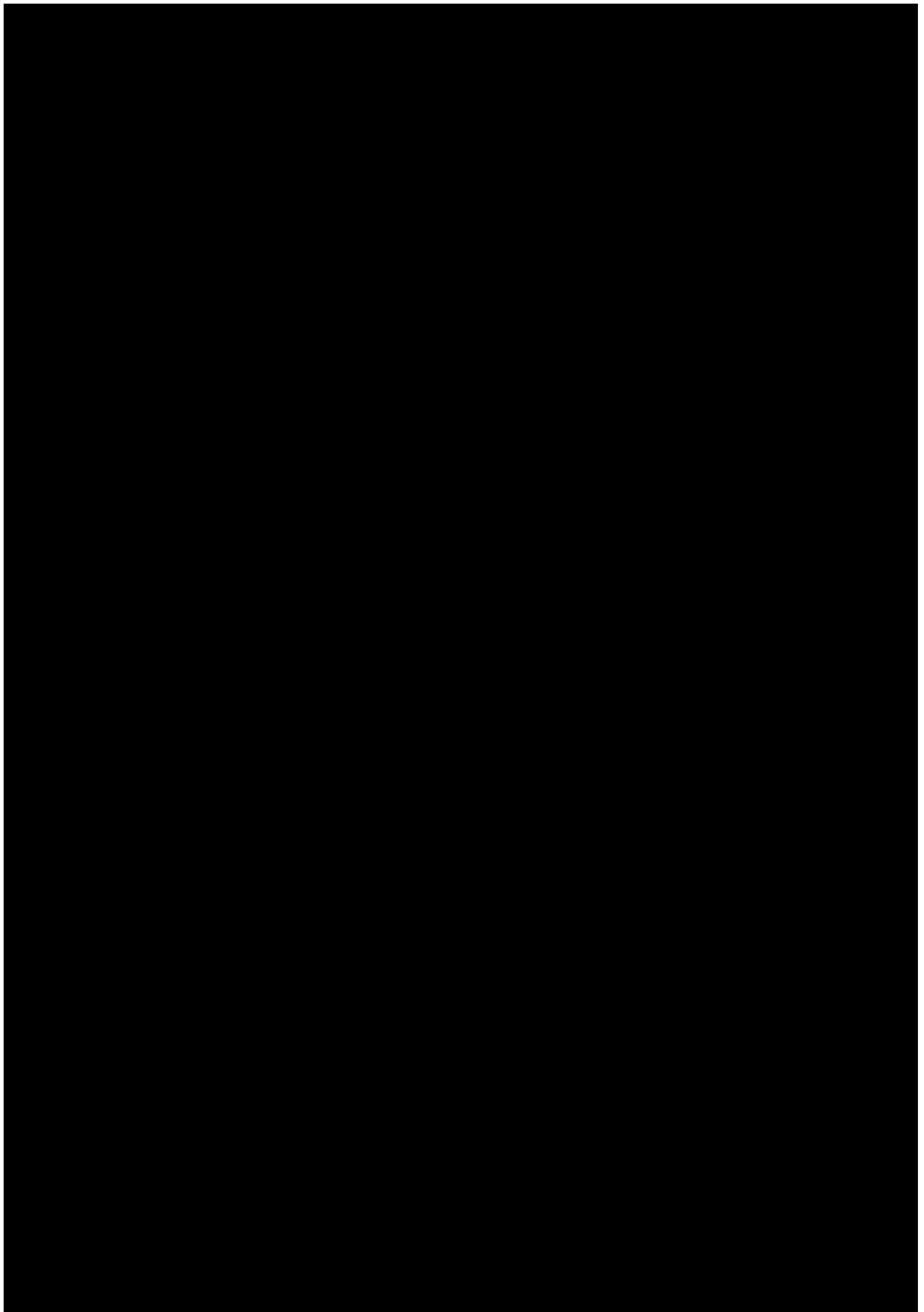
Central Station Main Works

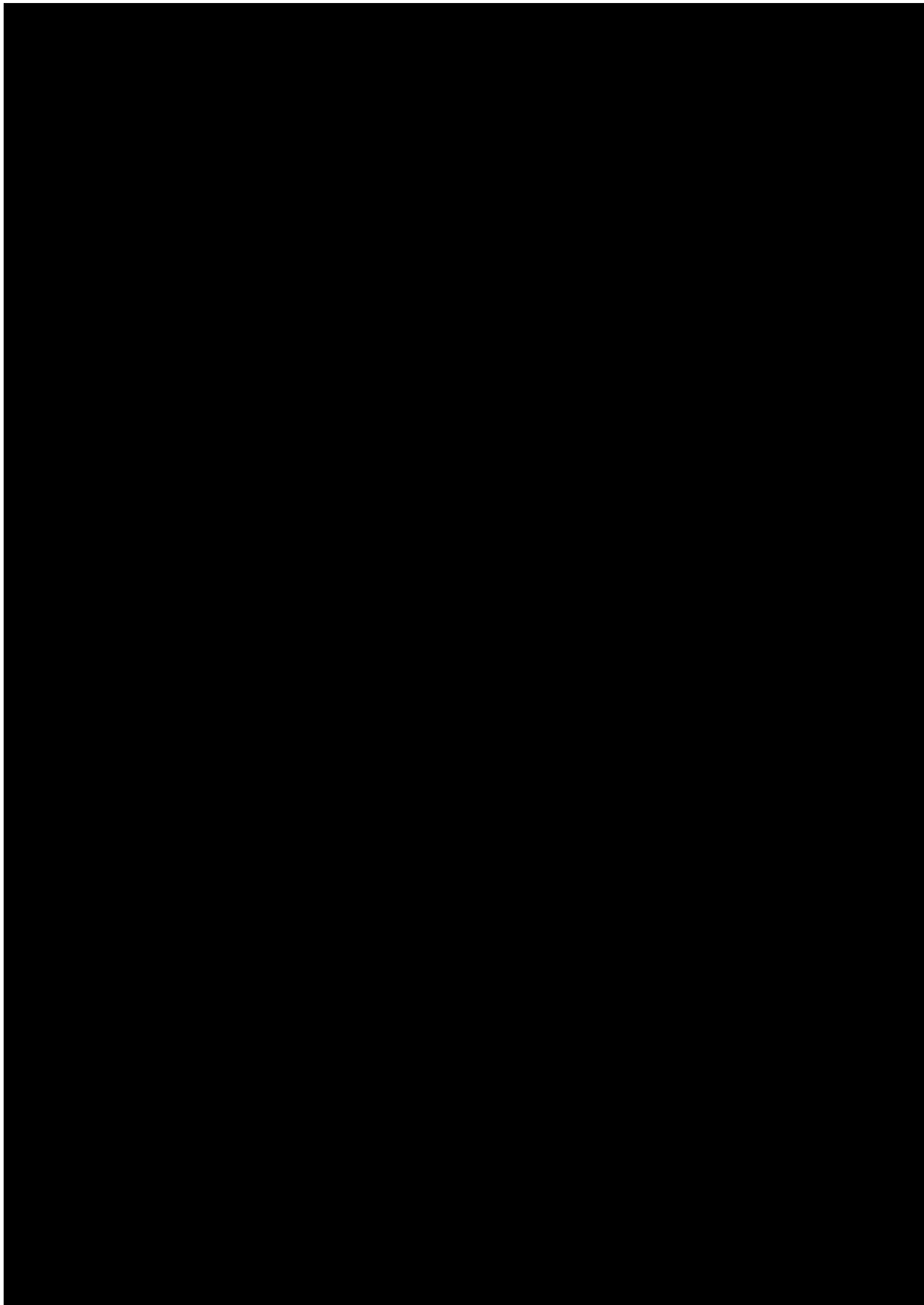
Schedule C1

Scope of Works and Technical Criteria

Appendix E02

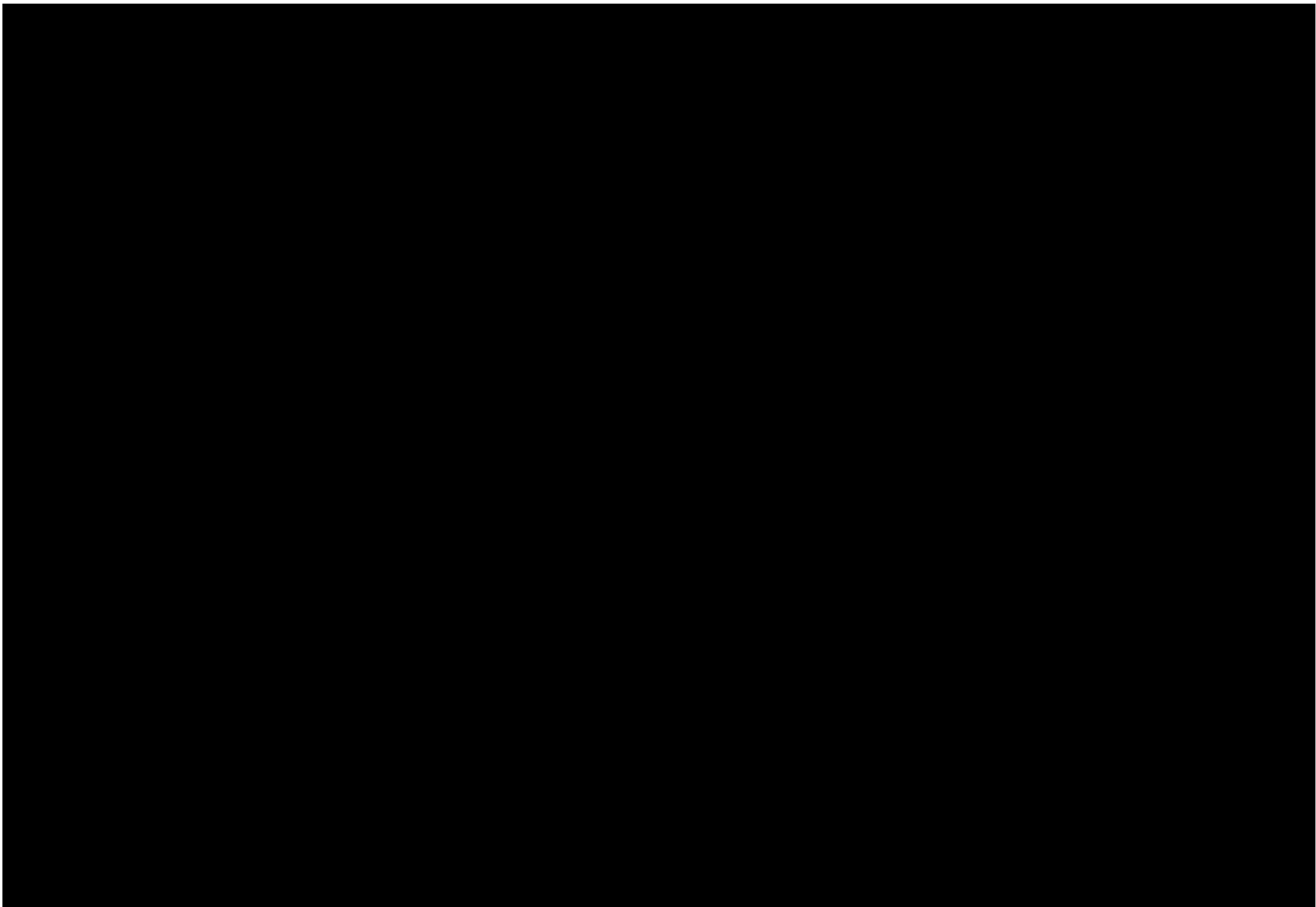
**Central Station Works and Central Walk
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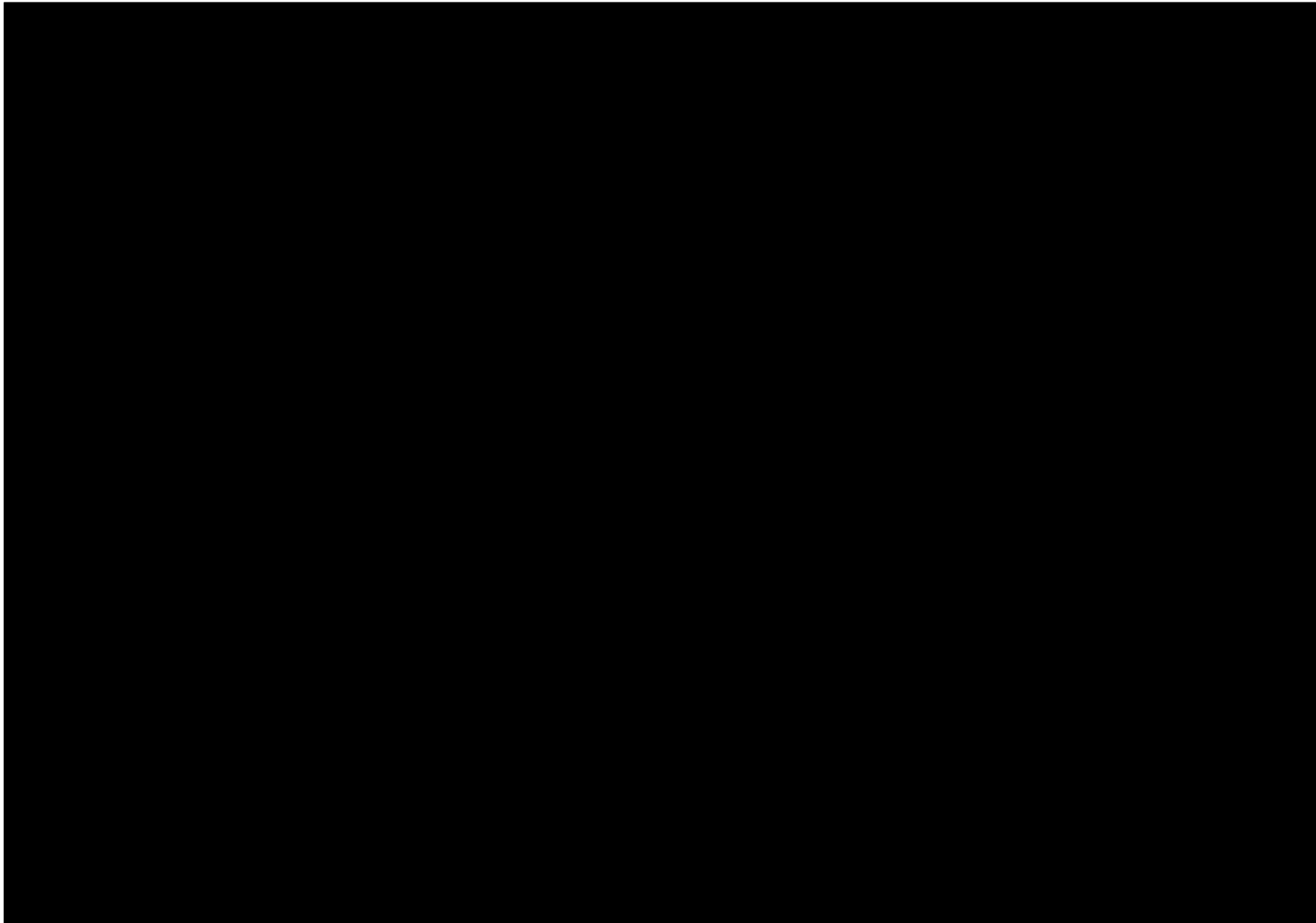




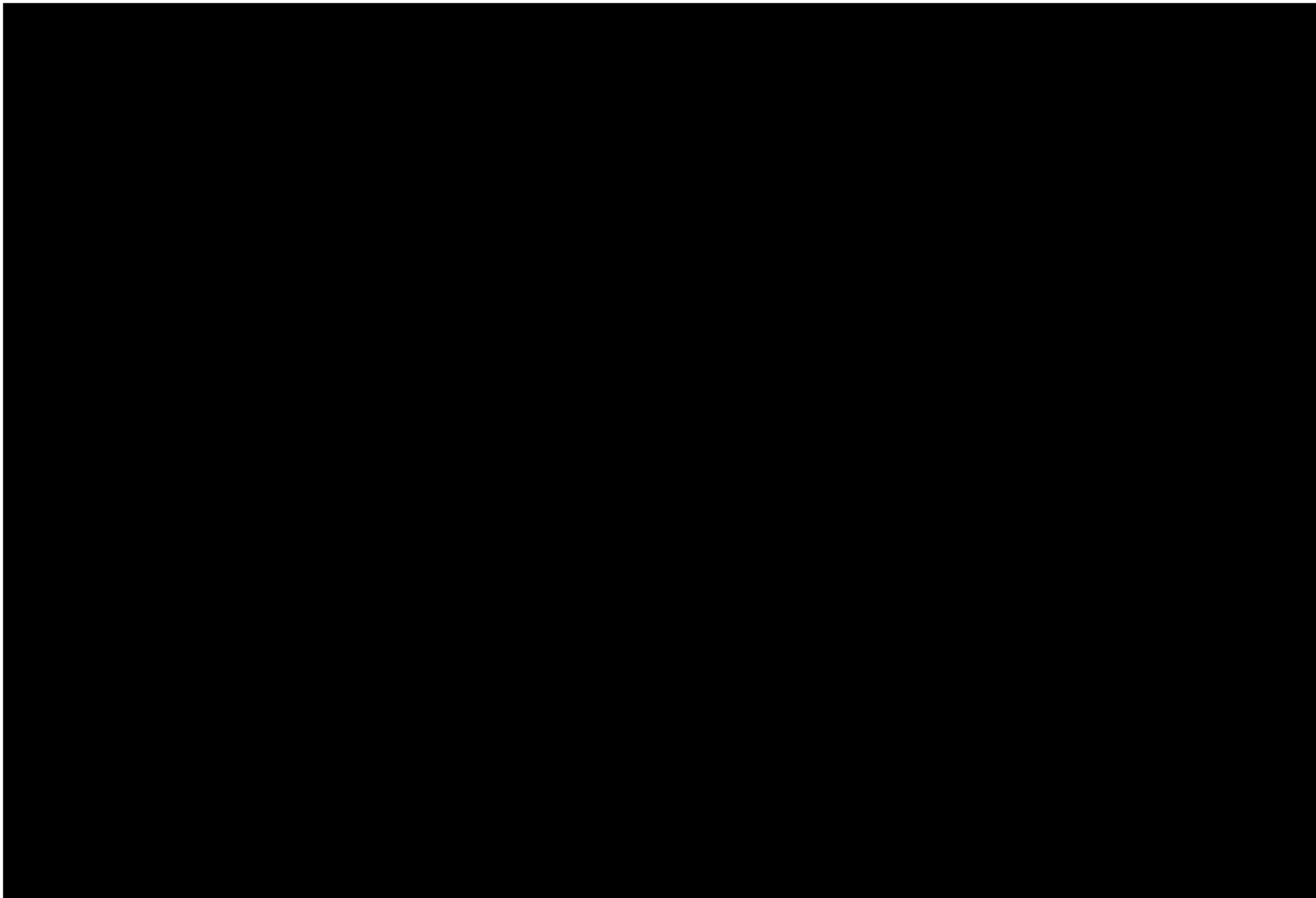


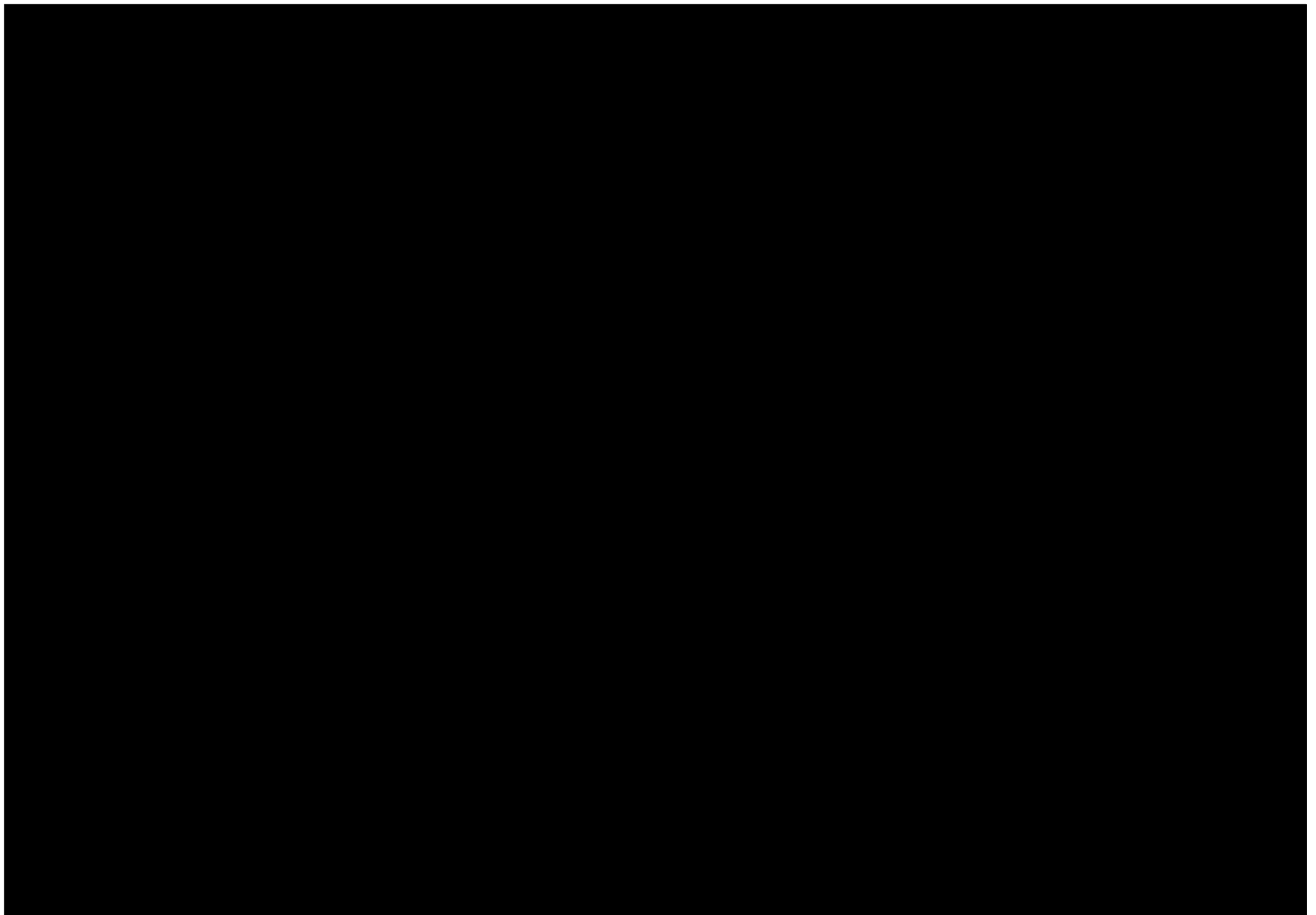


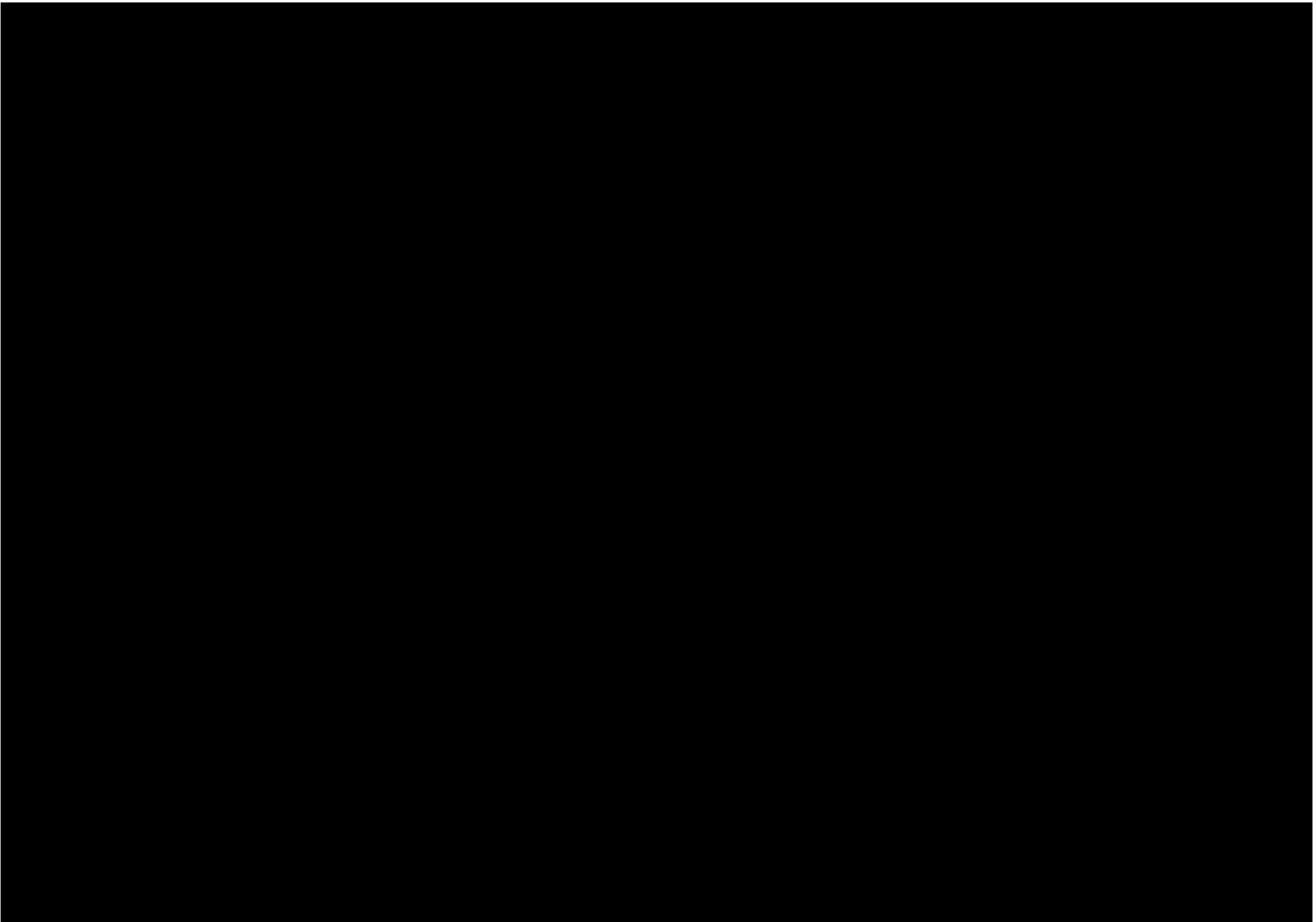




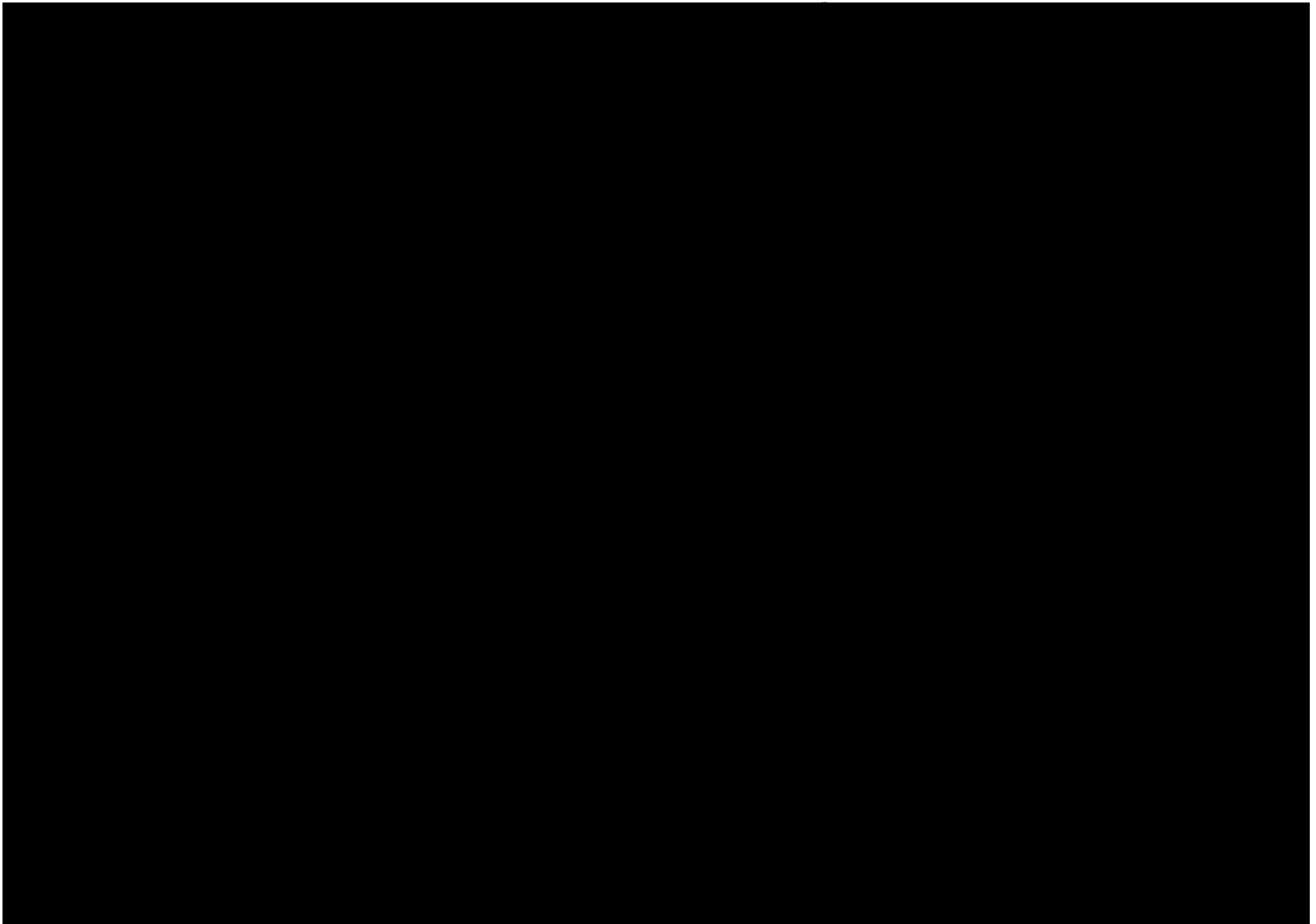


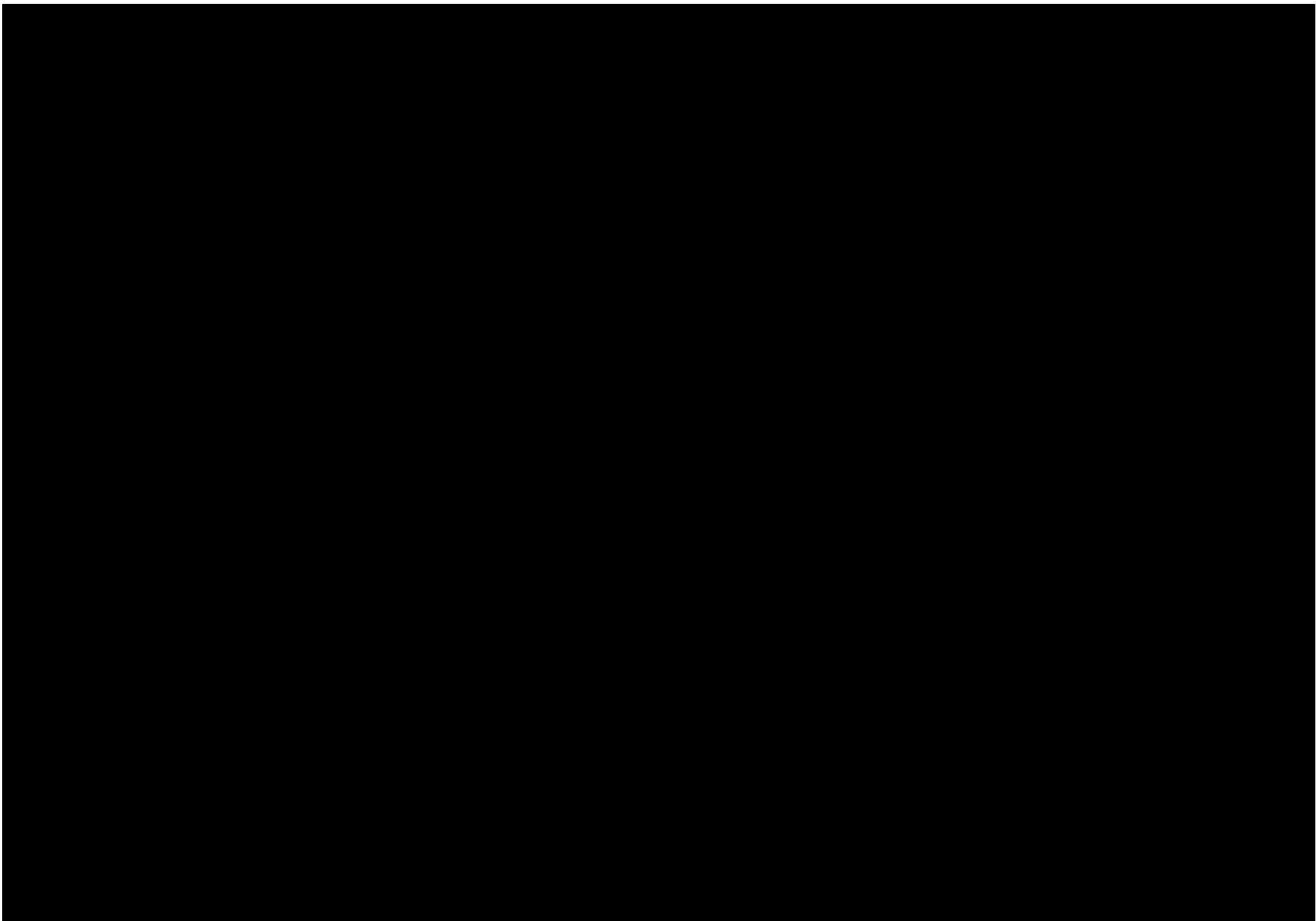


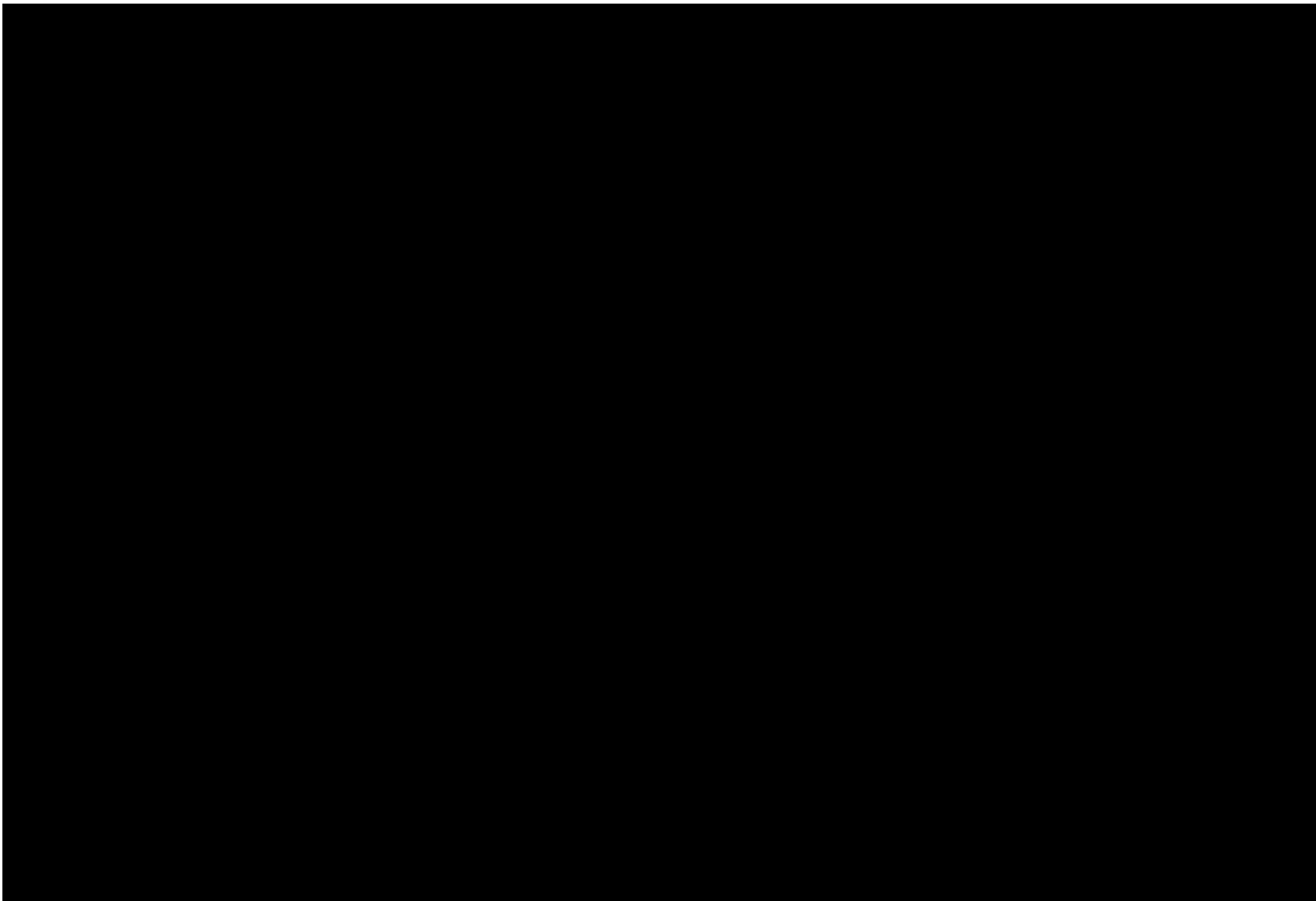


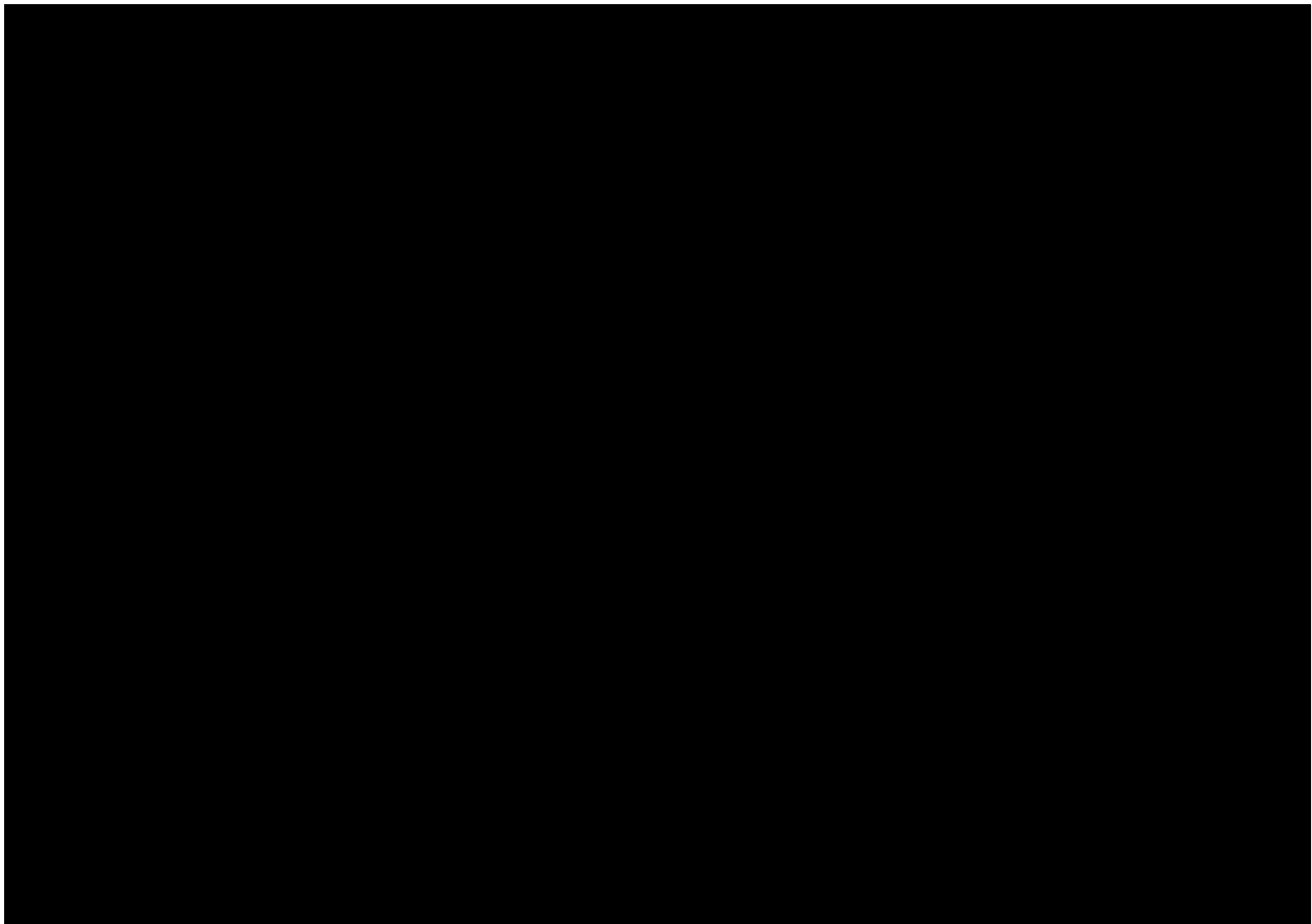


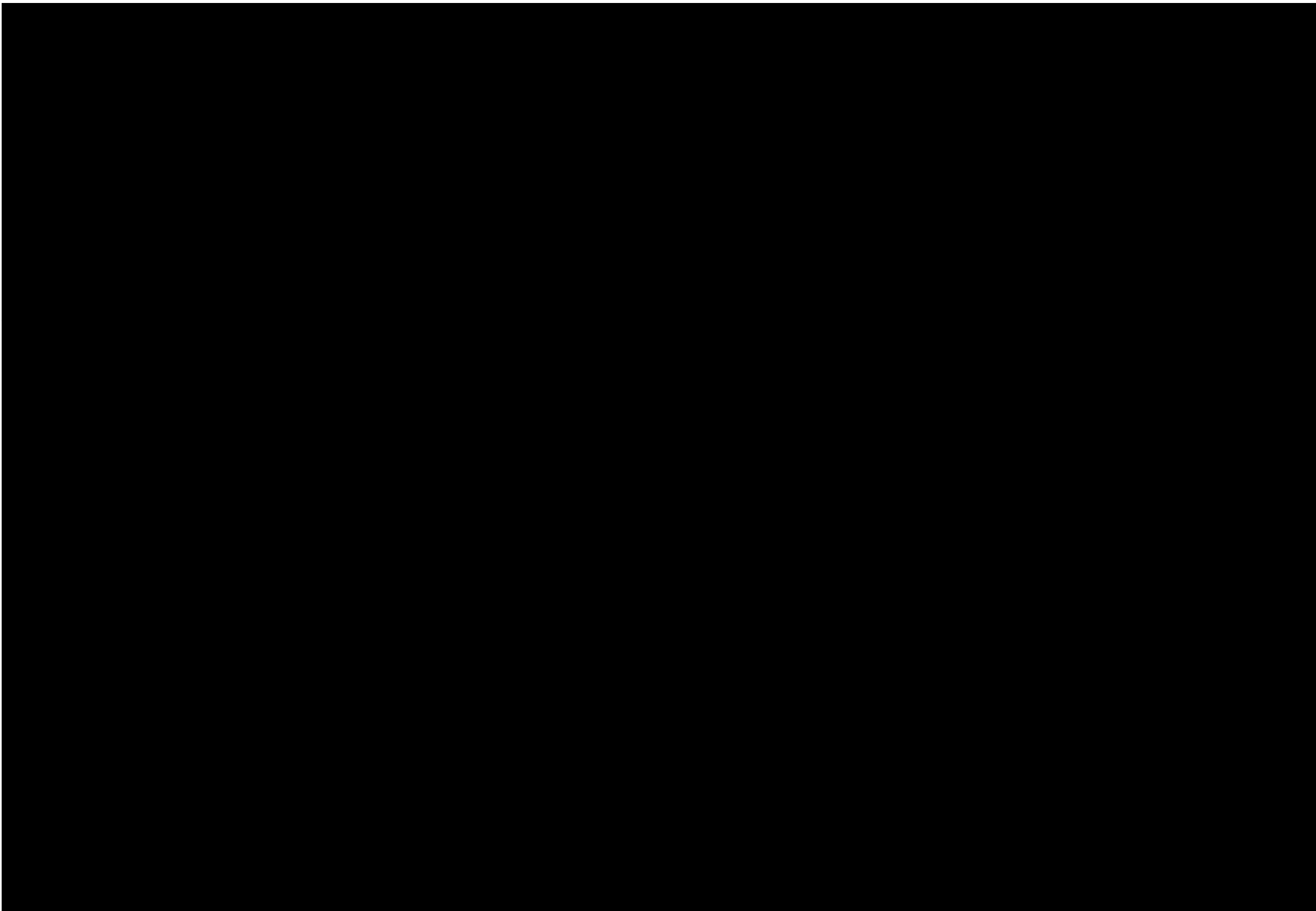


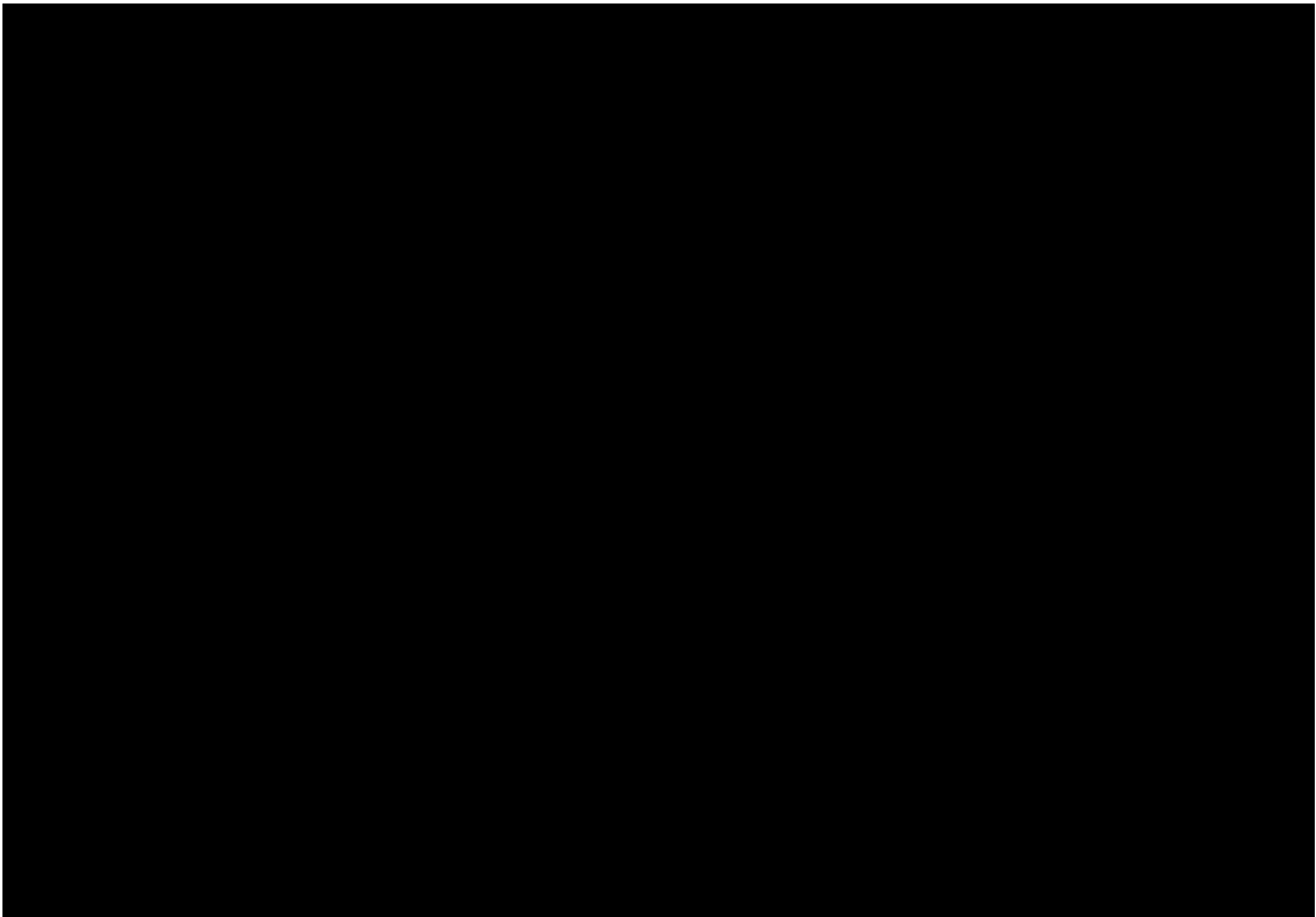


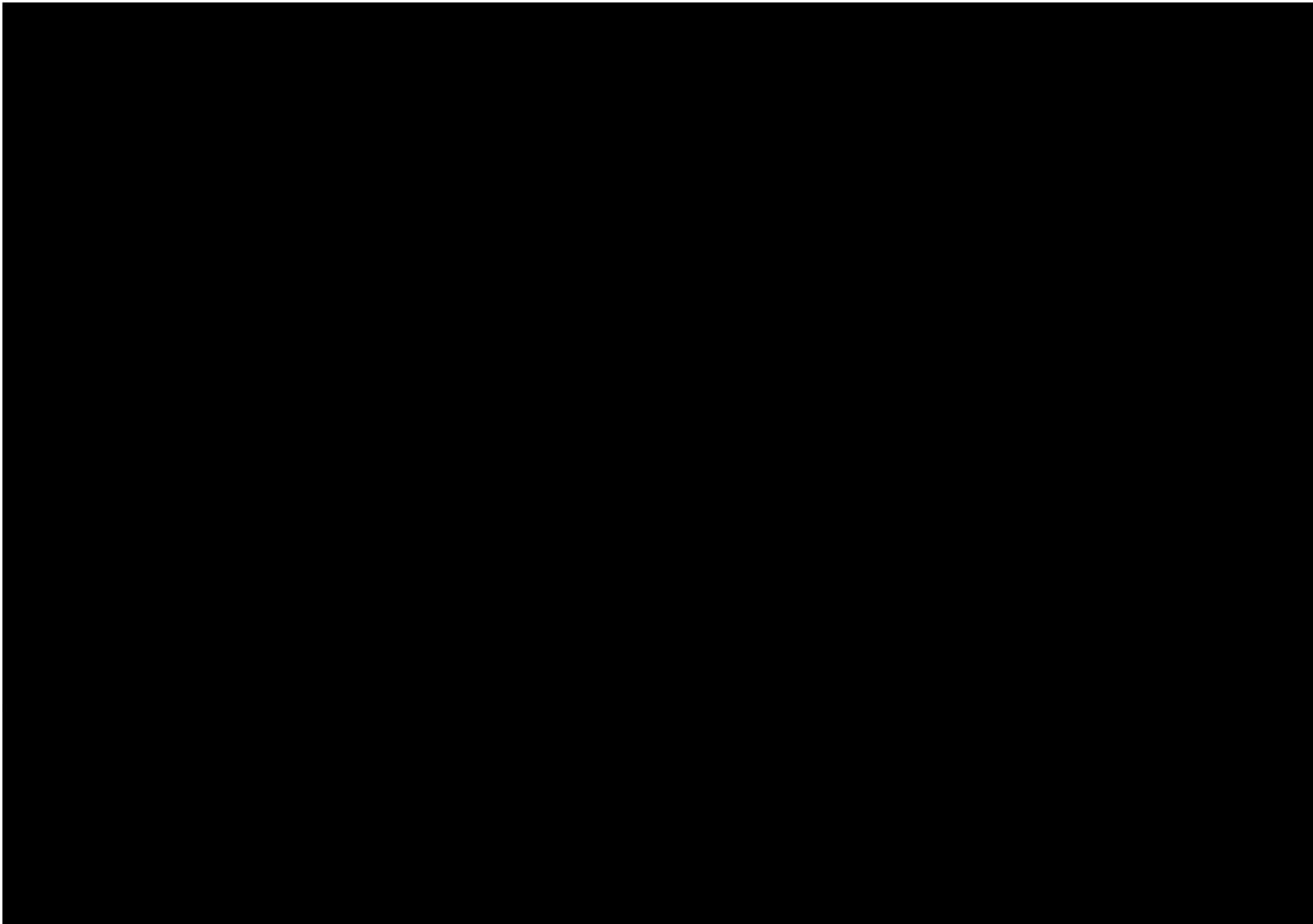


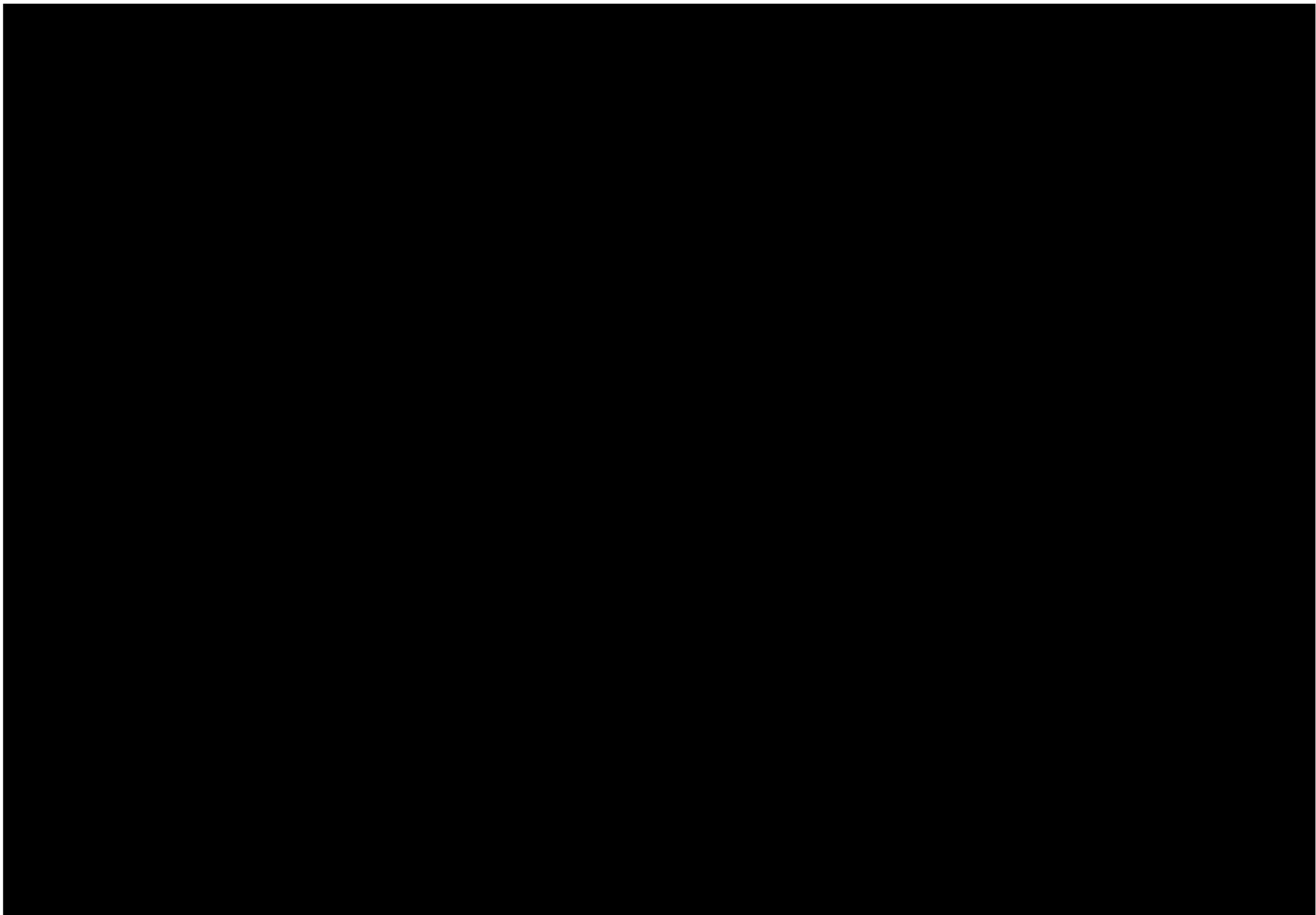


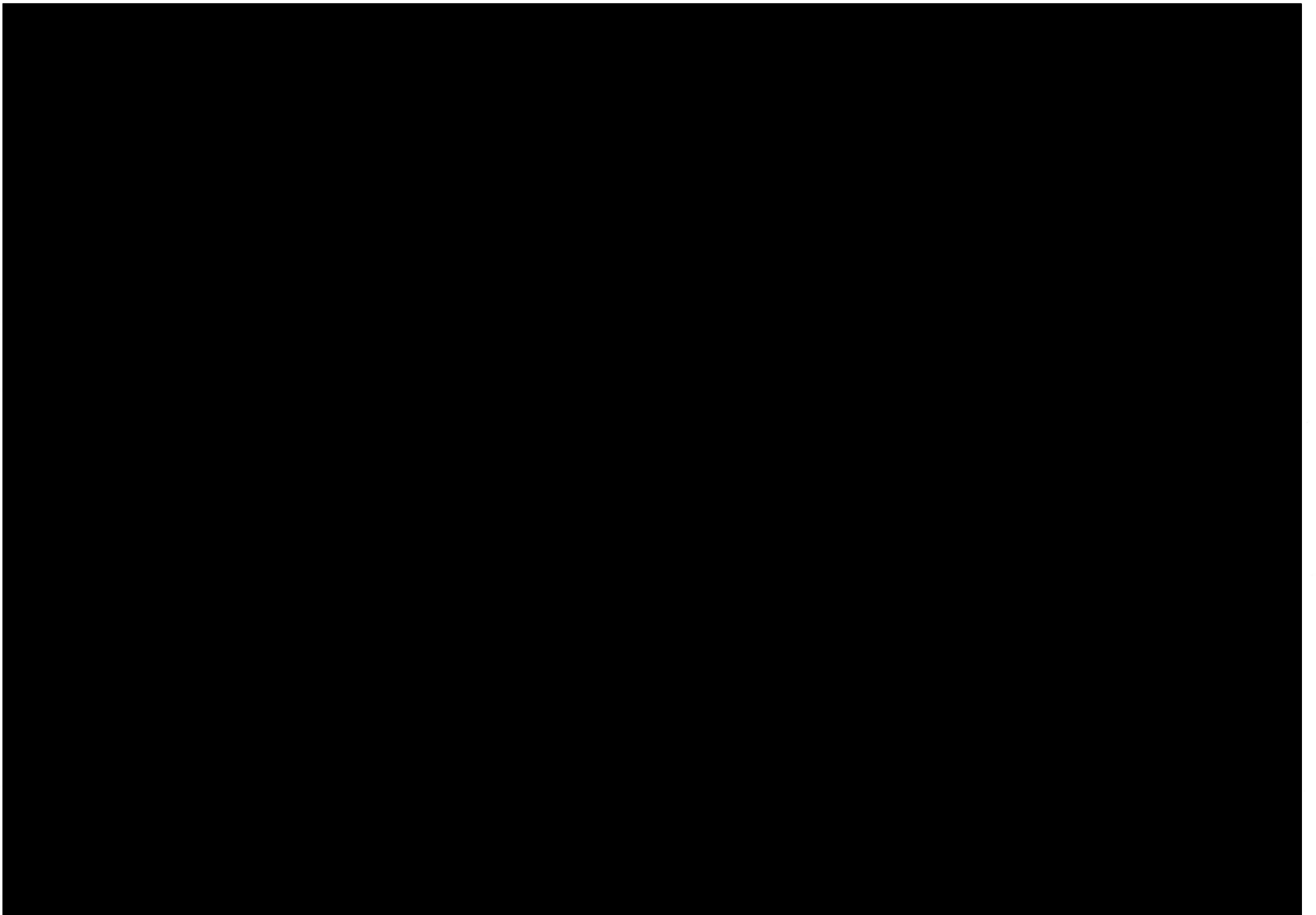


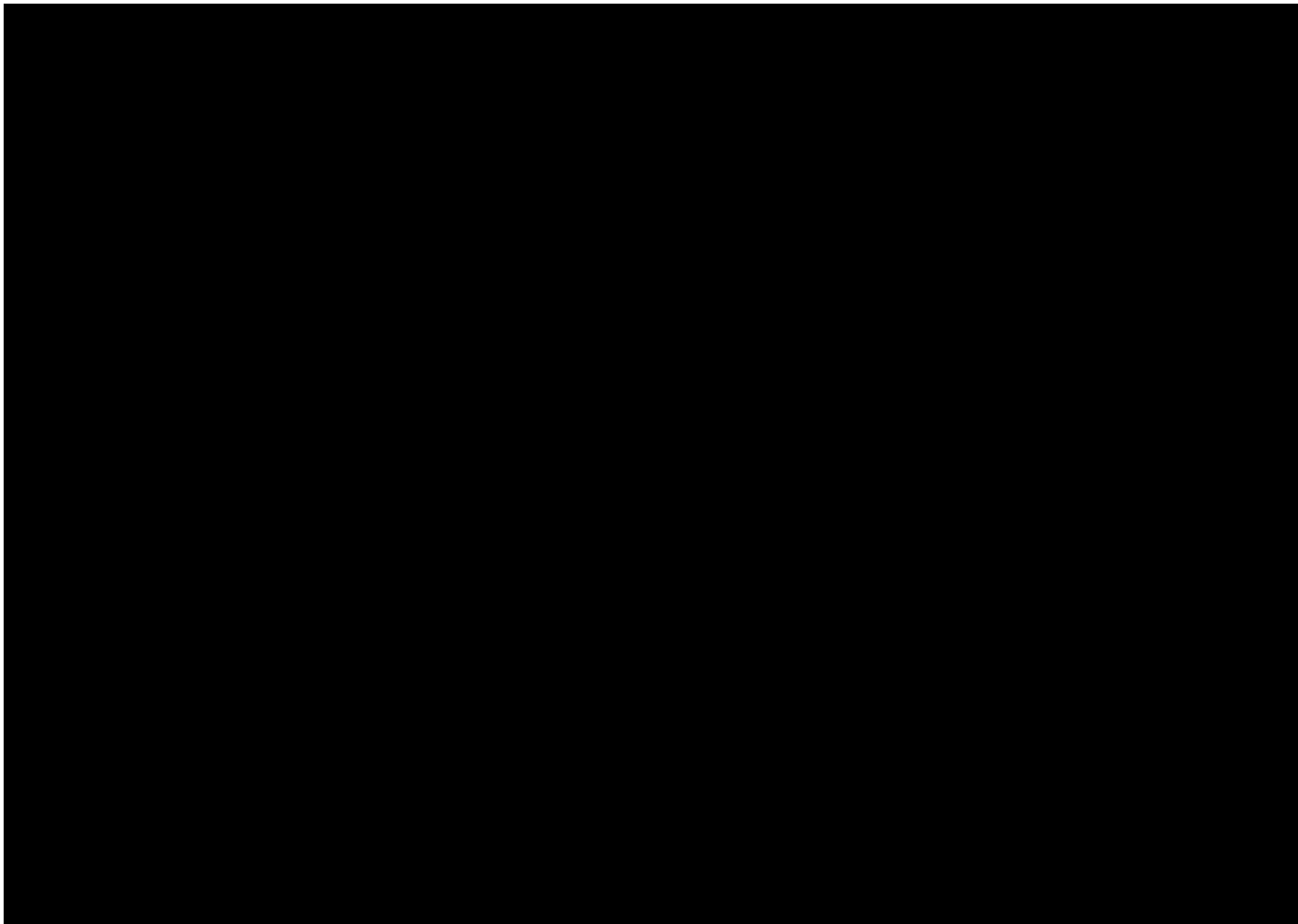


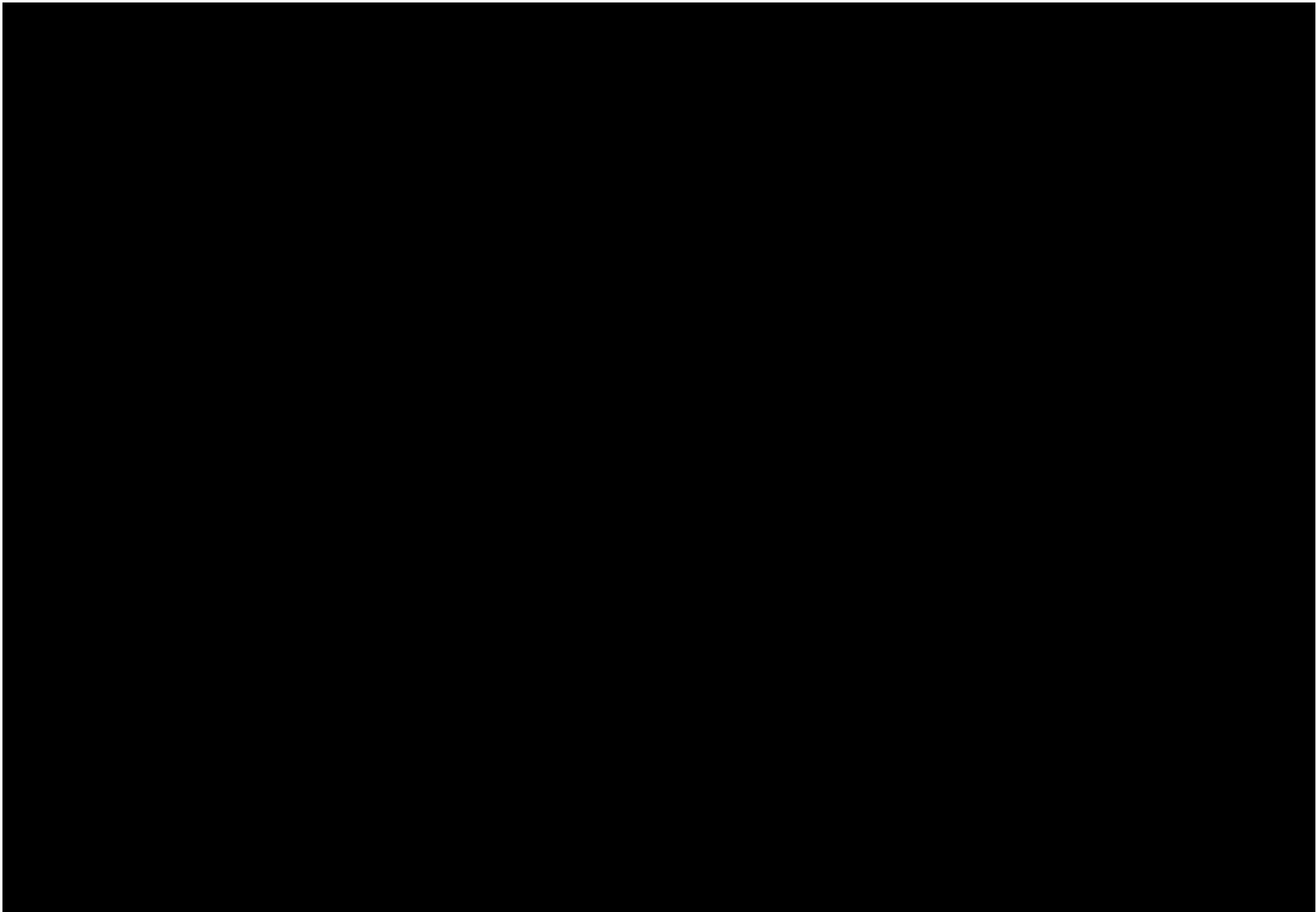


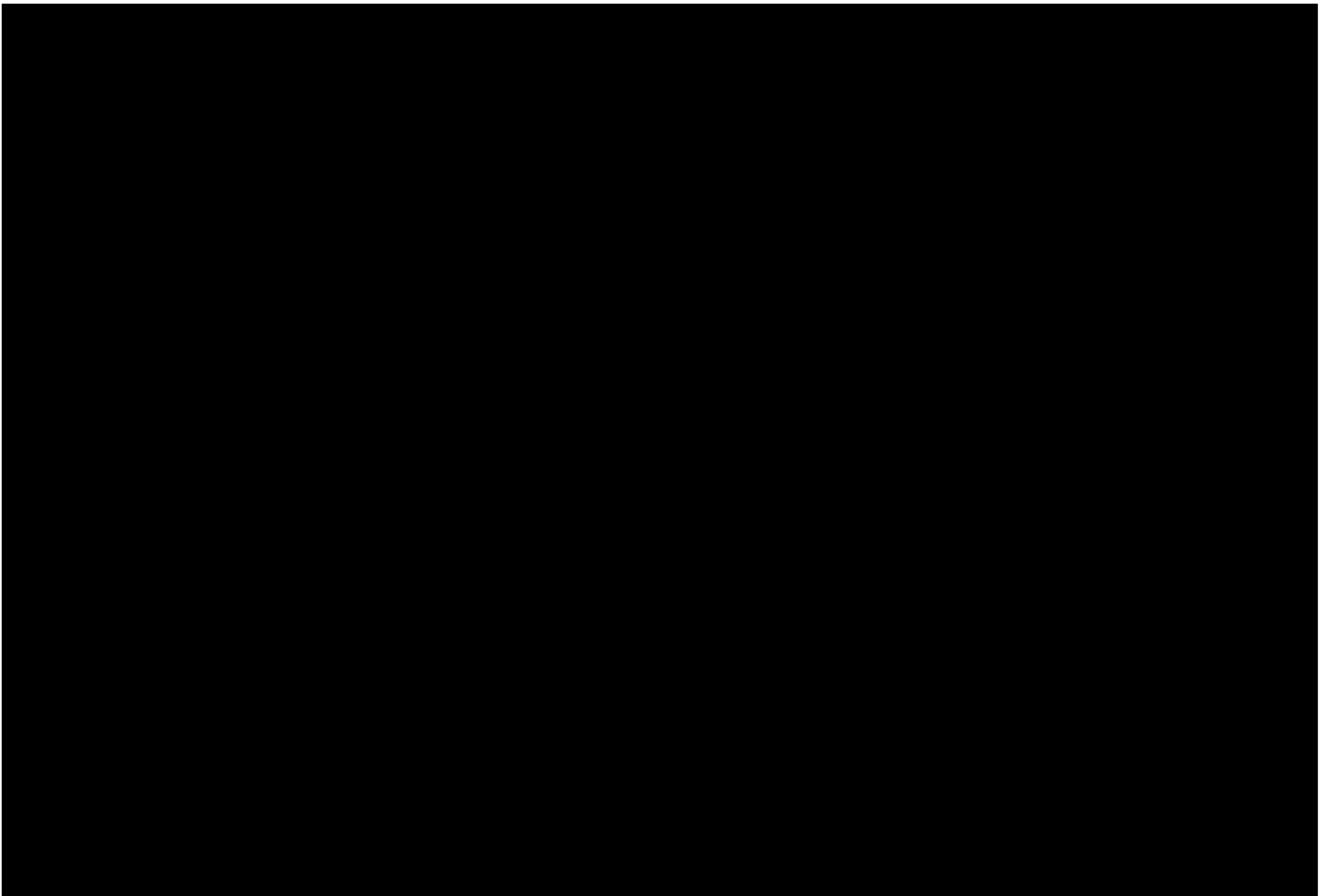


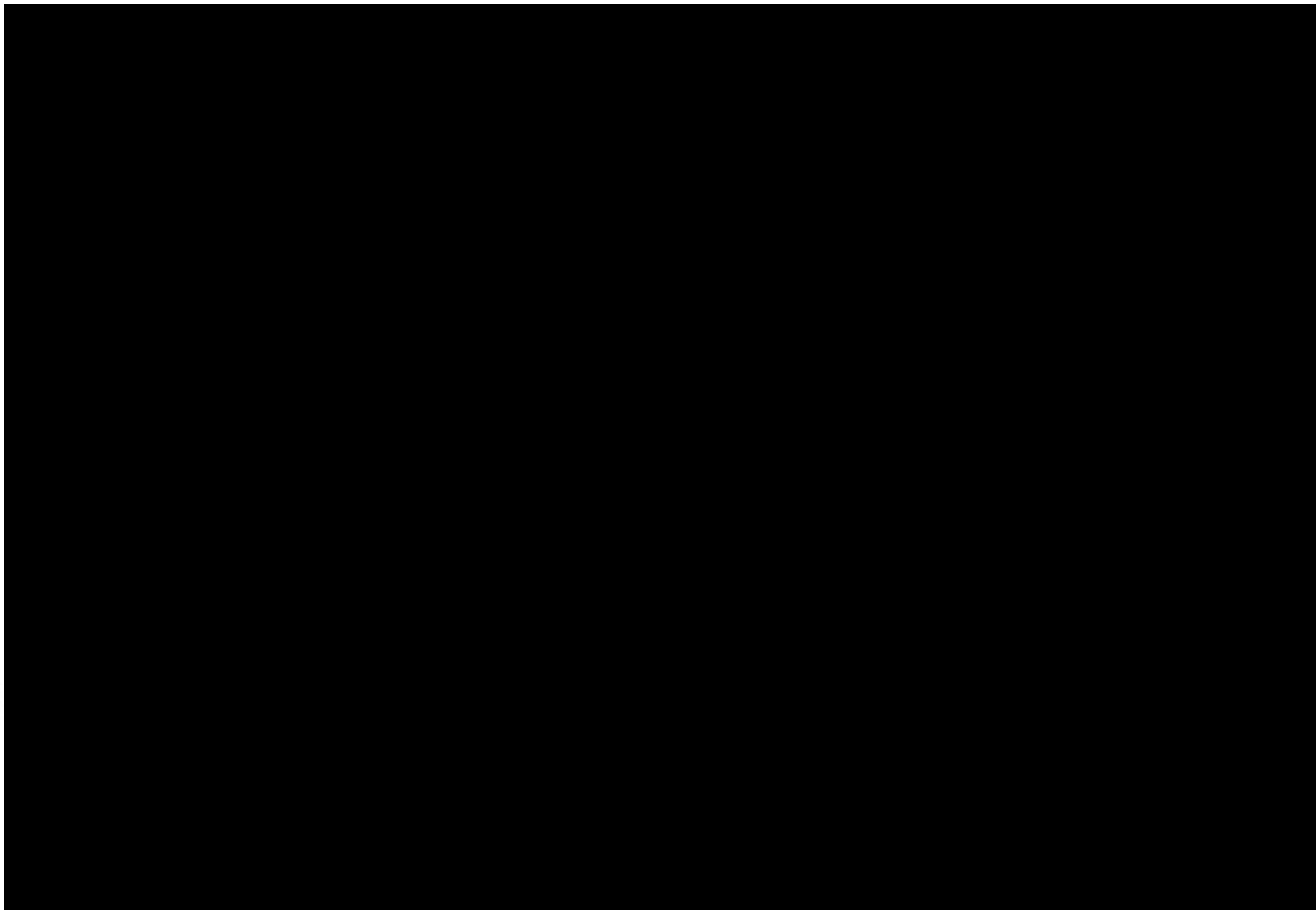


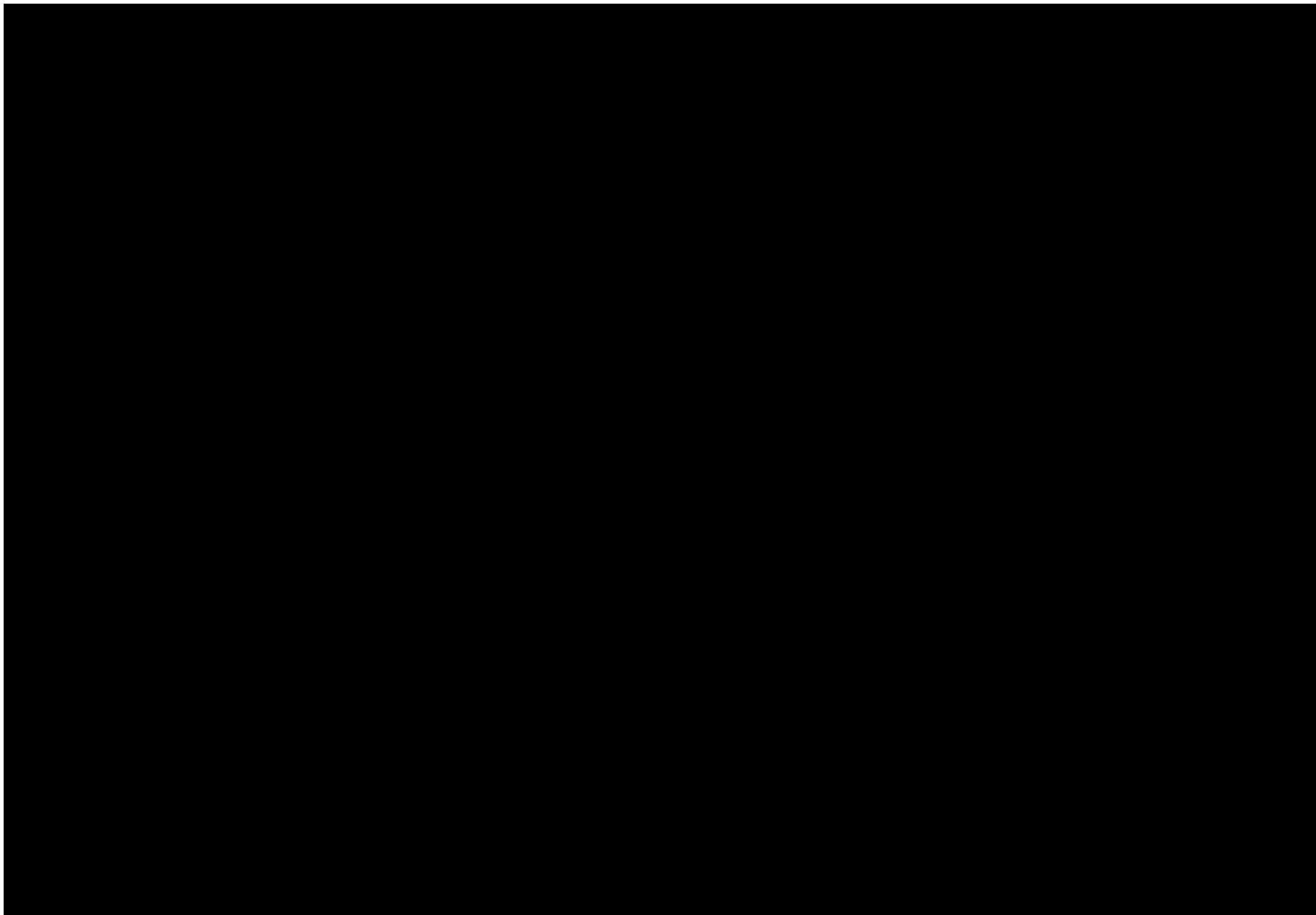


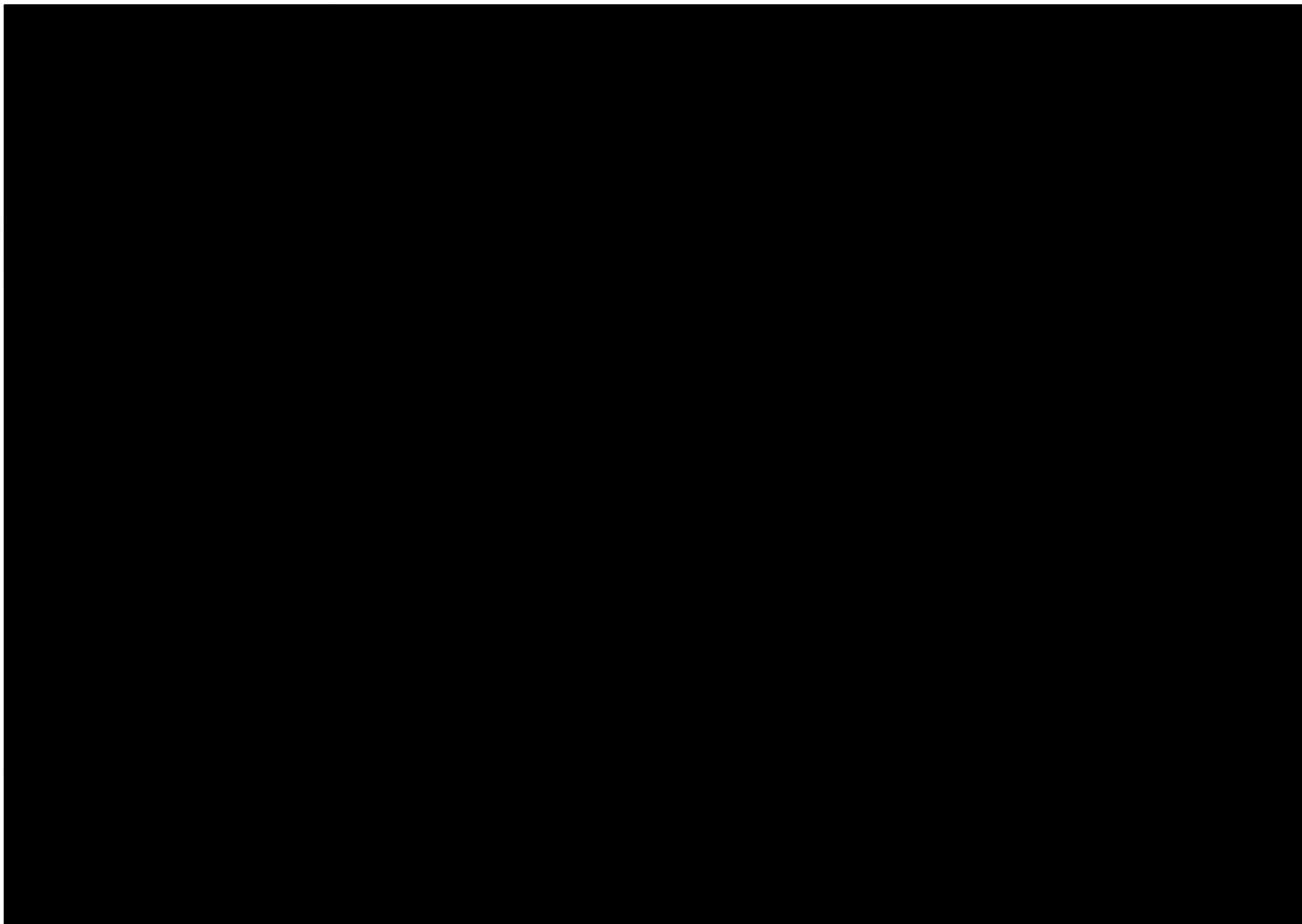


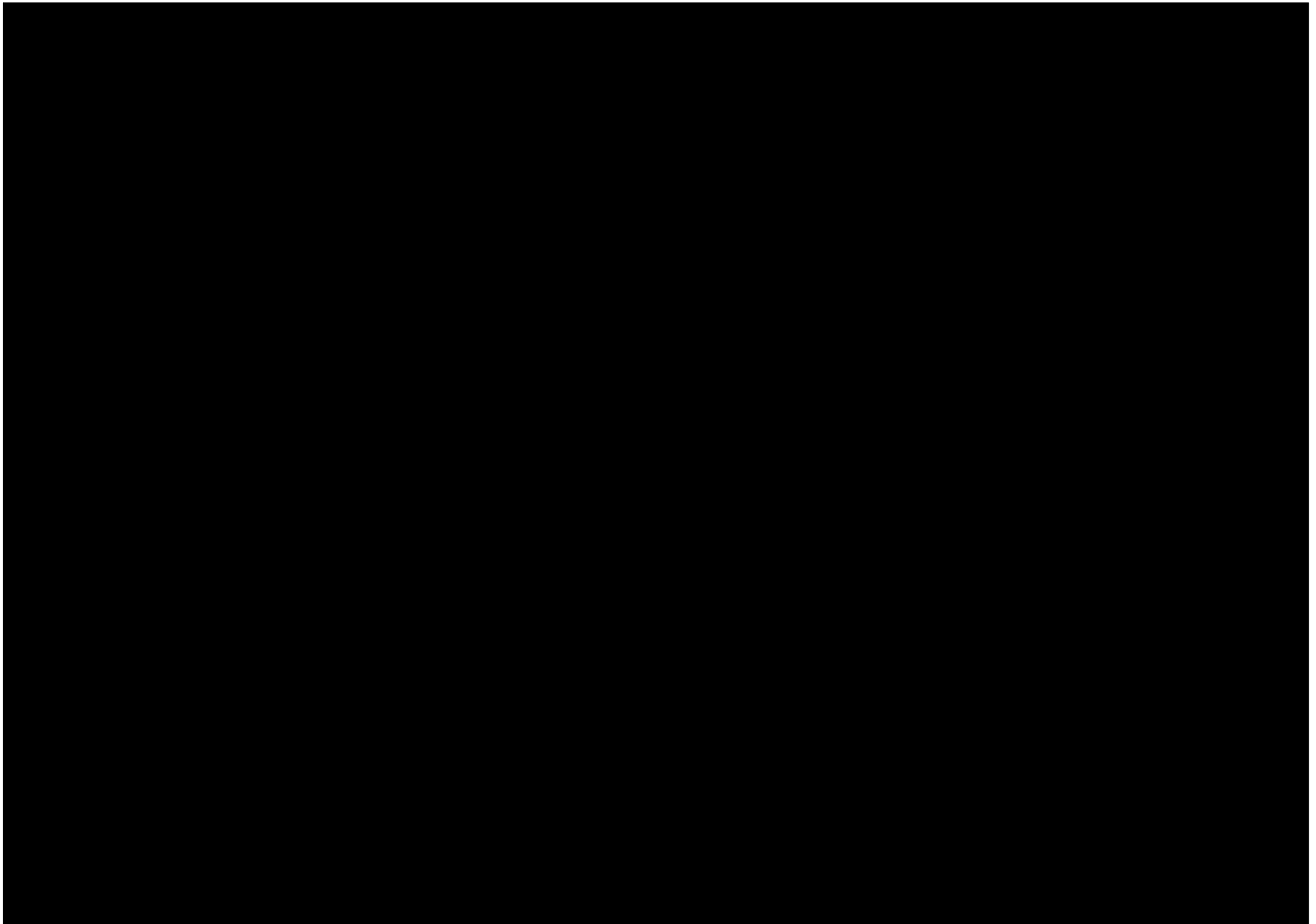


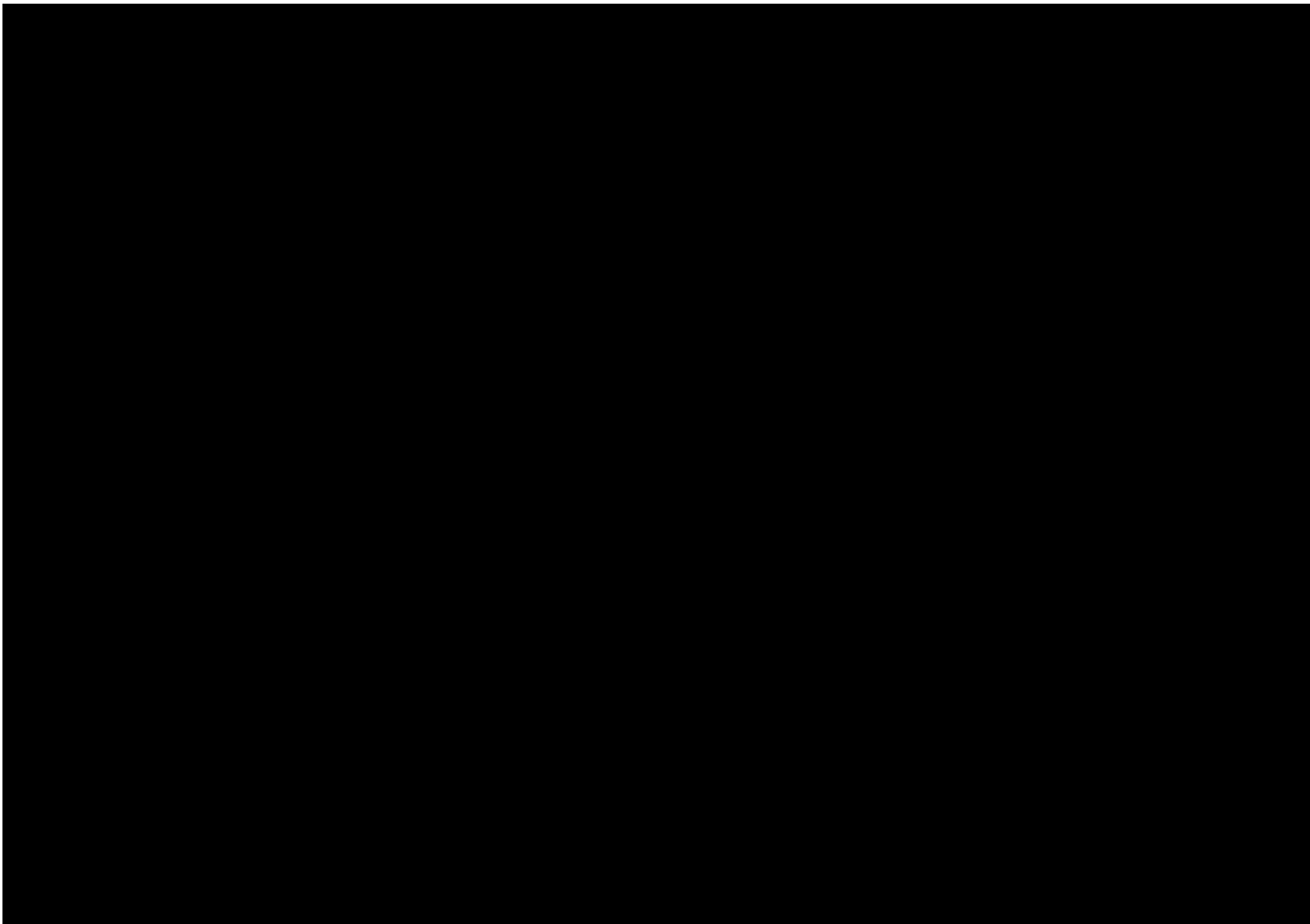


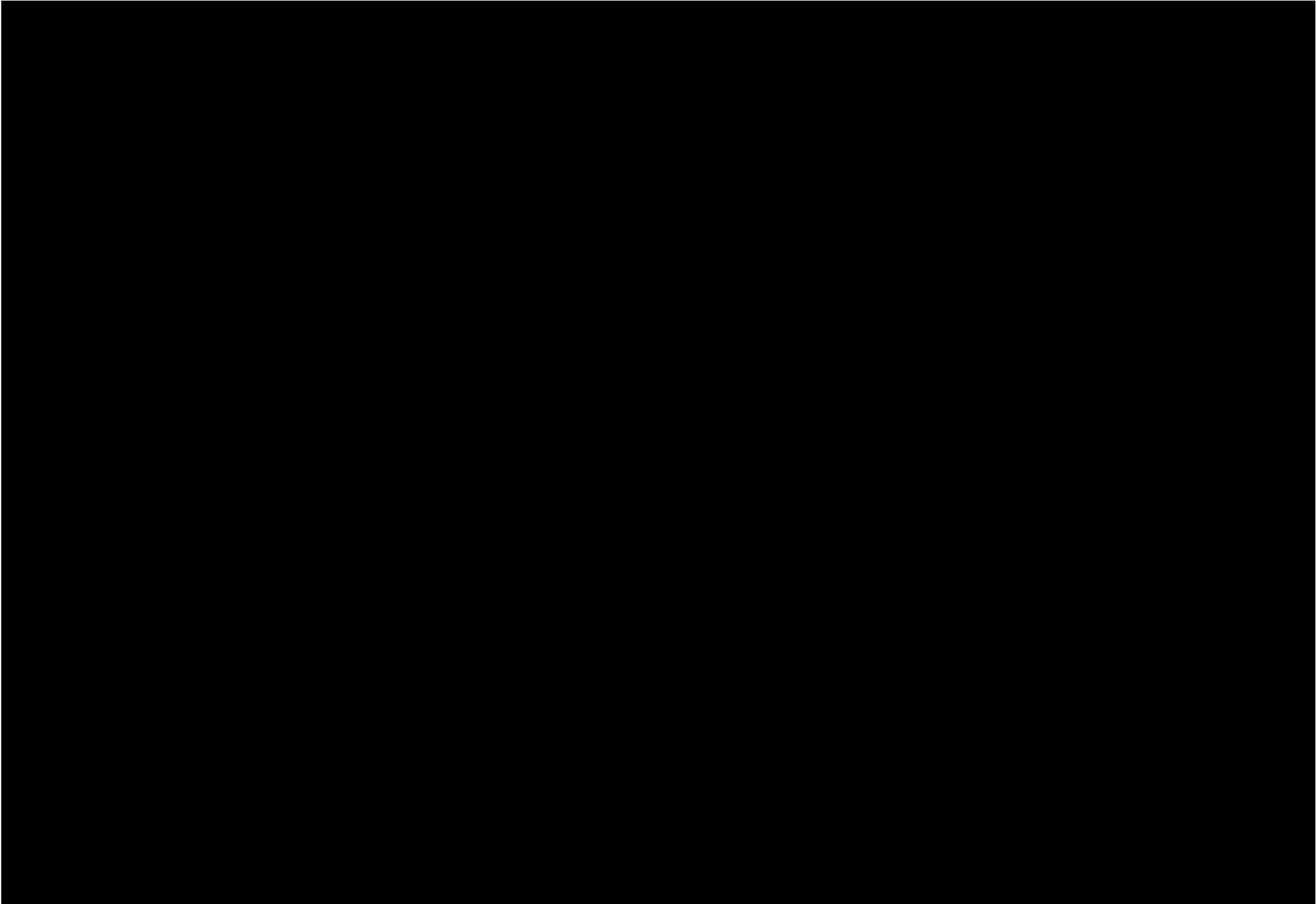


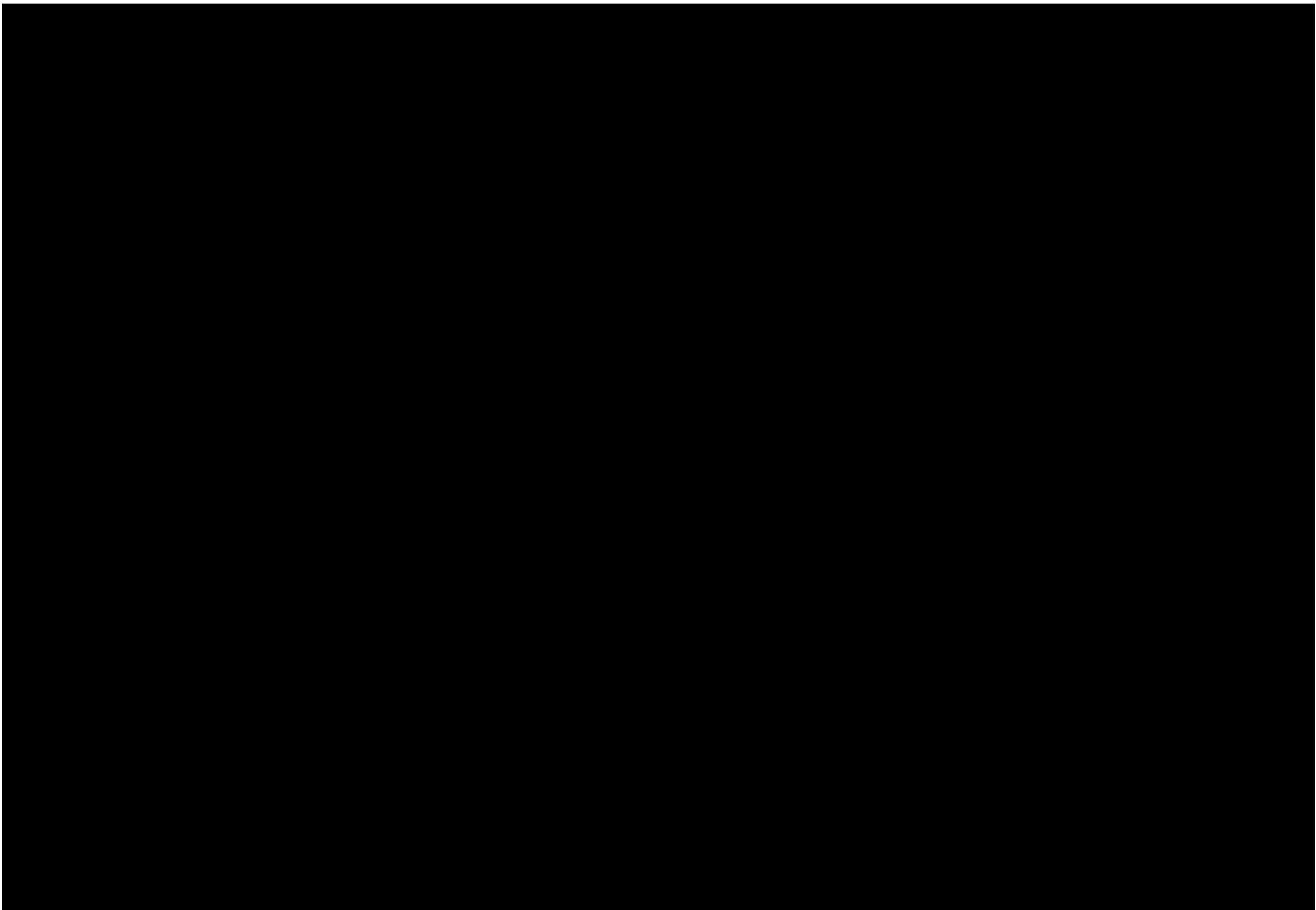


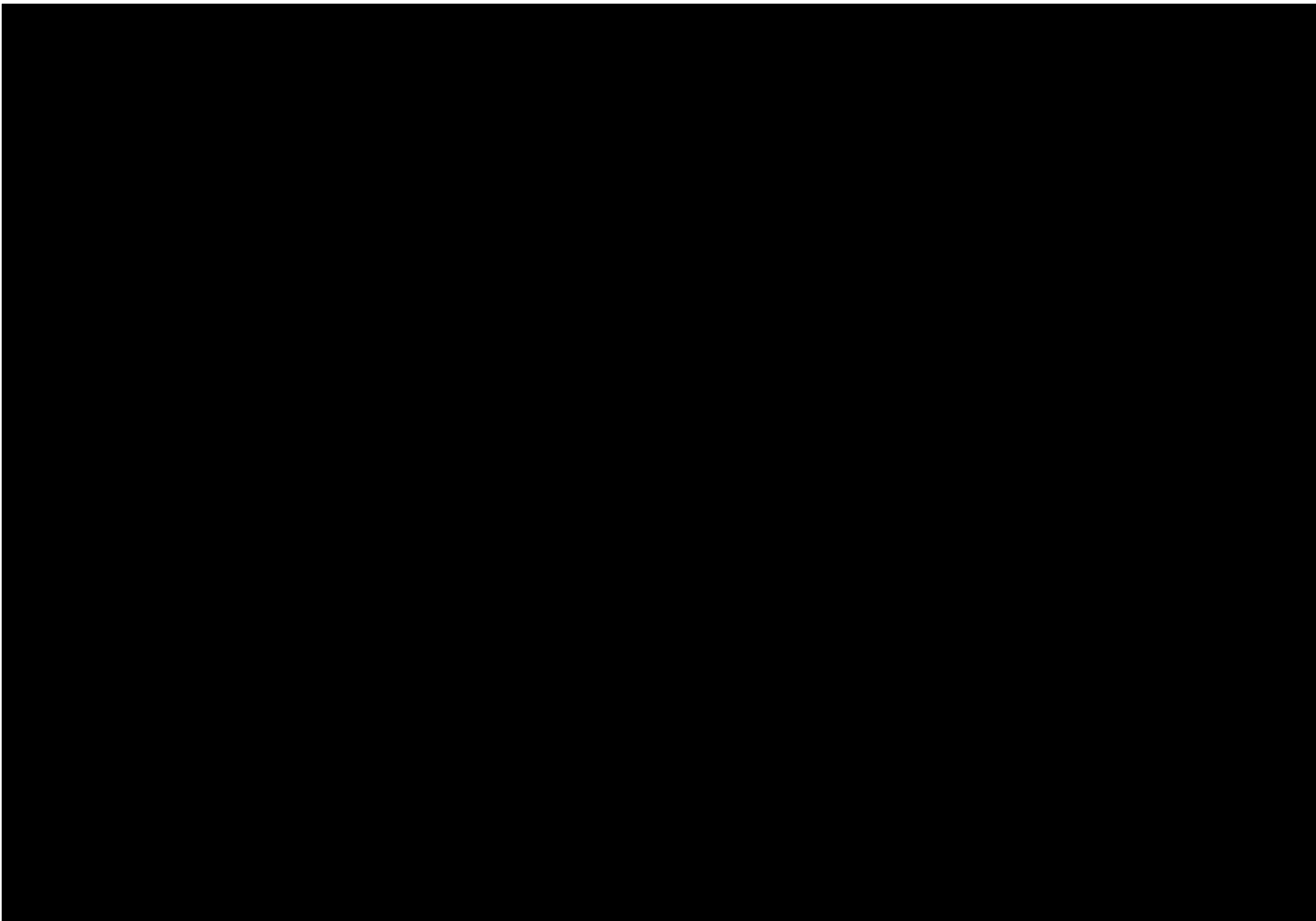


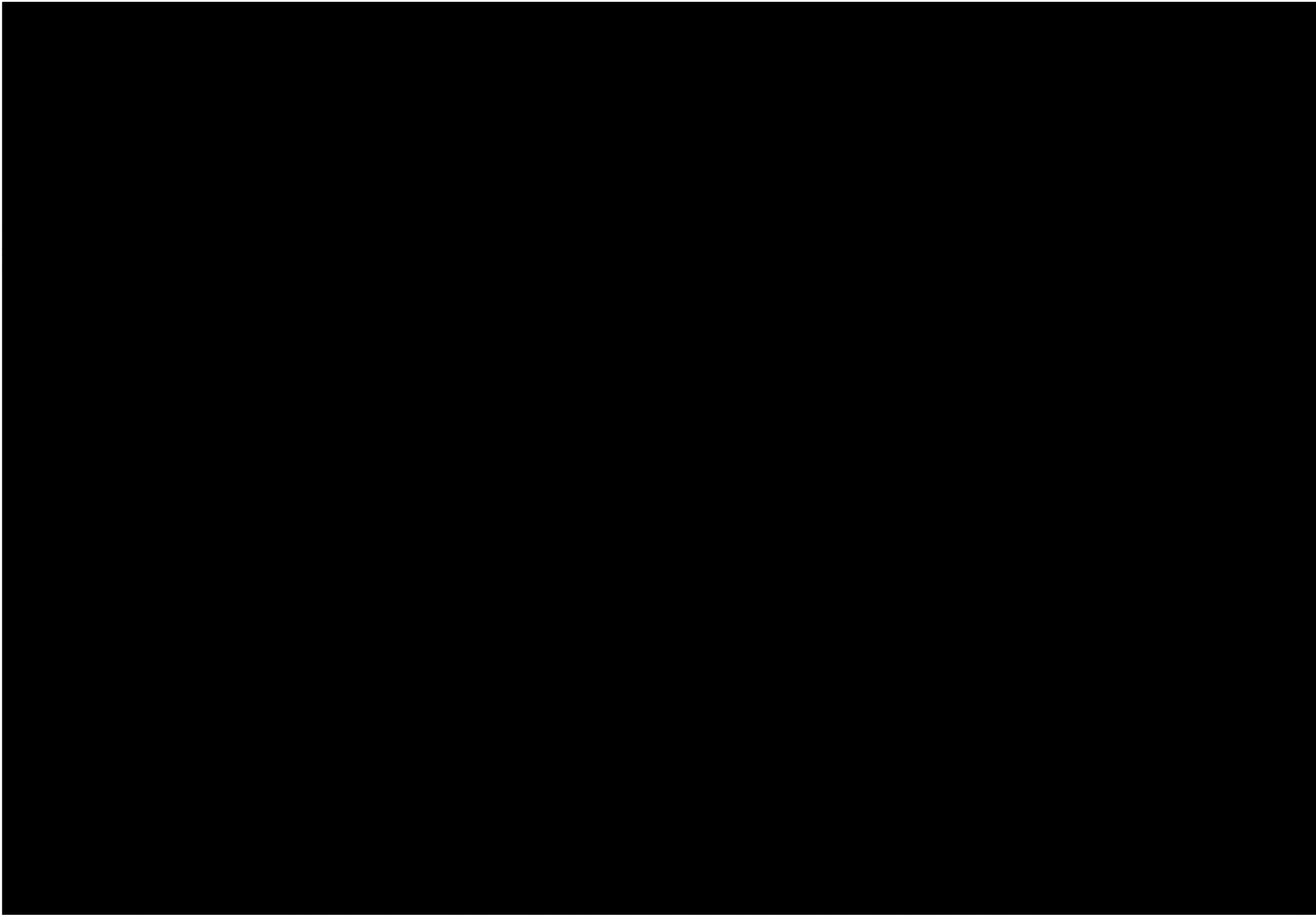


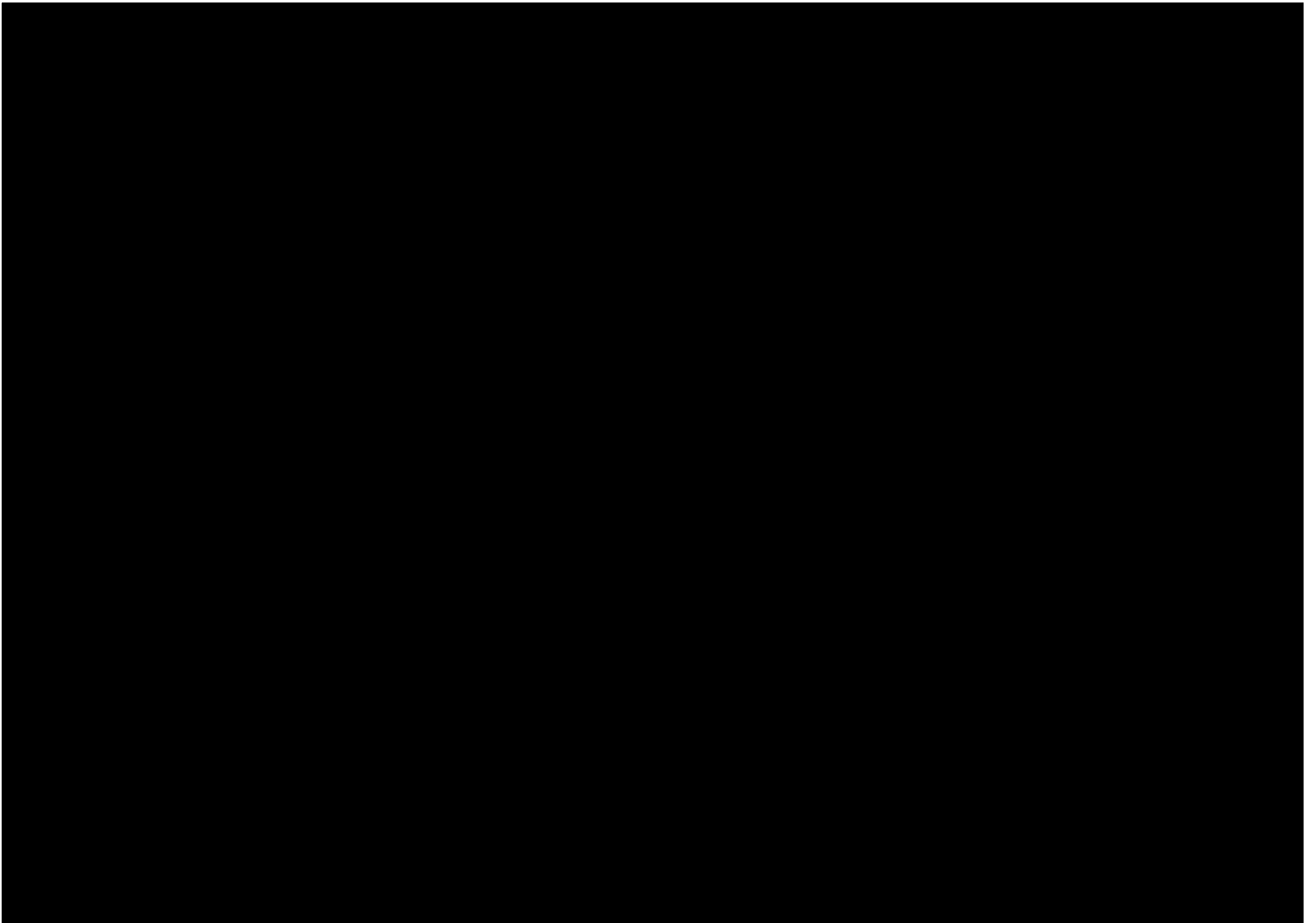












Central Station Main Works: SWTC Appendix F1 - Metro Station Works - Room Schedule

Room No.	Room Name	Critical Equipment Rooms(*)	Location	Connectivity and Adjacency	Minimum Area (m2)
100A	Signaling Equipment Room	Yes	Platform end (close to track side. Not near, above or below HV power equipment rooms)	Direct to service corridor	60
100B	PSD Equipment Room	Yes	Platform level / Adjacent to Signaling Equipment Room	Direct to service corridor	24
200	Telecom Equipment Room 1	Yes	Preferably Directly above cable termination room	Direct to service corridor 8m(L) x 6m(W) x 3m(H)	48
201	Telecom Equipment Room 2	Yes	Preferably Directly above cable termination room	Direct to service corridor 5.2m(L) x 6m(W) x 3m(H)	31.2
203	Common Telecom Equipment Room		Preferably Directly above cable termination room Telecom cable lead in manhole at Ground level is required	Direct to service corridor	72
205	Station Computer Room	Yes	Adjacent to station control room where practical	Access through Station Control Room preferred	42
306A	DC Isolating Links Room 1 (1500V)		At each end of the platform. Sub-floor required for cable trenches/basement	Direct to service corridor	14
306B	DC Isolating Links Room 2 (1500V)		At each end of the platform. Sub-floor required for cable trenches/basement	Direct to service corridor	14
400A	11kV Switchboard & Transformer Room 1		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
400B	11kV Switchboard & Transformer Room 2		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
400C	11kV Switchboard & Transformer Room 3		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
400D	11kV Switchboard & Transformer Room 4		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
420A			Centralized UPS Room 1		refer RDS
420B			Centralized UPS Room 2		refer RDS
500E	Tunnel Ventilation System Shaft		(Southern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
500F	Tunnel Ventilation System Shaft		(Southern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
500G	Tunnel Ventilation System Shaft		(Northern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
500H	Tunnel Ventilation System Shaft		(Northern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
	Track Exhaust System Shaft		(Southern End)		12
	Track Exhaust System Shaft		(Southern End)		12
509A	MCC and Control Equipment Room #1	Yes	Adjacent to TEF/TSF and TVS Fan Rooms (Southern End)	Direct to service corridor 12.1m(L) x 4m(W)	refer RDS
509B	MCC and Control Equipment Room #2	Yes	Adjacent to TEF/TSF and TVS Fan Rooms (Northern End)	Direct to service corridor 8.6m(L) x 4m(W)	refer RDS
601A	Tunnel Ventilation Nozzle Room 1		At southern end of station (Uptrack)	Nozzle to be made of concrete	refer RDS
601B	Tunnel Ventilation Nozzle Room 2		At southern end of station (Downtrack)	Nozzle to be made of concrete	refer RDS
602A	Tunnel Ventilation Fan (TVF) Room 1		Close to tunnels (assumed 1 TVS Fans per room) (Southern End)	Direct to service corridor and track	refer RDS
602B	Tunnel Ventilation Fan (TVF) Room 2		Close to tunnels (assumed 1 TVS Fans per room) (Southern End)	Direct to service corridor and track	refer RDS
602C	Tunnel Ventilation Fan (TVF) Room 3		Close to tunnels (assumed 1 TVS Fans per room) (Northern End)	Direct to service corridor and track	refer RDS
602D	Tunnel Ventilation Fan (TVF) Room 4		Close to tunnels (assumed 1 TVS Fans per room) (Northern End)	Direct to service corridor and track	refer RDS
605A	Tunnel Exhaust Fan (TEF) Room 1		Close to tunnels (assumed 5 TEFs Fans per room at one end) (Southern End)	Direct to service corridor and track	refer RDS
-	Overtrack Exhaust (OTE) Duct			Along each track	8
-	Under Platform Exhaust (UPE) duct			Along each track	4
-	Draught Relief Shaft		One at each end of platform (total = 2 nos) and close to TVF Fan Room	Connect to Up-track and Down-track Tunnels	20
613A	TVS Air Compressor and Receiver Room 1		Adjacent to TEF/TSF and TVS Fan Rooms (Southern End)	Connection service corridor	28
613B	TVS Air Compressor and Receiver Room 2		Adjacent to TEF/TSF and TVS Fan Rooms (Northern End)	Connection service corridor	28
614A	Trackside LV switch room 1		Each end of platform (North)	Connection service corridor	12
614B	Trackside LV switch room 2		Each end of platform (South)	Connection service corridor	12
7C1	Fire Brigade Booster - Tunnel Hydrants		Surface level accessible	Adjacent to fire pump room where possible	2
702	Trackside FS Pump Room 1		Surface level accessible	Next to Fire Water Storage Tank room and at same station end of Fire Control Room	36
704	Fire Control Room	Yes	Ground/ Street level		12
705	Fire Water Storage Tank Room			Next to Fire Pump Room	25
802	Primary Tunnel Water Sump		Southern End of Platform		refer RDS
802S	Primary Tunnel Water Sump Subfloor		Southern End of Platform		refer RDS
803	Secondary Tunnel Water Sump		Northern End of Platform		refer RDS
803S	Secondary Tunnel Water Sump Subfloor		Northern End of Platform		refer RDS
1002A	Staff Locker Room 1 (Male / Female)		Adjacent to multi-purpose room		8
1002B	Staff Locker Room 2 (Male / Female)		Adjacent to multi-purpose room		8
1003	Multipurpose Room		Adjacent to locker room within concourse		15
1003A	Refuse Room		Street / Ground Level with direct access to a lift		11
1004B	Bin Room		Concourse back of house area. Accessible to Refuse room and Platforms via lift		5
1005A	Chemical Store Room 1				10
1006	Platform Cleaning Machine Room		Platform adjacent to cleaner store room with direct access to a lift	3m circulation required externally at the door required for machine turning	12
1006A	Presentation Store Room			Adjacent to cleaner store room	10
1007A	Cleaners store 1			Adjacent to toilets	10
1007B	Cleaners store 2			Adjacent to toilets	10
1008A	Station Staff (Concourse W.C 1)		Concourse within the back of house area	Adjacent to staff locker room	7
1008B	Station Staff (Concourse W.C 2)		Concourse within the back of house area	Adjacent to staff locker room	7
1009	Station Control Room	Yes	Quick access from Sydney Metro areas		55
1016	Store Room		Connection within the back of house areas		20
1017A	Maintenance office		Concourse within the back of house area. Adjacent to maintenance store room.		12
1017E	Maintenance store room		Connection within the back of house areas. Adjacent to maintenance office		5
1025	Emergency track trolley room		Back of house platform		15
1030	Cable Termination Room 1		One at each platform end. One of the CTR be directly under the TER	Direct to service corridor	6
1031	Cable Termination Room 2		One at each platform end	Direct to service corridor	6
HWU1	Headwall Unit 1				refer RDS
HWU2	Headwall Unit 2				refer RDS
TWU1	Tailwall Unit 1				refer RDS
TWU2	Tailwall Unit 2				refer RDS
	Communications Cupboard 1		Platform	Under platform escalator 1	2
	Communications Cupboard 2		Platform	Under platform escalator 2	2

Central Station Main Works: SWTC Appendix F1 - Metro Station Works - Room Schedule

Room No.	Room Name	Critical Equipment Rooms(*)	Location	Connectivity and Adjacency	Minimum Area (m2)
	Communications Cupboard 3		Concourse	within 80m (cable containment length) of communication field equipment	2
	Communications Cupboard 4		Concourse	within 80m (cable containment length) of communication field equipment	2
	Communications Cupboard 5		Concourse	within 80m (cable containment length) of communication field equipment	2
	Communications Cupboard 6		Concourse	within 80m (cable containment length) of communication field equipment	2
402A	LV MAIN SWITCH ROOM (415V DBs)				
402B	LV MAIN SWITCH ROOM (415V DBs)				
402C	LV MAIN SWITCH ROOM (415V DBs)				
402D	LV MAIN SWITCH ROOM (415V DBs)				
500A	FIRE STAIRCASE PRESSURISATION PLANT ROOM				
500B	FIRE STAIRCASE PRESSURISATION PLANT ROOM				
503	WATERCOOLED VRV PLANT ROOM				
504C	COOLING TOWER WATER PUMPS AND TANKS				
505	SIGNALLING/TELECOMS CRITICAL COOLING SYSTEMS PLANT ROOM #1	Yes			
505	SIGNALLING/TELECOMS CRITICAL COOLING SYSTEMS PLANT ROOM #1	Yes			
506A	SIGNALLING/TELECOMS CRITICAL COOLING SYSTEMS PLANT ROOM #2	Yes			
506B	EQUIPMENT COOLING SYSTEMS PLANT ROOM				
506C	EQUIPMENT COOLING SYSTEMS PLANT ROOM				
507AA	PLANTROOM SUPPLY VENTILATION FAN ROOM				
507AB	PLANTROOM SUPPLY VENTILATION FAN ROOM				
507BA	PLANTROOM EXHAUST VENTILATION FAN ROOM				
507BB	PLANTROOM EXHAUST VENTILATION FAN ROOM				
507CA	AHU OUTSIDE AIR FAN ROOM				
507CB	AHU OUTSIDE AIR FAN ROOM				
508	E&M SYSTEMS MCC AND CONTROL EQUIPMENT ROOM #1				
509A	E&M SYSTEMS MCC AND CONTROL EQUIPMENT ROOM #2				
700A	GAS SUPPRESSION EQUIPMENT ROOM				
701	FIRE BRIGADE BOOSTER - TUNNEL HYDRANTS				
702A	FIRE PUMP ROOM #1				
705	FIRE WATER STORAGE TANK ROOM				
706A	EMERGENCY TROLLEY STORE				
706B	EMERGENCY TROLLEY STORE				
801	WATER TREATMENT PLANT ROOM				
802	PRIMARY GROUND WATER/TUNNEL WATER SUMP				
803	SECONDARY GROUND WATER/TUNNEL WATER SUMP				
804A	SEWAGE EJECTOR PUMP ROOM				
808B	HOT WATER PLANT				
10F1	POSTER CASES - INWARD JOURNEY PLANNING				

Notes:

RDS means Metro Station room data sheets

(*) The following are the minimum quantity and number of Critical Equipment Rooms. All other rooms and locations are subject to the definition of Critical Equipment Rooms (Refer to SWTC Appendix A1)

Central Station Main Works: SWTC Appendix F1 - Metro Station Works - Room Schedule

Room No.	Room Name	Critical Equipment Rooms(*)	Location	Connectivity and Adjacency	Minimum Area (m2)
100A	Signaling Equipment Room	Yes	Platform end (close to track side. Not near, above or below HV power equipment rooms)	Direct to service corridor	60
100B	PSD Equipment Room	Yes	Platform level / Adjacent to Signaling Equipment Room	Direct to service corridor	24
200	Telecom Equipment Room 1	Yes	Preferably Directly above cable termination room	Direct to service corridor 8m(L) x 6m(W) x 3m(H)	48
201	Telecom Equipment Room 2	Yes	Preferably Directly above cable termination room	Direct to service corridor 5.2m(L) x 6m(W) x 3m(H)	31.2
203	Common Telecom Equipment Room		Preferably Directly above cable termination room Telecom cable lead in manhole at Ground level is required	Direct to service corridor	72
205	Station Computer Room	Yes	Adjacent to station control room where practical	Access through Station Control Room preferred	42
306A	DC Isolating Links Room 1 (1500V)		At each end of the platform. Sub-floor required for cable trenches/basement	Direct to service corridor	14
306B	DC Isolating Links Room 2 (1500V)		At each end of the platform. Sub-floor required for cable trenches/basement	Direct to service corridor	14
400A	11kV Switchboard & Transformer Room 1		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
400B	11kV Switchboard & Transformer Room 2		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
400C	11kV Switchboard & Transformer Room 3		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
400D	11kV Switchboard & Transformer Room 4		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
420A			Centralized UPS Room 1		refer RDS
420B			Centralized UPS Room 2		refer RDS
500E	Tunnel Ventilation System Shaft		(Southern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
500F	Tunnel Ventilation System Shaft		(Southern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
500G	Tunnel Ventilation System Shaft		(Northern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
500H	Tunnel Ventilation System Shaft		(Northern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
500I	Track Exhaust System Shaft		(Southern End)		12
500J	Track Exhaust System Shaft		(Southern End)		12
509A	MCC and Control Equipment Room #1	Yes	Adjacent to TEF/TSF and TVS Fan Rooms (Southern End)	Direct to service corridor 12.1m(L) x 4m(W)	refer RDS
509B	MCC and Control Equipment Room #2	Yes	Adjacent to TEF/TSF and TVS Fan Rooms (Northern End)	Direct to service corridor 8.6m(L) x 4m(W)	refer RDS
601A	Tunnel Ventilation Nozzle Room 1		At southern end of station (Uptrack)	Nozzle to be made of concrete	refer RDS
601B	Tunnel Ventilation Nozzle Room 2		At southern end of station (Downtrack)	Nozzle to be made of concrete	refer RDS
602A	Tunnel Ventilation Fan (TVF) Room 1		Close to tunnels (assumed 1 TVS Fans per room) (Southern End)	Direct to service corridor and track	refer RDS
602B	Tunnel Ventilation Fan (TVF) Room 2		Close to tunnels (assumed 1 TVS Fans per room) (Southern End)	Direct to service corridor and track	refer RDS
602C	Tunnel Ventilation Fan (TVF) Room 3		Close to tunnels (assumed 1 TVS Fans per room) (Northern End)	Direct to service corridor and track	refer RDS
602D	Tunnel Ventilation Fan (TVF) Room 4		Close to tunnels (assumed 1 TVS Fans per room) (Northern End)	Direct to service corridor and track	refer RDS
605A	Tunnel Exhaust Fan (TEF) Room 1		Close to tunnels (assumed 5 TEFs Fans per room at one end) (Southern End)	Direct to service corridor and track	refer RDS
-	Overtrack Exhaust (OTE) Duct			Along each track	8
-	Under Platform Exhaust (UPE) duct			Along each track	4
-	Draught Relief Shaft		One at each end of platform (total = 2 nos) and close to TVF Fan Room	Connect to Up-track and Down-track Tunnels	20
613A	TVS Air Compressor and Receiver Room 1		Adjacent to TEF/TSF and TVS Fan Rooms (Southern End)	Connection service corridor	28
613B	TVS Air Compressor and Receiver Room 2		Adjacent to TEF/TSF and TVS Fan Rooms (Northern End)	Connection service corridor	28
614A	Trackside LV switch room 1		Each end of platform (North)	Connection service corridor	12
614B	Trackside LV switch room 2		Each end of platform (South)	Connection service corridor	12
7C1	Fire Brigade Booster - Tunnel Hydrants		Surface level accessible	Adjacent to fire pump room where possible	2
702	Trackside FS Pump Room 1		Surface level accessible	Next to Fire Water Storage Tank room and at same station end of Fire Control Room	36
704	Fire Control Room	Yes	Ground/ Street level		12
705	Fire Water Storage Tank Room			Next to Fire Pump Room	25
802	Primary Tunnel Water Sump		Southern End of Platform		refer RDS
802S	Primary Tunnel Water Sump Subfloor		Southern End of Platform		refer RDS
803	Secondary Tunnel Water Sump		Northern End of Platform		refer RDS
803S	Secondary Tunnel Water Sump Subfloor		Northern End of Platform		refer RDS
1002A	Staff Locker Room 1 (Male / Female)		Adjacent to multi-purpose room		8
1002B	Staff Locker Room 2(Male / Female)		Adjacent to multi-purpose room		8
1003	Multipurpose Room		Adjacent to locker room within concourse		15
1003A	Refuse Room		Street / Ground Level with direct access to a lift		11
1004B	Bin Room		Concourse back of house area. Accessible to Refuse room and Platforms via lift		5
1005A	Chemical Store Room 1				10
1006	Platform Cleaning Machine Room		Platform adjacent to cleaner store room with direct access to a lift	3m circulation required externally at the door required for machine turning	12
1006A	Presentation Store Room			Adjacent to cleaner store room	10
1007A	Cleaners store 1			Adjacent to toilets	10
1007B	Cleaners store 2			Adjacent to toilets	10
1008A	Station Staff (Concourse W.C 1)		Concourse within the back of house area	Adjacent to staff locker room	7
1008B	Station Staff (Concourse W.C 2)		Concourse within the back of house area	Adjacent to staff locker room	7
1009	Station Control Room	Yes	Quick access from Sydney Metro areas		55
1016	Store Room		Connection within the back of house areas		20
1017A	Maintenance office		Concourse within the back of house area. Adjacent to maintenance store room.		12
1017E	Maintenance store room		Connection within the back of house areas. Adjacent to maintenance office		5
1025	Emergency track trolley room		Back of house platform		15
1030	Cable Termination Room 1		One at each platform end. One of the CTR be directly under the TER	Direct to service corridor	6
1031	Cable Termination Room 2		One at each platform end	Direct to service corridor	6
HWU1	Headwall Unit 1				refer RDS
HWU2	Headwall Unit 2				refer RDS
TWU1	Tailwall Unit 1				refer RDS
TWU2	Tailwall Unit 2				refer RDS
	Communications Cupboard 1		Platform	Under platform escalator 1	2
	Communications Cupboard 2		Platform	Under platform escalator 2	2

Central Station Main Works: SWTC Appendix F1 - Metro Station Works - Room Schedule

Room No.	Room Name	Critical Equipment Rooms(*)	Location	Connectivity and Adjacency	Minimum Area (m2)
	Communications Cupboard 3		Concourse	within 80m (cable containment length) of communication field equipment	2
	Communications Cupboard 4		Concourse	within 80m (cable containment length) of communication field equipment	2
	Communications Cupboard 5		Concourse	within 80m (cable containment length) of communication field equipment	2
	Communications Cupboard 6		Concourse	within 80m (cable containment length) of communication field equipment	2
402A	LV MAIN SWITCH ROOM (415V DBs)				
402B	LV MAIN SWITCH ROOM (415V DBs)				
402C	LV MAIN SWITCH ROOM (415V DBs)				
402D	LV MAIN SWITCH ROOM (415V DBs)				
500A	FIRE STAIRCASE PRESSURISATION PLANT ROOM				
500B	FIRE STAIRCASE PRESSURISATION PLANT ROOM				
503	WATERCOOLED VRV PLANT ROOM				
504C	COOLING TOWER WATER PUMPS AND TANKS				
505	SIGNALLING/TELECOMS CRITICAL COOLING SYSTEMS PLANT ROOM #1	Yes			
505	SIGNALLING/TELECOMS CRITICAL COOLING SYSTEMS PLANT ROOM #1	Yes			
506A	SIGNALLING/TELECOMS CRITICAL COOLING SYSTEMS PLANT ROOM #2	Yes			
506B	EQUIPMENT COOLING SYSTEMS PLANT ROOM				
506C	EQUIPMENT COOLING SYSTEMS PLANT ROOM				
507AA	PLANTROOM SUPPLY VENTILATION FAN ROOM				
507AB	PLANTROOM SUPPLY VENTILATION FAN ROOM				
507BA	PLANTROOM EXHAUST VENTILATION FAN ROOM				
507BB	PLANTROOM EXHAUST VENTILATION FAN ROOM				
507CA	AHU OUTSIDE AIR FAN ROOM				
507CB	AHU OUTSIDE AIR FAN ROOM				
508	E&M SYSTEMS MCC AND CONTROL EQUIPMENT ROOM #1				
509A	E&M SYSTEMS MCC AND CONTROL EQUIPMENT ROOM #2				
700A	GAS SUPPRESSION EQUIPMENT ROOM				
701	FIRE BRIGADE BOOSTER - TUNNEL HYDRANTS				
702A	FIRE PUMP ROOM #1				
705	FIRE WATER STORAGE TANK ROOM				
706A	EMERGENCY TROLLEY STORE				
706B	EMERGENCY TROLLEY STORE				
801	WATER TREATMENT PLANT ROOM				
802	PRIMARY GROUND WATER/TUNNEL WATER SUMP				
803	SECONDARY GROUND WATER/TUNNEL WATER SUMP				
804A	SEWAGE EJECTOR PUMP ROOM				
808B	HOT WATER PLANT				
10F1	POSTER CASES - INWARD JOURNEY PLANNING				

Notes:

RDS means Metro Station room data sheets

(*) The following are the minimum quantity and number of Critical Equipment Rooms. All other rooms and locations are subject to the definition of Critical Equipment Rooms (Refer to SWTC Appendix A1)

CSM SWTC Appendix F2: Central Station Room Schedule

Room Number	Existing ST door number	Room Name	No. of rooms	Floor Useable Area (per room)	Access Provisions	Area Affinity	Notes
				Minimum (m ²)			
F704		FIRE CONTROL ROOM (existing)	1	0	single door	existing fire control room located at Eddie Avenue entrance way.	This Fire control room at Central is shared between Sydney trains and Sydney Metro systems
707		METRO CBD INCIDENT CONTROL ROOM	1	12			Combine with Fire Control Room
F1301		MEWP STORE	1	12	Double doors, 1.5m clear.	At concourse level with direct access to lift.	3m circulation required externally at the door to allow machine turning.
F1006		BIN ROOM	1	5	Double doors, 1.5m clear.	At new Eastern Entrance, accessed from paid concourse.	
F1007		CHEMICAL STORE ROOM	1	9	Single door in stand-alone room or in lockable enclosure if in cleaners' room	At new Eastern Entrance, accessed from paid concourse.	Combine with Cleaner's store above.
F1008		CLEANING MACHINE ROOM	1	12	Double doors, 1.5m clear.	At new Eastern Entrance, near cleaners store, adjacent to cleaners store with direct access to lift, or on platform level.	3m circulation required externally at the door to allow machine turning.
F1009		CLEANERS STORE ROOM	1	10	Single door 1m clear	At new Eastern Entrance, adjacent to chemical store.	
F1011		STATION STAFF W.C (Accessible & Unisex)	1	7	Single accessible door	At new Eastern Entrance, remote from main staff facilities.	Accessible unisex facility. Potential to include accessible shower.
14		STATION STORE ROOM	4	20	Double doors, 1.5m clear.	At new Eastern Entrance	
F1015		MAINTENANCE OFFICE - CUSTOMER SERVICE REP.	2	12	Single accessible door	At new Eastern Entrance and North Concourse.	
F1016		MAINTENANCE STORE ROOM	1	5	Single accessible door	Adjacent to maintenance office.	
F1302	ESR-30	MULTI-PURPOSE MEETING ROOM	1	47	Single accessible door	ESR Concourse	Must be in place prior to demolition of existing ESR meeting rooms.
F1303		MULTI-PURPOSE ROOM	1	40	Single accessible door	North-South Concourse	
F1304	P16-02 P16-03 P16-04 P16RS-01	PLATFORM 16/17 STAND-BY GUARD ROOM	1	12	Single accessible door	Southern end of Platform 16/17	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1305	P18-02 P18-03 P18-04 P18RS-01	PLATFORM 18/19 STAND-BY GUARD ROOM	1	12	Single accessible door	Northern end of Platform 18/19	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1306	P20-02 P20-03 P20-04 P20RS-01	PLATFORM 20/21 STAND-BY GUARD ROOM	1	12	Single accessible door	Southern end of Platform 20/21	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1307	P22-02 P22-03 P22-04 P22RS-01	PLATFORM 22/23 STAND-BY GUARD ROOM	1	12	Single accessible door	Northern end of Platform 22/23	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1308	-	REMOTE STAND-BY GUARD ROOM	1	TBD	Single accessible door	Within 120 seconds walking distance to all Suburban platform Stand-by Guard Rooms.	Remote facility to suit 9 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
1103		MALE PUBLIC WC	2	3	Single accessible door	North-South Concourse - ideally grouped by sex.	Individual ambulant male WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
1103		MALE PUBLIC WC	2	3	Single accessible door	At new Eastern Entrance, in the paid concourse - ideally grouped by sex.	Individual ambulant male WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
1104		FEMALE PUBLIC WC	2	3	Single accessible door	North-South Concourse - ideally grouped by sex.	Individual ambulant female WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
F1104		FEMALE PUBLIC WC	2	3	Single accessible door	At new Eastern Entrance, in the paid concourse - ideally grouped.	Individual ambulant female WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
1105		ACCESSIBLE PUBLIC WC	2	6	Single accessible door	North-South Concourse - ideally grouped by sex.	Separate accessible male and female facilities. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy
F1105		ACCESSIBLE PUBLIC WC	2	6	Single accessible door	At new Eastern Entrances, in the paid concourse - ideally grouped.	Separate accessible male and female facilities. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy
1106		PARENTING ROOM	1	8	Single accessible door	North-South Concourse - ideally grouped by sex.	to include WC, chair and baby change facilities.
F1106		PARENTING ROOM	1	8	Single accessible door	At new Eastern Entrance, in the paid concourse - adjacent to public WC.	to include WC, chair and baby change facilities.

CSM SWTC Appendix F2: Central Station Room Schedule

Room Number	Existing ST door number	Room Name	No. of rooms	Floor Useable Area (per room)	Access Provisions	Area Affinity	Notes
				Minimum (m ²)	Doorways/Corridors/Cable Entries etc	location constraint	
11F4		VENDING MACHINES				Paid concourse area	x2 per paid concourse visible from main flow
12F1		SECURED BICYCLE PARKING				Within secure shelter	
F808		HOT WATER PLANT			double door, 1.5m corridor to lift	At new Eastern Entrance, central to all amenity and public toilet areas.	Not a 'boiler' as defined by the BCA
7C2		FIRE BRIGADE BOOSTER - STATION HYDRANTS AND SPRINKLERS				Surface level accessible outside of station from fire tender. Next to water meter cupboard and water main connection. Minimum 10m from substation/electrical room.	Adjacent to fire pump room where possible.
F7C4		FIRE HYDRANT AND HOSEREEL CUPBOARD			number of cupboards are indicative only, dependent on system design	See Services Cupboard location map	multiple locations and qty's in stations and buildings. Distance between Hydrants are separated no further apart than 60m horizontally
F7C5		FIRE DETECTION EQUIPMENT CABINET			number of cupboards are indicative only, dependent on system design	located at end of the East concourse entrance area, located in the wall, 2000mm high	To locate new FIP specified for Sydney Train Enabling Work
-		New ST room to be added "EASTERN HYDRANT AND SPRINKLER ZONE PUMP ROOM"			Preferably loured face. Level access for fuel replacement and maintenance.		Diesel fired fire pump exhaust to outside. Diesel storage tank. Accommodates hydrant and sprinkler pumps. Services Eastern zone station hydrant and sprinklers.
F4C1		ELECTRICAL DISTRIBUTION CUPBOARDS EDB'S			Accessible from standing position without use of ladders, mounted on or recessed in walls	Located within concourses and station entrances, as required.	Contain local distribution switch boards, number of boards dependent on design requirements
F400		HV SWITCHGEAR ROOM (11KV)			Double door for equipment entry, single door for egress to adjacent room or exit. Equipment installation corridor to access hatch (2m W x 3 m H)	4 off at Ghost platform/mezzanine level of ESR box (2 off for CSS refurbishment 2 off for new CES).	Fired rating between each half of substation must be maintained, fire rating not required between rooms within the same half but would minimise equipment damage in case of fire. Min 0.6m perimeter around equipment. Cable basement required for incoming and outgoing cables, 2.1m high, in addition to noted room height. Room Layout General Arrangement shown in NWRLSRT-PBA-SCS-ED-DWG-338225
F401		11kV TRANSFORMER ROOM (11KV/415V)			5 tonne TX. Double door for equipment entry, single door for egress to adjacent room or exit. Equipment installation corridor to access hatch (2m W x 2.4m H)	4 off at Ghost platform/mezzanine level of ESR box (2 off for CSS refurbishment 2 off for new CES).	Fired rating between each half of substation must be maintained, fire rating not required between rooms within the same half but would minimise equipment damage in case of fire. Min 0.6m perimeter around equipment. Cable basement required for incoming and outgoing cables, 2.1m high, in addition to noted room height. Room Layout General Arrangement shown in NWRLSRT-PBA-SCS-ED-DWG-338225
F402		LV MAIN SWITCH ROOM (415V MSB)			Double door for equipment entry, single door for egress to adjacent room or exit. Equipment installation corridor to access hatch (2m W x 2.4m H)	4 off at Ghost platform/mezzanine level of ESR box (2 off for CSS refurbishment 2 off for new CES).	Fired rating between each half of substation must be maintained, fire rating not required between rooms within the same half but would minimise equipment damage in case of fire. Min 0.6m perimeter around equipment. Cable basement required for incoming and outgoing cables, 2.1m high, in addition to noted room height. Room Layout General Arrangement shown in NWRLSRT-PBA-SCS-ED-DWG-338225
F507		CONCOURSE VENTILATION FAN ROOM			double doors for access and egress from the corridor, and access hatch for plant replacement.	Concourse level	
F700		GAS SUPPRESSION EQUIPMENT ROOM			Lift/level access to room for bottle replacement/servicing	In vicinity of critical systems equipment rooms - No more than 150m of piping length to Electrical rooms & relocated comms rooms on Eastern Concourse	Number of rooms subject to the serviced room distribution and number.
F2C1	-	SYDNEY TRAINS STATION SYSTEMS COMMUNICATIONS CUPBOARD			1 off double door leaf 2000 mm x 2100 mm high,	Various locations on the East Concourse and Eastern entry	Room/cupboard spacing is determined by maximum Ethernet cabling length to devices. Needs in-floor cable access to gateline
F2C7	-	THIRD PARTY TELECOMS CUPBOARD			1 off double door leaf 2000 mm x 2100 mm high	Eastern gateline	Room/cupboard spacing is determined by maximum Ethernet cabling length to devices
F200		CONCOURSE TELECOMMUNICATIONS ROOM (Sydney trains asset located in North-South concourse)			1 off single door leaf 920 mm x 2040 mm high	On North-South concourse	Room/cupboard spacing is determined by maximum Ethernet cabling length to devices
F201	ESR-65	COMMUNICATIONS EQUIPMENT ROOM CENA 5			As per existing room, unless newer standards dictate greater access provisions.	Sydney Trains want this room on ESR Concourse	reinstate existing Sydney train equipment room, room size to be 50% greater in floor area and access provisions to be the same
F202	ESR-69	COMMUNICATIONS EQUIPMENT ROOM CENA 2			As per existing room, unless newer standards dictate greater access provisions.	Sydney Trains want this room on ESR Concourse	Existing room to increase from 16m2 to 26m2 to accommodate a planned mobile phone capacity and speed upgrade.
F813a		SOUTHERN Y TUNNEL SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813c		OLYMPIC TUNNEL EAST SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813d		OLYMPIC TUNNEL WEST SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813e		STORMWATER REUSE PUMP UPGRADES - for toilet flushing of new concourse toilets (only if stormwater is available and suitable)			Ability to maintain and replace pumps is required, 1.5m corridor.		

CSM SWTC Appendix F2: Central Station Room Schedule

Room Number	Existing ST door number	Room Name	Floor Useable Area (per room)		Access Provisions	Area Affinity	Notes
			No. of rooms	Minimum (m ²)			
F813f		RAINWATER HARVESTING TANK EMPTYING PUMPS (possible improvement of stormwater harvesting tank operations)			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813g		EASTERN ENTRANCE SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F901		VERTICAL TRANSPORTATION; PASSENGER LIFTS			self contained	Various locations ;See vertical transportation location table tab	number and size dependent on architecture, refer indicative drawing, width across door face
F902		VERTICAL TRANSPORTATION; ESCALATORS			self contained	Various Locations; See vertical transportation location table tab	number and size dependent on architecture, refer indicative drawing
1100		UNPAID CONCOURSE (indicative only varies for each station)			Accessible by vertical transportation, lifts and escalators from station entry level	station entrances, ticket gate line	Floor areas as per architectural allowances and pedestrian modelling requirements
1101		PAID CONCOURSE (indicative only varies for each station)			Accessible by vertical transportation, lifts and escalators from station entry level	ticket gate line and platforms	Floor areas as per architectural allowances and pedestrian modelling requirements
12F2		SHELTERED BICYCLE PARKING HOOPS				Under shelter at street level, within 50m of gateline	Located adjacent to the Chalmers Street Entrance.
12F3		BICYCLE PARKING HOOPS				At street level, within 50m of gateline	Located adjacent to the Chalmers Street Entrance.
12F4		CUSTOMER ASSISTANCE (HELP) POINTS			number of help points are indicative only, subject to area affinity and ASA requirements	Either side of gate line, at lifts and visible on arrival to platform	located out of flow, number of help points are indicative only, subject to area affinity requirements
F12F5		DIGITAL WAYFINDING SCREENS				Operator requirement	x2 per paid concourse
1300		UNPAID CONCOURSE RETAIL OPPORTUNITY				Unpaid concourse - ideally at street	the equivalent size of 2 x ATM's per entrance - could be ATM, phone, Click and Shop - utility space
1301		RETAIL OPPORTUNITY				Unpaid concourse - ideally at street	Unpaid retail the equivalent size of x2 ATM's per entrance. Could be ATM, phone, Click and Shop - utility space
1302		RETAIL TO BE ASSESSED STATION BY STATION				Primary access from the street	

CSM SWTC Appendix F2: Central Station Room Schedule

Room Number	Existing ST door number	Room Name	No. of rooms	Floor Useable Area (per room)	Access Provisions	Area Affinity	Notes
				Minimum (m ²)			
F704		FIRE CONTROL ROOM (existing)	1	0	single door	existing fire control room located at Eddie Avenue entrance way.	This Fire control room at Central is shared between Sydney trains and Sydney Metro systems
707		METRO CBD INCIDENT CONTROL ROOM	1	12			Combine with Fire Control Room
F1301		MEWP STORE	1	12	Double doors, 1.5m clear.	At concourse level with direct access to lift.	3m circulation required externally at the door to allow machine turning.
F1006		BIN ROOM	1	5	Double doors, 1.5m clear.	At new Eastern Entrance, accessed from paid concourse.	
F1007		CHEMICAL STORE ROOM	1	9	Single door in stand-alone room or in lockable enclosure if in cleaners' room	At new Eastern Entrance, accessed from paid concourse.	Combine with Cleaner's store above.
F1008		CLEANING MACHINE ROOM	1	12	Double doors, 1.5m clear.	At new Eastern Entrance, near cleaners store, adjacent to cleaners store with direct access to lift, or on platform level.	3m circulation required externally at the door to allow machine turning.
F1009		CLEANERS STORE ROOM	1	10	Single door 1m clear	At new Eastern Entrance, adjacent to chemical store.	
F1011		STATION STAFF W.C (Accessible & Unisex)	1	7	Single accessible door	At new Eastern Entrance, remote from main staff facilities.	Accessible unisex facility. Potential to include accessible shower.
14		STATION STORE ROOM	4	20	Double doors, 1.5m clear.	At new Eastern Entrance	
F1015		MAINTENANCE OFFICE - CUSTOMER SERVICE REP.	2	12	Single accessible door	At new Eastern Entrance and North Concourse.	
F1016		MAINTENANCE STORE ROOM	1	5	Single accessible door	Adjacent to maintenance office.	
F1302	ESR-30	MULTI-PURPOSE MEETING ROOM	1	47	Single accessible door	ESR Concourse	Must be in place prior to demolition of existing ESR meeting rooms.
F1303		MULTI-PURPOSE ROOM	1	40	Single accessible door	North-South Concourse	
F1304	P16-02 P16-03 P16-04 P16RS-01	PLATFORM 16/17 STAND-BY GUARD ROOM	1	12	Single accessible door	Southern end of Platform 16/17	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1305	P18-02 P18-03 P18-04 P18RS-01	PLATFORM 18/19 STAND-BY GUARD ROOM	1	12	Single accessible door	Northern end of Platform 18/19	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1306	P20-02 P20-03 P20-04 P20RS-01	PLATFORM 20/21 STAND-BY GUARD ROOM	1	12	Single accessible door	Southern end of Platform 20/21	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1307	P22-02 P22-03 P22-04 P22RS-01	PLATFORM 22/23 STAND-BY GUARD ROOM	1	12	Single accessible door	Northern end of Platform 22/23	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1308	-	REMOTE STAND-BY GUARD ROOM	1	TBD	Single accessible door	Within 120 seconds walking distance to all Suburban platform Stand-by Guard Rooms.	Remote facility to suit 9 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
1103		MALE PUBLIC WC	2	3	Single accessible door	North-South Concourse - ideally grouped by sex.	Individual ambulant male WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
1103		MALE PUBLIC WC	2	3	Single accessible door	At new Eastern Entrance, in the paid concourse - ideally grouped by sex.	Individual ambulant male WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
1104		FEMALE PUBLIC WC	2	3	Single accessible door	North-South Concourse - ideally grouped by sex.	Individual ambulant female WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
F1104		FEMALE PUBLIC WC	2	3	Single accessible door	At new Eastern Entrance, in the paid concourse - ideally grouped.	Individual ambulant female WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
1105		ACCESSIBLE PUBLIC WC	2	6	Single accessible door	North-South Concourse - ideally grouped by sex.	Separate accessible male and female facilities. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy
F1105		ACCESSIBLE PUBLIC WC	2	6	Single accessible door	At new Eastern Entrances, in the paid concourse - ideally grouped.	Separate accessible male and female facilities. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy
1106		PARENTING ROOM	1	8	Single accessible door	North-South Concourse - ideally grouped by sex.	to include WC, chair and baby change facilities.
F1106		PARENTING ROOM	1	8	Single accessible door	At new Eastern Entrance, in the paid concourse - adjacent to public WC.	to include WC, chair and baby change facilities.

CSM SWTC Appendix F2: Central Station Room Schedule

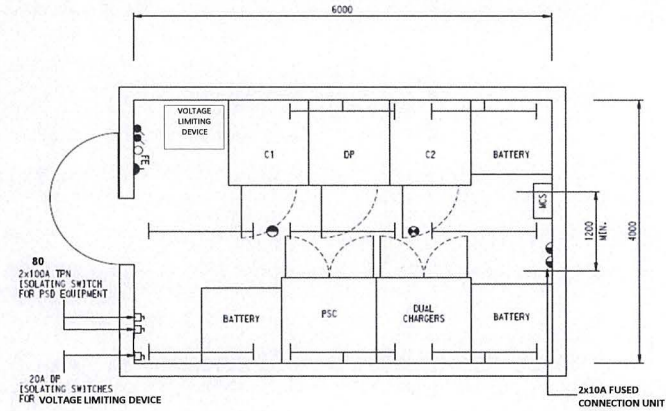
Room Number	Existing ST door number	Room Name	No. of rooms	Floor Useable Area (per room)	Access Provisions	Area Affinity	Notes
				Minimum (m ²)	Doorways/Corridors/Cable Entries etc	location constraint	
11F4		VENDING MACHINES				Paid concourse area	x2 per paid concourse visible from main flow
12F1		SECURED BICYCLE PARKING				Within secure shelter	
F808		HOT WATER PLANT			double door, 1.5m corridor to lift	At new Eastern Entrance, central to all amenity and public toilet areas.	Not a 'boiler' as defined by the BCA
7C2		FIRE BRIGADE BOOSTER - STATION HYDRANTS AND SPRINKLERS				Surface level accessible outside of station from fire tender. Next to water meter cupboard and water main connection. Minimum 10m from substation/electrical room.	Adjacent to fire pump room where possible.
F7C4		FIRE HYDRANT AND HOSEREEL CUPBOARD			number of cupboards are indicative only, dependent on system design	See Services Cupboard location map	multiple locations and qty's in stations and buildings. Distance between Hydrants are separated no further apart than 60m horizontally
F7C5		FIRE DETECTION EQUIPMENT CABINET			number of cupboards are indicative only, dependent on system design	located at end of the East concourse entrance area, located in the wall, 2000mm high	To locate new FIP specified for Sydney Train Enabling Work
		New ST room to be added "EASTERN HYDRANT AND SPRINKLER ZONE PUMP ROOM"			Preferably louvred face. Level access for fuel replacement and maintenance.		Diesel fired fire pump exhaust to outside. Diesel storage tank. Accommodates hydrant and sprinkler pumps. Services Eastern zone station hydrant and sprinklers.
F4C1		ELECTRICAL DISTRIBUTION CUPBOARDS EDB'S			Accessible from standing position without use of ladders, mounted on or recessed in walls	Located within concourses and station entrances, as required.	Contain local distribution switch boards, number of boards dependent on design requirements
F400		HV SWITCHGEAR ROOM (11kV)			Double door for equipment entry, single door for egress to adjacent room or exit. Equipment installation corridor to access hatch (2m W x 3 m H)	4 off at Ghost platform/mezzanine level of ESR box (2 off for CSS refurbishment 2 off for new CES)	Fired rating between each half of substation must be maintained, fire rating not required between rooms within the same half but would minimise equipment damage in case of fire. Min 0.6m perimeter around equipment. Cable basement required for incoming and outgoing cables, 2.1m high, in addition to noted room height. Room Layout General Arrangement shown in NWRLSRT-PBA-SCS-ED-DWG-338225
F401		11kV TRANSFORMER ROOM (11kV/415V)			5 tonne TX. Double door for equipment entry, single door for egress to adjacent room or exit. Equipment installation corridor to access hatch (2m W x 2.4m H)	4 off at Ghost platform/mezzanine level of ESR box (2 off for CSS refurbishment 2 off for new CES)	Fired rating between each half of substation must be maintained, fire rating not required between rooms within the same half but would minimise equipment damage in case of fire. Min 0.6m perimeter around equipment. Cable basement required for incoming and outgoing cables, 2.1m high, in addition to noted room height. Room Layout General Arrangement shown in NWRLSRT-PBA-SCS-ED-DWG-338225
F402		LV MAIN SWITCH ROOM (415V MSB)			Double door for equipment entry, single door for egress to adjacent room or exit. Equipment installation corridor to access hatch (2m W x 2.4m H)	4 off at Ghost platform/mezzanine level of ESR box (2 off for CSS refurbishment 2 off for new CES)	Fired rating between each half of substation must be maintained, fire rating not required between rooms within the same half but would minimise equipment damage in case of fire. Min 0.6m perimeter around equipment. Cable basement required for incoming and outgoing cables, 2.1m high, in addition to noted room height. Room Layout General Arrangement shown in NWRLSRT-PBA-SCS-ED-DWG-338225
F507		CONCOURSE VENTILATION FAN ROOM			double doors for access and egress from the corridor, and access hatch for plant replacement.	Concourse level	
F700		GAS SUPPRESSION EQUIPMENT ROOM			Lift/level access to room for bottle replacement/servicing	In vicinity of critical systems equipment rooms - No more than 150m of piping length to Electrical rooms & relocated comms rooms on Eastern Concourse	Number of rooms subject to the serviced room distribution and number.
F2C1	-	SYDNEY TRAINS STATION SYSTEMS COMMUNICATIONS CUPBOARD			1 off double door leaf 2000 mm x 2100 mm high,	Various locations on the East Concourse and Eastern entry	Room/cupboard spacing is determined by maximum Ethernet cabling length to devices. Needs in-floor cable access to gateline
F2C7	-	THIRD PARTY TELECOMS CUPBOARD			1 off double door leaf 2000 mm x 2100 mm high	Eastern gateline	Room/cupboard spacing is determined by maximum Ethernet cabling length to devices
F200		CONCOURSE TELECOMMUNICATIONS ROOM (Sydney trains asset located in North-South concourse)			1 off single door leaf 920 mm x 2040 mm high	On North-South concourse	Room/cupboard spacing is determined by maximum Ethernet cabling length to devices
F201	ESR-65	COMMUNICATIONS EQUIPMENT ROOM CENA 5			As per existing room, unless newer standards dictate greater access provisions.	Sydney Trains want this room on ESR Concourse	reinstate existing Sydney train equipment room, room size to be 50% greater in floor area and access provisions to be the same
F202	ESR-69	COMMUNICATIONS EQUIPMENT ROOM CENA 2			As per existing room, unless newer standards dictate greater access provisions.	Sydney Trains want this room on ESR Concourse	Existing room to increase from 16m2 to 26m2 to accommodate a planned mobile phone capacity and speed upgrade.
F813a		SOUTHERN Y TUNNEL SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813c		OLYMPIC TUNNEL EAST SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813d		OLYMPIC TUNNEL WEST SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813e		STORMWATER REUSE PUMP UPGRADES - for toilet flushing of new concourse toilets (only if stormwater is available and suitable)			Ability to maintain and replace pumps is required, 1.5m corridor.		

CSM SWTC Appendix F2: Central Station Room Schedule

Room Number	Existing ST door number	Room Name	Floor Useable Area (per room)		Access Provisions Doorways/Corridors/Cable Entries etc	Area Affinity location constraint	Notes
			No. of rooms	Minimum (m ²)			
F813f		RAINWATER HARVESTING TANK EMPTYING PUMPS (possible improvement of stormwater harvesting tank operations)			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813g		EASTERN ENTRANCE SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F901		VERTICAL TRANSPORTATION; PASSENGER LIFTS			self contained	Various locations ; See vertical transportation location table tab	number and size dependent on architecture, refer indicative drawing, width across door face
F902		VERTICAL TRANSPORTATION; ESCALATORS			self contained	Various Locations; See vertical transportation location table tab	number and size dependent on architecture, refer indicative drawing
1100		UNPAID CONCOURSE (indicative only varies for each station)			Accessible by vertical transportation, lifts and escalators from station entry level	station entrances, ticket gate line	Floor areas as per architectural allowances and pedestrian modelling requirements
1101		PAID CONCOURSE (indicative only varies for each station)			Accessible by vertical transportation, lifts and escalators from station entry level	ticket gate line and platforms	Floor areas as per architectural allowances and pedestrian modelling requirements
12F2		SHELTERED BICYCLE PARKING HOOPS				Under shelter at street level, within 50m of gateline	Located adjacent to the Chalmers Street Entrance.
12F3		BICYCLE PARKING HOOPS				At street level, within 50m of gateline	Located adjacent to the Chalmers Street Entrance.
F12F4		CUSTOMER ASSISTANCE (HELP) POINTS			number of help points are indicative only, subject to area affinity and ASA requirements	Either side of gate line, at lifts and visible on arrival to platform	located out of flow, number of help points are indicative only, subject to area affinity requirements
F12F5		DIGITAL WAYFINDING SCREENS				Operator requirement	x2 per paid concourse
1300		UNPAID CONCOURSE RETAIL OPPORTUNITY				Unpaid concourse - ideally at street	the equivalent size of 2 x ATM's per entrance - could be ATM, phone, Click and Shop - utility space
1301		RETAIL OPPORTUNITY				Unpaid concourse - ideally at street	Unpaid retail the equivalent size of x2 ATM's per entrance. Could be ATM, phone, Click and Shop - utility space
1302		RETAIL TO BE ASSESSED STATION BY STATION				Primary access from the street	

ROOM DATA SHEET				
ROOM NAME		PSD EQUIPMENT ROOM		
ROOM NUMBER (To be Adopted)		100B		
FUNCTIONAL REQUIREMENTS				
FUNCTION		TO HOUSE PSD/PEB EQUIPMENTS		
SIZE / DIMENSION		Minimum 6m x 4m x 3.5m		
LOCATION		PLATFORM LEVEL		
CONNECTION		DIRECT TO SERVICE PLATFORM		
MATERIALS & FINISHES				
FLOOR		Epoxy Floor Coating on Granolithic		WATER TIGHTNESS*
SKIRTING		Epoxy Floor Coating on Granolithic		N/A
WALL		Epoxy Paint on Fair Faced Concrete or Blockwork		The complete absence of any leakage, seepage and damp patches.
CEILING		Fair Faced Concrete		
OTHERS				
DOORS & IRONMONGERY				
DOOR TYPE		SET 1	SET 2	
CLEAR OPENING REQUIRED		2100mm (H) x 1200 mm (W)		
DIRECTION OF SWING		SWING OUT AT 180°		
FIRE RESISTANCE		SAME AS FRP AS THE ENCLOSURE		
AIR RESISTANCE		N/A		
STC RATING		20		
LOCK FUNCTION		EACS		
ACCESSORIES		KICK PLATES		
EACS/SECURITY LEVEL		HIGH: Fail safe electric lock; latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader unit Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1		
OTHERS				
BUILDING SERVICES				
DELIVERY ROUTE SIZE		1.5 m (W) x 2.2m (H)		
RM. NOISE LEVEL		NR80		
COMMUNICATIONS FACILITIES				
		RADIO COVERAGE RJ45 socket (digital phone) Qty 1 PABX analogue phones Qty 1 Direct Line Phones Qty 1		
ECS		Ventilation (from Essential Power Supply);-Ventilation rate of 5l/s/m2 ; Max Temperature of ambient +5°C ; 2 duty fans each min 60% of design flow		
LIGHTING		1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting		
		DIFFUSER		
		LUX		
		IP		
FIRE PROTECTION		DETECTION Smoke Detection/Heat Detection SUPPRESSION Gas suppression EXTINGUISHER Yes SEPARATION Yes SMOKE EXTRACT NIL OTHERS --		
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
		2	WALL	Twin 10A, 230V
		CONDUIT TYPE EXPOSED		
		- TWO 80A TPN ISOLATING SWITCH (ONE FROM ESSENTIAL POWER SUPPLY AND ONE FROM CENTRALISED UPS) - TWO 10A FUSED CONNECTION UNITS FOR CCS, - EARTHING TERMINAL - ONE 20A DP ISOLATING SWITCH FROM ESSENTIAL POWER SUPPLY (FOR VOLTAGE LIMITING DEVICE) - 2 x 10A Fused Connection Units from UPS Supply (for PCS) - double power point = 1 number		
PLUMBING & DRAINAGE		NIL		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		NIL		
OTHERS		NIL		
OTHERS		-All building services requirement above are indicative only. Contractor to ensure statutory compliance.		

Typical Layout



NOTE:

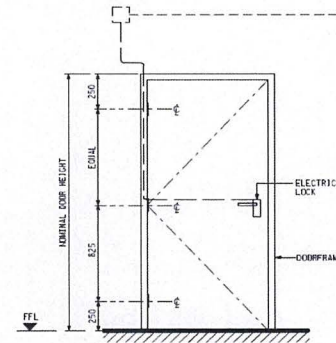
1. BUILDING SERVICES INSTALLED DIRECTLY ABOVE THE PANELS SHOULD BE AVOIDED AS FAR AS POSSIBLE.

PLAN

LEGEND :

C1-DP-C2 POWER SUPPLY CABINETS
PSC PSD CONTROL PANEL

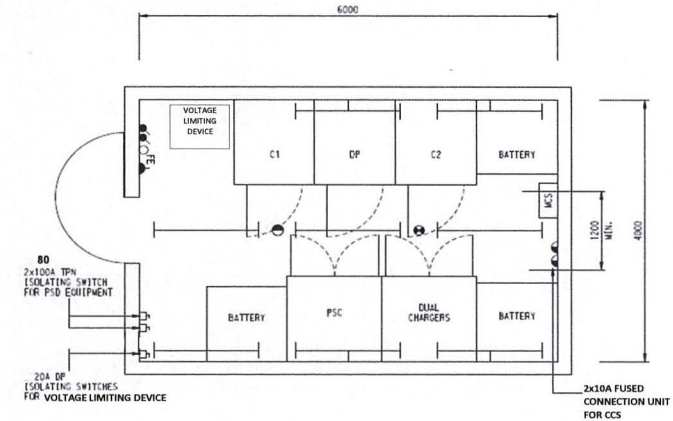
DOOR



TYPE 05

ROOM DATA SHEET			
ROOM NAME		PSD EQUIPMENT ROOM	
ROOM NUMBER (To be Adopted)		100B	
FUNCTIONAL REQUIREMENTS			
FUNCTION		TO HOUSE PSD/PFB EQUIPMENTS	
SIZE / DIMENSION		Minimum 6m x 4m x 3.5m	
LOCATION		PLATFORM LEVEL	
CONNECTION		DIRECT TO SERVICE PLATFORM	
MATERIALS & FINISHES		WATER TIGHTNESS*	
FLOOR	Epoxy Floor Coating on Granolithic	N/A	
SKIRTING	Epoxy Floor Coating on Granolithic	The complete absence of any leakage, seepage and damp patches.	
WALL	Epoxy Paint on Fair Faced Concrete or Blockwork		
CEILING	Fair Faced Concrete		
DOORS & IRONMONGERY		SET 1	SET 2
DOOR TYPE	5		
CLEAR OPENING REQUIRED	2100mm (H) x 1200 mm (W)		
DIRECTION OF SWING	SWING OUT AT 180°		
FIRE RESISTANCE	SAME AS FRP AS THE ENCLOSURE		
AIR RESISTANCE	N/A		
STC RATING	20		
LOCK FUNCTION	EACS		
ACCESSORIES	KICK PLATES		
EACS/SECURITY LEVEL		HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader unit Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1	
BUILDING SERVICES			
DELIVERY ROUTE SIZE		1.5 m (W) x 2.2m (H)	
RM. NOISE LEVEL		NR80	
COMMUNICATIONS FACILITIES			
RADIO COVERAGE RJ45 socket (digital phone) Qty 1 PABX analogue phones Qty 1 Direct Line Phones Qty 1			
Ventilation (from Essential Power Supply):-Ventilation rate of 5l/s/m ² ; Max Temperature of ambient +5°C; 2 duty fans each min 60% of design flow			
ECS		1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting	
LIGHTING	TYPE	--	
	DIFFUSER	--	
	LUX	Essential: 300; Emergency: 10	
FIRE PROTECTION	DETECTION	Smoke Detection/Heat Detection	
	SUPPRESSION	Gas suppression	
	EXTINGUISHER	Yes	
	SEPARATION	Yes	
	SMOKE EXTRACT	NIL	
ELECTRICAL/ POWER REQUIREMENTS	GENERAL SOCKET	NUMBER	LOCATION
	SPECIFIC EQUIPMENT	2	WALL
		SOCKET TYPE	Twin 10A, 230V
		CONDUIT TYPE	EXPOSED
		- TWO 80A TPN ISOLATING SWITCH (ONE FROM ESSENTIAL POWER SUPPLY AND ONE FROM CENTRALISED UPS) - TWO 10A FUSED CONNECTION UNITS FOR CCS, - EARTHING TERMINAL - ONE 20A DP ISOLATING SWITCH FROM ESSENTIAL POWER SUPPLY (FOR VOLTAGE LIMITING DEVICE) - 2 x 10A Fused Connection Units from UPS Supply (for PCS) - double power point = 1 number	
PLUMBING & DRAINAGE			
NIL			
FIXTURES, EQUIPMENT & LOOSE FURNITURE			
TYPE & LOCATION		NIL	
OTHERS		NIL	
OTHERS			
-All building services requirement above are indicative only. Contractor to ensure statutory compliance.			

Typical Layout



NOTE:

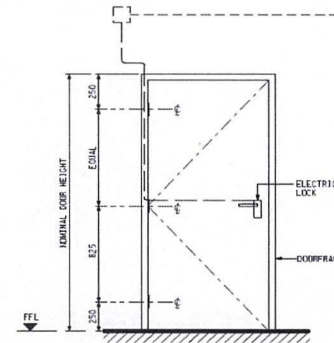
1. BUILDING SERVICES INSTALLED DIRECTLY ABOVE THE PANELS SHOULD BE AVOIDED AS FAR AS POSSIBLE.

PLAN

LEGEND :

C1, C2 POWER SUPPLY CABINETS
PSC PSD CONTROL PANEL

DOOR



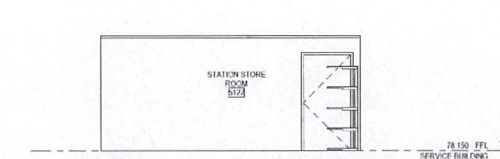
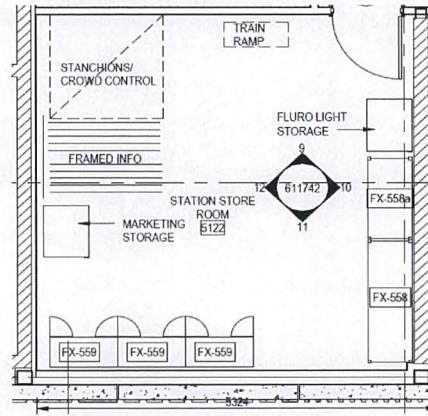
TYPE 05

ROOM DATA SHEET	
ROOM NAME	Station Store Room
ROOM NUMBER	F1014
FUNCTIONAL REQUIREMENTS	
FUNCTION	TBD in accordance with Sydney Metro Station Store Room (1014) requirements in consultation with TfNSW and Sydney Trains.
SIZE / DIMENSION	
LOCATION	4 x total required. 1 x adjacent to new Eastern Entrance with new staff facilities including the Maintenance Office - Customer Service Rep.
CONNECTION	3 x in ESR Concourse Back-of-House. Individual room size and equipment TBD in consultation with TfNSW and Sydney Trains.
MATERIALS & FINISHES	
FLOOR	
SKIRTING	
WALL	TBD in accordance with Sydney Metro Station Store Room (1014) requirements in consultation with TfNSW and Sydney Trains.
CEILING	
OTHERS	
DOORS & IRONMONGERY	
DOOR TYPE	
CLEAR OPENING REQUIRED	
DIRECTION OF SWING	
FIRE RESISTANCE	
AIR RESISTANCE	
STC RATING	
LOCK FUNCTION	
ACCESSORIES	
SAMS/SECURITY LEVEL	
OTHERS	
BUILDING SERVICES	
DELIVERY ROUTE SIZE	
RM. NOISE LEVEL	
COMMUNICATIONS FACILITIES	
ECS	
LIGHTING	
TBD in accordance with Sydney Metro Station Store Room (1014) requirements in consultation with TfNSW and Sydney Trains.	
FIRE PROTECTION	
TBD in accordance with Sydney Metro Station Store Room (1014) requirements in consultation with TfNSW and Sydney Trains.	
ELECTRICAL/ POWER REQUIREMENTS	
TBD in accordance with Sydney Metro Station Store Room (1014) requirements in consultation with TfNSW and Sydney Trains.	
PLUMBING & DRAINAGE	
Match Metro Male Public WC (1103) requirements	
TYPE & LOCATION	TBD in accordance with Sydney Metro Station Store Room (1014) requirements in consultation with TfNSW and Sydney Trains.
OTHERS	
OTHERS	

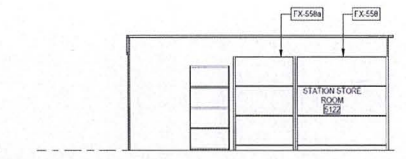
* Water Tightness Control Requirements	
Class	Description
I	Free from all visible leakage, seepage, and damp patches
II	Leakage shall be restricted to minor damp patches with no visible flow of water.
III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.

"damp" means wet with no visible film of water

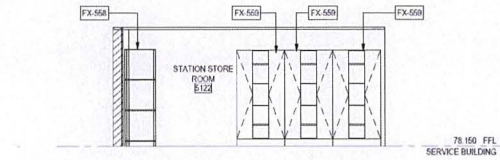
Example Layout (NTS) - Metro Northwest - Bella Vista Station - NWRLOTS-NRT-BLV-AT-DWG-611736.H.01.REV & NWRLOTS-NRT-BLV-AT-DWG-611742.E.01.REV



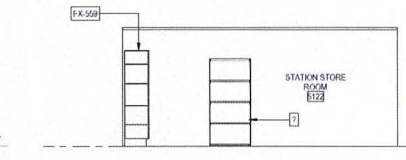
9 STATION STORE ROOM ELEVATION A
1:50



10 STATION STORE ROOM ELEVATION B
1:50



11 STATION STORE ROOM ELEVATION C
1:50



12 STATION STORE ROOM ELEVATION D
1:50

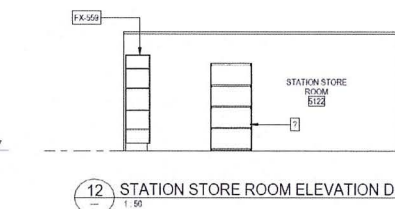
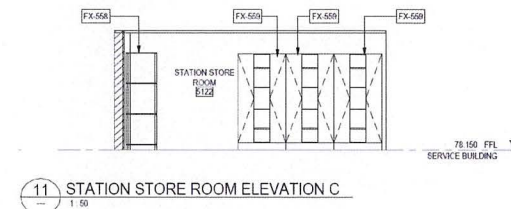
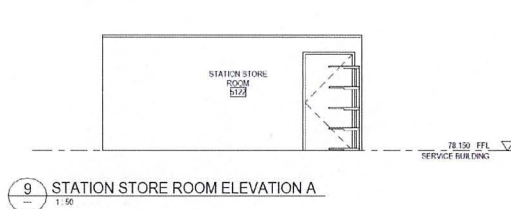
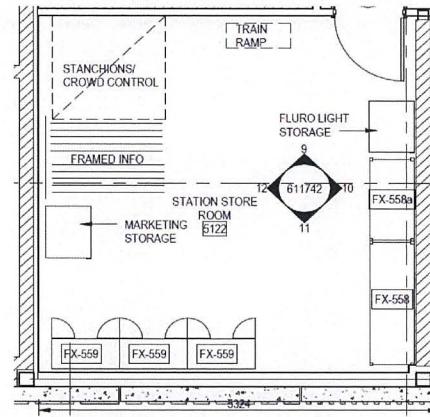
Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule

ROOM DATA SHEET	
ROOM NAME	Station Store Room
ROOM NUMBER	F1014
FUNCTIONAL REQUIREMENTS	
FUNCTION	TBD in accordance with Sydney Metro Station Store Room (1014) requirements in consultation with TfNSW and Sydney Trains.
SIZE / DIMENSION	
LOCATION	4 x total required. 1 x adjacent to new Eastern Entrance with new staff facilities including the Maintenance Office - Customer Service Rep.
CONNECTION	3 x in ESR Concourse Back-of-House. Individual room size and equipment TBD in consultation with TfNSW and Sydney Trains.
MATERIALS & FINISHES	
WATER TIGHTNESS*	
FLOOR	
SKIRTING	
WALL	TBD in accordance with Sydney Metro Station Store Room (1014) requirements in consultation with TfNSW and Sydney Trains.
CEILING	
OTHERS	
DOORS & IRONMONGERY	
DOOR TYPE	SET 1 SET 2
CLEAR OPENING REQUIRED	
DIRECTION OF SWING	
FIRE RESISTANCE	
AIR RESISTANCE	
STC RATING	TBD in accordance with Sydney Metro Station Store Room (1014) requirements in consultation with TfNSW and Sydney Trains.
LOCK FUNCTION	
ACCESSORIES	
SAMS/SECURITY LEVEL	
OTHERS	
BUILDING SERVICES	
DELIVERY ROUTE SIZE	
RM. NOISE LEVEL	
COMMUNICATIONS FACILITIES	
ECS	
LIGHTING	
TYPE	
DIFFUSER	
LUX	
IP	
FIRE PROTECTION	
DETECTION	
SUPPRESSION	
EXTINGUISHER	
SEPARATION	
SMOKE EXTRACT	
OTHERS	
ELECTRICAL/POWER REQUIREMENTS	
GENERAL SOCKET	
SPECIFIC EQUIPMENT	TBD in accordance with Sydney Metro Station Store Room (1014) requirements in consultation with TfNSW and Sydney Trains.
PLUMBING & DRAINAGE	
Match Metro Male Public WC (1103) requirements	
TYPE & LOCATION	TBD in accordance with Sydney Metro Station Store Room (1014) requirements in consultation with TfNSW and Sydney Trains.
OTHERS	

* Water Tightness Control Requirements	
Class	Description
I	Free from all visible leakage, seepage, and damp patches
II	Leakage shall be restricted to minor damp patches with no visible flow of water.
III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Letting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m2 per day overall and 0.24 l/day on any separate square metre.

damp means wet with no visible film of water

Example Layout (NTS) - Metro Northwest - Bella Vista Station - NWRL0TS-NRT-BLV-AT-DWG-611736.H.01.REV & NWRL0TS-NRT-BLV-AT-DWG-611742.E.01.REV



Central Station Main Works: SWTC Appendix F1 - Metro Station Works - Room Schedule

Room No.	Room Name	Critical Equipment Rooms(*)	Location	Connectivity and Adjacency	Minimum Area (m2)
100A	Signaling Equipment Room	Yes	Platform end (close to track side. Not near, above or below HV power equipment rooms)	Direct to service corridor	60
100B	PSD Equipment Room	Yes	Platform level / Adjacent to Signaling Equipment Room	Direct to service corridor	24
200	Telecom Equipment Room 1	Yes	Preferably Directly above cable termination room	Direct to service corridor 8m(L) x 6m(W) x 3m(H)	48
201	Telecom Equipment Room 2	Yes	Preferably Directly above cable termination room	Direct to service corridor 5.2m(L) x 6m(W) x 3m(H)	31.2
203	Common Telecom Equipment Room		Preferably Directly above cable termination room Telecom cable lead in manhole at Ground level is required	Direct to service corridor	72
205	Station Computer Room	Yes	Adjacent to station control room where practical	Access through Station Control Room preferred	42
306A	DC Isolating Links Room 1 (1500V)		At each end of the platform. Sub-floor required for cable trenches/basement	Direct to service corridor	14
306B	DC Isolating Links Room 2 (1500V)		At each end of the platform. Sub-floor required for cable trenches/basement	Direct to service corridor	14
400A	11kV Switchboard & Transformer Room 1		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
400B	11kV Switchboard & Transformer Room 2		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
400C	11kV Switchboard & Transformer Room 3		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
400D	11kV Switchboard & Transformer Room 4		Preferably adjacent to LV Switchroom / Sub-floor required for cable trenches/basement	Direct to service corridor	34.2
420A			Centralized UPS Room 1		refer RDS
420B			Centralized UPS Room 2		refer RDS
500E	Tunnel Ventilation System Shaft		(Southern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
500F	Tunnel Ventilation System Shaft		(Southern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
500G	Tunnel Ventilation System Shaft		(Northern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
500H	Tunnel Ventilation System Shaft		(Northern End)	At each station end, each attached to each tunnel ventilation fan plant room.	20
	Track Exhaust System Shaft		(Southern End)		12
	Track Exhaust System Shaft		(Southern End)		12
509A	MCC and Control Equipment Room #1	Yes	Adjacent to TEF/TSF and TVS Fan Rooms (Southern End)	Direct to service corridor 12.1m(L) x 4m(W)	refer RDS
509B	MCC and Control Equipment Room #2	Yes	Adjacent to TEF/TSF and TVS Fan Rooms (Northern End)	Direct to service corridor 8.6m(L) x 4m(W)	refer RDS
601A	Tunnel Ventilation Nozzle Room 1		At southern end of station (Uptrack)	Nozzle to be made of concrete	refer RDS
601B	Tunnel Ventilation Nozzle Room 2		At southern end of station (Downtrack)	Nozzle to be made of concrete	refer RDS
602A	Tunnel Ventilation Fan (TVF) Room 1		Close to tunnels (assumed 1 TVS Fans per room) (Southern End)	Direct to service corridor and track	refer RDS
602B	Tunnel Ventilation Fan (TVF) Room 2		Close to tunnels (assumed 1 TVS Fans per room) (Southern End)	Direct to service corridor and track	refer RDS
602C	Tunnel Ventilation Fan (TVF) Room 3		Close to tunnels (assumed 1 TVS Fans per room) (Northern End)	Direct to service corridor and track	refer RDS
602D	Tunnel Ventilation Fan (TVF) Room 4		Close to tunnels (assumed 1 TVS Fans per room) (Northern End)	Direct to service corridor and track	refer RDS
605A	Tunnel Exhaust Fan (TEF) Room 1		Close to tunnels (assumed 5 TEFS Fans per room at one end) (Southern End)	Direct to service corridor and track	refer RDS
-	Overtrack Exhaust (OTE) Duct			Along each track	8
-	Under Platform Exhaust (UPE) duct			Along each track	4
-	Draught Relief Shaft		One at each end of platform (total = 2 nos) and close to TVF Fan Room	Connect to Up-track and Down-track Tunnels	20
613A	TVS Air Compressor and Receiver Room 1		Adjacent to TEF/TSF and TVS Fan Rooms (Southern End)	Connection service corridor	28
613B	TVS Air Compressor and Receiver Room 2		Adjacent to TEF/TSF and TVS Fan Rooms (Northern End)	Connection service corridor	28
614A	Trackside LV switch room 1		Each end of platform (North)	Connection service corridor	12
614B	Trackside LV switch room 2		Each end of platform (South)	Connection service corridor	12
7C1	Fire Brigade Booster - Tunnel Hydrants		Surface level accessible	Adjacent to fire pump room where possible	2
702	Trackside FS Pump Room 1		Surface level accessible	Next to Fire Water Storage Tank room and at same station end of Fire Control Room	36
704	Fire Control Room	Yes	Ground/ Street level		12
705	Fire Water Storage Tank Room			Next to Fire Pump Room	25
802	Primary Tunnel Water Sump		Southern End of Platform		refer RDS
802S	Primary Tunnel Water Sump Subfloor		Southern End of Platform		refer RDS
803	Secondary Tunnel Water Sump		Northern End of Platform		refer RDS
803S	Secondary Tunnel Water Sump Subfloor		Northern End of Platform		refer RDS
1002A	Staff Locker Room 1 (Male / Female)		Adjacent to multi-purpose room		8
1002B	Staff Locker Room 2 (Male / Female)		Adjacent to multi-purpose room		8
1003	Multipurpose Room		Adjacent to locker room within concourse		15
1004	Refuse Room		Street / Ground Level with direct access to a lift		11
1004B	Bin Room		Concourse back of house area. Accessible to Refuse room and Platforms via lift		5
1005A	Chemical Store Room 1				10
1006	Platform Cleaning Machine Room		Platform adjacent to cleaner store room with direct access to a lift	3m circulation required externally at the door required for machine turning	12
1006A	Presentation Store Room			Adjacent to cleaner store room	10
1007A	Cleaners store 1			Adjacent to toilets	10
1007B	Cleaners store 2			Adjacent to toilets	10
1008A	Station Staff (Concourse W.C 1)		Concourse within the back of house area	Adjacent to staff locker room	7
1008B	Station Staff (Concourse W.C 2)		Concourse within the back of house area	Adjacent to staff locker room	7
1009	Station Control Room	Yes	Quick access from Sydney Metro areas		55
1016	Store Room		Connection within the back of house areas		20
1017A	Maintenance office		Concourse within the back of house area. Adjacent to maintenance store room.		12
1017E	Maintenance store room		Connection within the back of house areas. Adjacent to maintenance office		5
1025	Emergency track trolley room		Back of house platform		15
1030	Cable Termination Room 1		One at each platform end. One of the CTR be directly under the TER	Direct to service corridor	6
1031	Cable Termination Room 2		One at each platform end	Direct to service corridor	6
HWU1	Headwall Unit 1				refer RDS
HWU2	Headwall Unit 2				refer RDS
TWU1	Tailwall Unit 1				refer RDS
TWU2	Tailwall Unit 2				refer RDS
	Communications Cupboard 1		Platform	Under platform escalator 1	2
	Communications Cupboard 2		Platform	Under platform escalator 2	2

Central Station Main Works: SWTC Appendix F1 - Metro Station Works - Room Schedule

Room No.	Room Name	Critical Equipment Rooms(*)	Location	Connectivity and Adjacency	Minimum Area (m2)
	Communications Cupboard 3		Concourse	within 80m (cable containment length) of communication field equipment	2
	Communications Cupboard 4		Concourse	within 80m (cable containment length) of communication field equipment	2
	Communications Cupboard 5		Concourse	within 80m (cable containment length) of communication field equipment	2
	Communications Cupboard 6		Concourse	within 80m (cable containment length) of communication field equipment	2
402A	LV MAIN SWITCH ROOM (415V DBs)				
402B	LV MAIN SWITCH ROOM (415V DBs)				
402C	LV MAIN SWITCH ROOM (415V DBs)				
402D	LV MAIN SWITCH ROOM (415V DBs)				
500A	FIRE STAIRCASE PRESSURISATION PLANT ROOM				
500B	FIRE STAIRCASE PRESSURISATION PLANT ROOM				
503	WATERCOOLED VRV PLANT ROOM				
504C	COOLING TOWER WATER PUMPS AND TANKS				
505	SIGNALLING/TELECOMS CRITICAL COOLING SYSTEMS PLANT ROOM #1	Yes			
505	SIGNALLING/TELECOMS CRITICAL COOLING SYSTEMS PLANT ROOM #1	Yes			
506A	SIGNALLING/TELECOMS CRITICAL COOLING SYSTEMS PLANT ROOM #2	Yes			
506B	EQUIPMENT COOLING SYSTEMS PLANT ROOM				
506C	EQUIPMENT COOLING SYSTEMS PLANT ROOM				
507AA	PLANTROOM SUPPLY VENTILATION FAN ROOM				
507AB	PLANTROOM SUPPLY VENTILATION FAN ROOM				
507BA	PLANTROOM EXHAUST VENTILATION FAN ROOM				
507BB	PLANTROOM EXHAUST VENTILATION FAN ROOM				
507CA	AHU OUTSIDE AIR FAN ROOM				
507CB	AHU OUTSIDE AIR FAN ROOM				
508	E&M SYSTEMS MCC AND CONTROL EQUIPMENT ROOM #1				
509A	E&M SYSTEMS MCC AND CONTROL EQUIPMENT ROOM #2				
700A	GAS SUPPRESSION EQUIPMENT ROOM				
701	FIRE BRIGADE BOOSTER - TUNNEL HYDRANTS				
702A	FIRE PUMP ROOM #1				
705	FIRE WATER STORAGE TANK ROOM				
706A	EMERGENCY TROLLEY STORE				
706B	EMERGENCY TROLLEY STORE				
801	WATER TREATMENT PLANT ROOM				
802	PRIMARY GROUND WATER/TUNNEL WATER SUMP				
803	SECONDARY GROUND WATER/TUNNEL WATER SUMP				
804A	SEWAGE EJECTOR PUMP ROOM				
808B	HOT WATER PLANT				
10F1	POSTER CASES - INWARD JOURNEY PLANNING				

Notes:

RDS means Metro Station room data sheets

(*) The following are the minimum quantity and number of Critical Equipment Rooms. All other rooms and locations are subject to the definition of Critical Equipment Rooms (Refer to SWTC Appendix A1)

CSM SWTC Appendix F2: Central Station Room Schedule

Room Number	Existing ST door number	Room Name	Floor Useable Area (per room)		Access Provisions	Area Affinity	Notes
			No. of rooms	Minimum (m ²)			
F704		FIRE CONTROL ROOM (existing)	1	0	single door	existing fire control room located at Eddie Avenue entrance way.	This Fire control room at Central is shared between Sydney trains and Sydney Metro systems
707		METRO CBD INCIDENT CONTROL ROOM	1	12			Combine with Fire Control Room
F1301		MEWP STORE	1	12	Double doors, 1.5m clear.	At concourse level with direct access to lift.	3m circulation required externally at the door to allow machine turning.
F1006		BIN ROOM	1	5	Double doors, 1.5m clear.	At new Eastern Entrance, accessed from paid concourse.	
F1007		CHEMICAL STORE ROOM	1	9	Single door in stand-alone room or in lockable enclosure if in cleaners' room	At new Eastern Entrance, accessed from paid concourse.	Combine with Cleaner's store above.
F1008		CLEANING MACHINE ROOM	1	12	Double doors, 1.5m clear.	At new Eastern Entrance, near cleaners store, adjacent to cleaners store with direct access to lift, or on platform level.	3m circulation required externally at the door to allow machine turning.
F1009		CLEANERS STORE ROOM	1	10	Single door 1m clear	At new Eastern Entrance, adjacent to chemical store.	
F1011		STATION STAFF W.C (Accessible & Unisex)	1	7	Single accessible door	At new Eastern Entrance, remote from main staff facilities.	Accessible unisex facility. Potential to include accessible shower.
F1014		STATION STORE ROOM	4	20	Double doors, 1.5m clear.	At new Eastern Entrance	
F1015		MAINTENANCE OFFICE - CUSTOMER SERVICE REP.	2	12	Single accessible door	At new Eastern Entrance and North Concourse.	
F1016		MAINTENANCE STORE ROOM	1	5	Single accessible door	Adjacent to maintenance office.	
F1302	ESR-30	MULTI-PURPOSE MEETING ROOM	1	47	Single accessible door	ESR Concourse	Must be in place prior to demolition of existing ESR meeting rooms.
F1303		MULTI-PURPOSE ROOM	1	40	Single accessible door	North-South Concourse	
F1304	P16-02 P16-03 P16-04 P16RS-01	PLATFORM 16/17 STAND-BY GUARD ROOM	1	12	Single accessible door	Southern end of Platform 16/17	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1305	P18-02 P18-03 P18-04 P18RS-01	PLATFORM 18/19 STAND-BY GUARD ROOM	1	12	Single accessible door	Northern end of Platform 18/19	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1306	P20-02 P20-03 P20-04 P20RS-01	PLATFORM 20/21 STAND-BY GUARD ROOM	1	12	Single accessible door	Southern end of Platform 20/21	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1307	P22-02 P22-03 P22-04 P22RS-01	PLATFORM 22/23 STAND-BY GUARD ROOM	1	12	Single accessible door	Northern end of Platform 22/23	To suit 2 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
F1308	-	REMOTE STAND-BY GUARD ROOM	1	TBD	Single accessible door	Within 120 seconds walking distance to all Suburban platform Stand-by Guard Rooms.	Remote facility to suit 9 stand-by guards. Must be in place prior to demolition of existing stand-by facilities.
1103		MALE PUBLIC WC	2	3	Single accessible door	North-South Concourse - ideally grouped by sex.	Individual ambulant male WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
1103		MALE PUBLIC WC	2	3	Single accessible door	At new Eastern Entrance, in the paid concourse - ideally grouped by sex.	Individual ambulant male WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
1104		FEMALE PUBLIC WC	2	3	Single accessible door	North-South Concourse - ideally grouped by sex.	Individual ambulant female WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
F1104		FEMALE PUBLIC WC	2	3	Single accessible door	At new Eastern Entrance, in the paid concourse - ideally grouped.	Individual ambulant female WC - x2 per paid concourse. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy.
1105		ACCESSIBLE PUBLIC WC	2	6	Single accessible door	North-South Concourse - ideally grouped by sex.	Separate accessible male and female facilities. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy
F1105		ACCESSIBLE PUBLIC WC	2	6	Single accessible door	At new Eastern Entrances, in the paid concourse - ideally grouped.	Separate accessible male and female facilities. Visible from paid concourse but not able to be seen directly in to, hinge door to maximise privacy
1106		PARENTING ROOM	1	8	Single accessible door	North-South Concourse - ideally grouped by sex.	to include WC, chair and baby change facilities.
F1106		PARENTING ROOM	1	8	Single accessible door	At new Eastern Entrance, in the paid concourse - adjacent to public WC.	to include WC, chair and baby change facilities.

CSM SWTC Appendix F2: Central Station Room Schedule

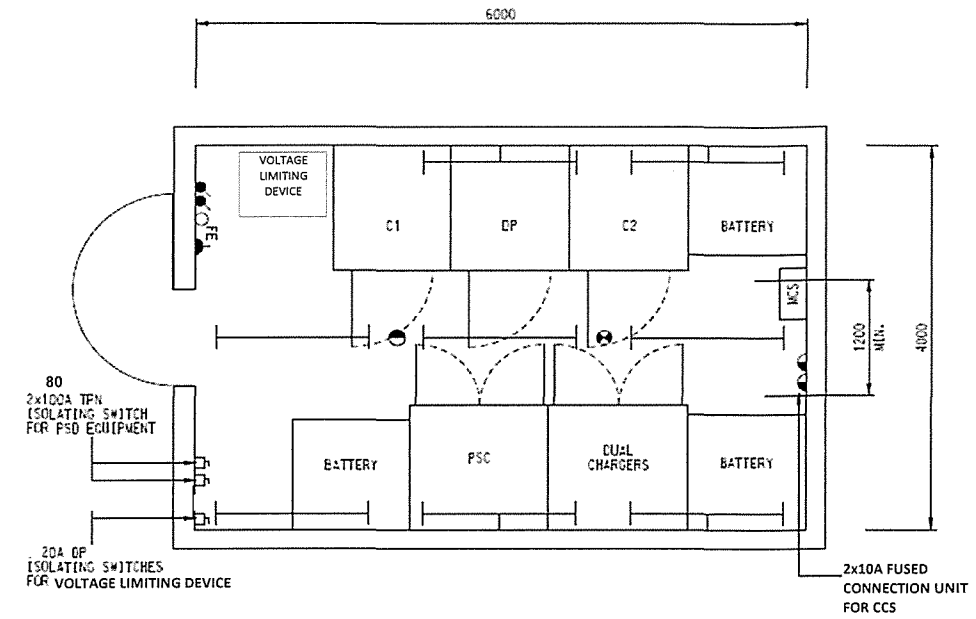
Room Number	Existing ST door number	Room Name	Floor Useable Area (per room)		Access Provisions	Area Affinity	Notes
			No. of rooms	Minimum (m²)			
					Doorways/Corridors/Cable Entries etc	location constraint	
11F4		VENDING MACHINES				Paid concourse area	x2 per paid concourse visible from main flow
12F1		SECURED BICYCLE PARKING				Within secure shelter	
F808		HOT WATER PLANT			double door, 1.5m corridor to lift	At new Eastern Entrance, central to all amenity and public toilet areas.	Not a 'boiler' as defined by the BCA
7C2		FIRE BRIGADE BOOSTER - STATION HYDRANTS AND SPRINKLERS				Surface level accessible outside of station from fire tender. Next to water meter cupboard and water main connection. Minimum 10m from substation/electrical room.	Adjacent to fire pump room where possible.
F7C4		FIRE HYDRANT AND HOSEREEL CUPBOARD			number of cupboards are indicative only, dependent on system design	See Services Cupboard location map	multiple locations and qty's in stations and buildings. Distance between Hydrants are separated no further apart than 60m horizontally
F7C5		FIRE DETECTION EQUIPMENT CABINET			number of cupboards are indicative only, dependent on system design	located at end of the East concourse entrance area, located in the wall, 2000mm high	To locate new FIP specified for Sydney Train Enabling Work
		New ST room to be added "EASTERN HYDRANT AND SPRINKLER ZONE PUMP ROOM"			Preferably louvred face. Level access for fuel replacement and maintenance.		Diesel fired fire pump exhaust to outside. Diesel storage tank. Accommodates hydrant and sprinkler pumps. Services Eastern zone station hydrant and sprinklers
F4C1		ELECTRICAL DISTRIBUTION CUPBOARDS ED8'S			Accessible from standing position without use of ladders, mounted on or recessed in walls	Located within concourses and station entrances, as required.	Contain local distribution switch boards, number of boards dependent on design requirements
F400		HV SWITCHGEAR ROOM (11KV)			Double door for equipment entry, single door for egress to adjacent room or exit. Equipment installation corridor to access hatch (2m W x 3 m H)	4 off at Ghost platform/mezzanine level of ESR box (2 off for CSS refurbishment 2 off for new CES).	Fired rating between each half of substation must be maintained, fire rating not required between rooms within the same half but would minimise equipment damage in case of fire. Min 0.6m perimeter around equipment. Cable basement required for incoming and outgoing cables, 2.1m high, in addition to noted room height. Room Layout General Arrangement shown in NWRLSRT-PBA-SCS-ED-DWG-338225
F401		11KV TRANSFORMER ROOM (11KV/415V)			5 tonne TX. Double door for equipment entry, single door for egress to adjacent room or exit. Equipment installation corridor to access hatch (2m W x 2.4m H)	4 off at Ghost platform/mezzanine level of ESR box (2 off for CSS refurbishment 2 off for new CES).	Fired rating between each half of substation must be maintained, fire rating not required between rooms within the same half but would minimise equipment damage in case of fire. Min 0.6m perimeter around equipment. Cable basement required for incoming and outgoing cables, 2.1m high, in addition to noted room height. Room Layout General Arrangement shown in NWRLSRT-PBA-SCS-ED-DWG-338225
F402		LV MAIN SWITCH ROOM (415V MSB)			Double door for equipment entry, single door for egress to adjacent room or exit. Equipment installation corridor to access hatch (2m W x 2.4m H)	4 off at Ghost platform/mezzanine level of ESR box (2 off for CSS refurbishment 2 off for new CES).	Fired rating between each half of substation must be maintained, fire rating not required between rooms within the same half but would minimise equipment damage in case of fire. Min 0.6m perimeter around equipment. Cable basement required for incoming and outgoing cables, 2.1m high, in addition to noted room height. Room Layout General Arrangement shown in NWRLSRT-PBA-SCS-ED-DWG-338225
F507		CONCOURSE VENTILATION FAN ROOM			double doors for access and egress from the corridor, and access hatch for plant replacement.	Concourse level	
F700		GAS SUPPRESSION EQUIPMENT ROOM			Lift/level access to room for bottle replacements/servicing	In vicinity of critical systems equipment rooms - No more than 150m of piping length to Electrical rooms & relocated comms rooms on Eastern Concourse	Number of rooms subject to the serviced room distribution and number.
F2C1		SYDNEY TRAINS STATION SYSTEMS COMMUNICATIONS CUPBOARD			1 off double door leaf 2000 mm x 2100 mm high,	Various locations on the East Concourse and Eastern entry	Room/cupboard spacing is determined by maximum Ethernet cabling length to devices. Needs in-floor cable access to gateline
F2C7		THIRD PARTY TELECOMS CUPBOARD			1 off double door leaf 2000 mm x 2100 mm high	Eastern gateline	Room/cupboard spacing is determined by maximum Ethernet cabling length to devices
F200		CONCOURSE TELECOMMUNICATIONS ROOM (Sydney trains asset located in North-South concourse)			1 off single door leaf 920 mm x 2040 mm high	On North-South concourse	Room/cupboard spacing is determined by maximum Ethernet cabling length to devices
F201	ESR-65	COMMUNICATIONS EQUIPMENT ROOM CENA 5			As per existing room, unless newer standards dictate greater access provisions.	Sydney Trains want this room on ESR Concourse	reinstate existing Sydney train equipment room, room size to be 50% greater in floor area and access provisions to be the same
F202	ESR-69	COMMUNICATIONS EQUIPMENT ROOM CENA 2			As per existing room, unless newer standards dictate greater access provisions.	Sydney Trains want this room on ESR Concourse	Existing room to increase from 16m2 to 26m2 to accommodate a planned mobile phone capacity and speed upgrade.
F813a		SOUTHERN Y TUNNEL SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813c		OLYMPIC TUNNEL EAST SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813d		OLYMPIC TUNNEL WEST SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813e		STORMWATER REUSE PUMP UPGRADES - for toilet flushing of new concourse toilets (only if stormwater is available and suitable)			Ability to maintain and replace pumps is required, 1.5m corridor.		

CSM SWTC Appendix F2: Central Station Room Schedule

Room Number	Existing ST door number	Room Name	Floor Useable Area (per room)		Access Provisions Doorways/Corridors/Cable Entries etc	Area Affinity location constraint	Notes
			No. of rooms	Minimum (m ²)			
F813f		RAINWATER HARVESTING TANK EMPTYING PUMPS (possible improvement of stormwater harvesting tank operations)			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F813g		EASTERN ENTRANCE SUBSURFACE PUMP			Ability to maintain and replace pumps is required, double door, with 1.5m corridor to 1x0.8m hatch		
F901		VERTICAL TRANSPORTATION; PASSENGER LIFTS			self contained	Various locations; See vertical transportation location table tab	number and size dependent on architecture, refer indicative drawing, width across door face
F902		VERTICAL TRANSPORTATION; ESCALATORS			self contained	Various Locations; See vertical transportation location table tab	number and size dependent on architecture, refer indicative drawing
1100		UNPAID CONCOURSE (indicative only varies for each station)			Accessible by vertical transportation, lifts and escalators from station entry level	station entrances, ticket gate line	Floor areas as per architectural allowances and pedestrian modelling requirements
1101		PAID CONCOURSE (indicative only varies for each station)			Accessible by vertical transportation, lifts and escalators from station entry level	ticket gate line and platforms	Floor areas as per architectural allowances and pedestrian modelling requirements
12F2		SHELTERED BICYCLE PARKING HOOPS				Under shelter at street level, within 50m of gateline	Located adjacent to the Chalmers Street Entrance.
12F3		BICYCLE PARKING HOOPS				At street level, within 50m of gateline	Located adjacent to the Chalmers Street Entrance.
F12F4		CUSTOMER ASSISTANCE (HELP) POINTS			number of help points are indicative only, subject to area affinity and ASA requirements	Either side of gate line, at lifts and visible on arrival to platform	located out of flow, number of help points are indicative only, subject to area affinity requirements
F12F5		DIGITAL WAYFINDING SCREENS				Operator requirement	x2 per paid concourse
1300		UNPAID CONCOURSE RETAIL OPPORTUNITY				Unpaid concourse - ideally at street	the equivalent size of 2 x ATM's per entrance - could be ATM, phone, Click and Shop - utility space
1301		RETAIL OPPORTUNITY				Unpaid concourse - ideally at street	Unpaid retail the equivalent size of x2 ATM's per entrance. Could be ATM, phone, Click and Shop - utility space
1302		RETAIL TO BE ASSESSED STATION BY STATION				Primary access from the street	

ROOM DATA SHEET			
ROOM NAME	PSD EQUIPMENT ROOM		
ROOM NUMBER (To be Adopted)	100B		
FUNCTIONAL REQUIREMENTS			
FUNCTION	TO HOUSE PSD/PEB EQUIPMENTS		
SIZE / DIMENSION	Minimum 6m x 4m x 3.5m		
LOCATION	PLATFORM LEVEL		
CONNECTION	DIRECT TO SERVICE PLATFORM		
MATERIALS & FINISHES		WATER TIGHTNESS*	
FLOOR	Epoxy Floor Coating on Granolithic	N/A	
SKIRTING	Epoxy Floor Coating on Granolithic	The complete absence of any leakage, seepage and damp patches.	
WALL	Epoxy Paint on Fair Faced Concrete or Blockwork		
CEILING	Fair Faced Concrete		
OTHERS			
DOORS & IRONMONGERY	SET 1	SET 2	
DOOR TYPE	5		
CLEAR OPENING REQUIRED	2100mm (H) x 1200 mm (W)		
DIRECTION OF SWING	SWING OUT AT 180°		
FIRE RESISTANCE	SAME AS FRP AS THE ENCLOSURE		
AIR RESISTANCE	N/A		
STC RATING	20		
LOCK FUNCTION	EACS		
ACCESSORIES	KICK PLATES		
EACS/SECURITY LEVEL	HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1		
BUILDING SERVICES			
DELIVERY ROUTE SIZE	1.5 m (W) x 2.2m (H)		
RM. NOISE LEVEL	NR80		
COMMUNICATIONS FACILITIES			
RADIO COVERAGE RJ45 socket (digital phone) Qty 1 PABX analogue phones Qty 1 Direct Line Phones Qty 1			
Ventilation (from Essential Power Supply);-Ventilation rate of 5l/s/m ² ; Max Temperature of ambient +5°C ; 2 duty fans each min 60% of design flow			
ECS	1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting		
LIGHTING	TYPE	-	
	DIFFUSER	-	
	LUX	Essential: 300; Emergency: 10	
	IP	N/A	
FIRE PROTECTION	DETECTION	Smoke Detection/Heat Detection	
	SUPPRESSION	Gas suppression	
	EXTINGUISHER	Yes	
	SEPARATION	Yes	
	SMOKE EXTRACT	NIL	
	OTHERS	-	
ELECTRICAL/ POWER REQUIREMENTS	GENERAL SOCKET	NUMBER	LOCATION
	SPECIFIC EQUIPMENT	SOCKET TYPE	CONDUIT TYPE
		2	WALL
		Twin 10A, 230V	EXPOSED
- TWO 80A TPN ISOLATING SWITCH (ONE FROM ESSENTIAL POWER SUPPLY AND ONE FROM CENTRALISED UPS) - TWO 10A FUSED CONNECTION UNITS FOR CCS, - EARTHING TERMINAL - ONE 20A DP ISOLATING SWITCH FROM ESSENTIAL POWER SUPPLY (FOR VOLTAGE LIMITING DEVICE) - 2 x 10A Fused Connection Units from UPS Supply (for PCS) - double power point = 1 number			
PLUMBING & DRAINAGE			
NIL			
FIXTURES, EQUIPMENT & LOOSE FURNITURE			
TYPE & LOCATION			
NIL			
OTHERS			
NIL			
OTHERS			
-All building services requirement above are indicative only. Contractor to ensure statutory compliance.			

Typical Layout



NOTE:

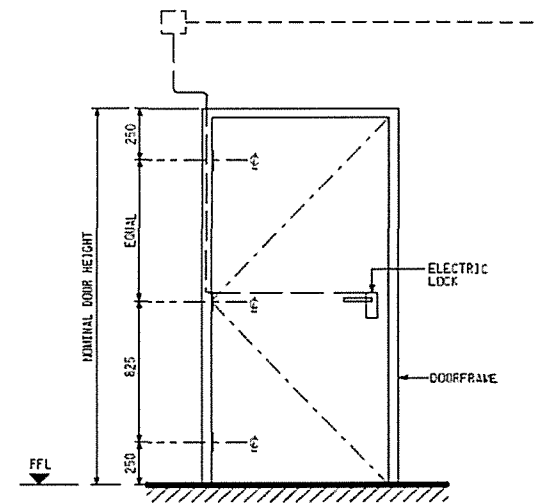
- BUILDING SERVICES INSTALLED DIRECTLY ABOVE THE PANELS SHOULD BE AVOIDED AS FAR AS POSSIBLE.

PLAN

LEGEND :

- C1,CP,C2 POWER SUPPLY CABINETS
- PSC PSD CONTROL PANEL

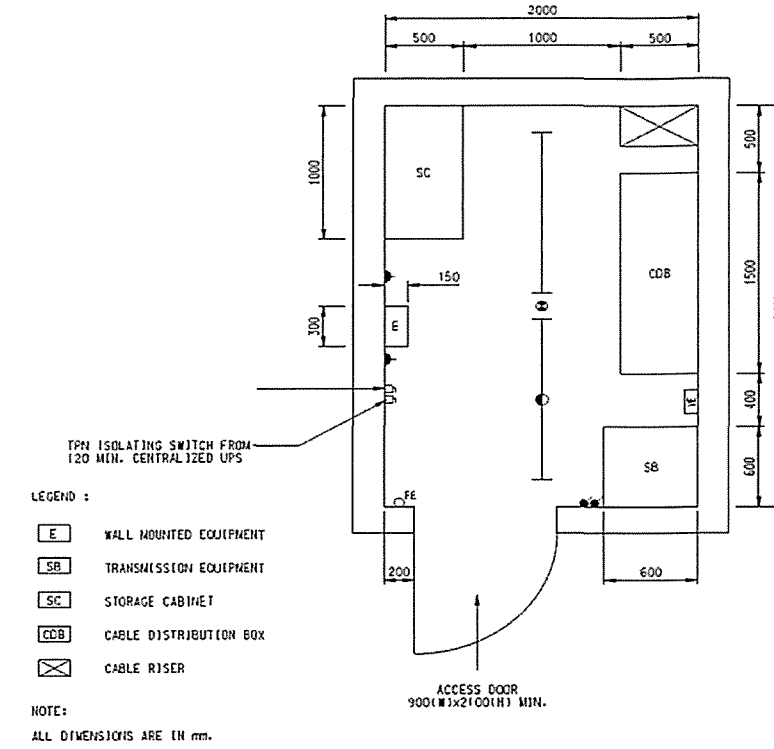
DOOR



TYPE 05

ROOM DATA SHEET									
ROOM NAME	CABLE TERMINATION ROOM								
FUNCTIONAL REQUIREMENTS									
FUNCTION	Terminate Trackside Trunk Cables and Telecom Equipment								
SIZE / DIMENSION	To suit equipment sizes. Minimum 2m (L) x 3m (W). Height > 3m								
LOCATION	End of Platform, City End (One of the CTR be directly under TER)								
CONNECTION	Direct to PLATFORM								
MATERIALS & FINISHES									
FLOOR	Epoxy Floor Coating on Granolithic								
SKIRTING	Epoxy Floor Coating on Granolithic								
WALL	Epoxy Paint on Fair Faced								
CEILING	Wall Sealer Paint on Fair Faced Concrete								
OTHERS	--								
DOORS & IRONMONGERY									
DOOR TYPE	SET 1								
CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)								
DIRECTION OF SWING	Swing out at 90 degrees								
FIRE RESISTANCE	Same FRP as the enclosure								
AIR RESISTANCE	N/A								
STC RATING	20								
LOCK FUNCTION	Latch operable by key outside; inside always free for exit								
ACCESSORIES	Kick Plates								
EACS/SECURITY LEVEL	Medium: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1								
OTHERS	--								
BUILDING SERVICES									
DELIVERY ROUTE SIZE	1m (W) x 2m (H)								
RM. NOISE LEVEL	NR80								
COMMUNICATIONS FACILITIES	Radio Coverage RJ45 socket (digital phone) Qty 1 PABX analogue phones Qty 1								
ECS	Ventilation (from Essential Power Supply); Ventilation rate of 5l/s/m ² ; Max Temperature of ambient +5°C ; 2 duty fans each min 60% of design flow								
LIGHTING	1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting								
	DIFFUSER --								
	LUX Essential: 300; Emergency: 10								
	IP N/A								
FIRE PROTECTION	DETECTION Smoke Detection/Heat Detection=1								
	SUPPRESSION NIL								
	EXTINGUISHER Yes								
	SEPARATION Yes								
	SMOKE EXTRACT NIL								
	OTHERS --								
ELECTRICAL/ POWER REQUIREMENTS	<table border="1"> <thead> <tr> <th>NUMBER</th> <th>LOCATION</th> <th>SOCKET TYPE</th> <th>CONDUIT TYPE</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>WALL</td> <td>Twin 10A, 230V</td> <td>EXPOSED</td> </tr> </tbody> </table> <p>SPECIFIC EQUIPMENT - Earthing terminal - one 20A SPN - dedicated room db = 1</p>	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE	2	WALL	Twin 10A, 230V	EXPOSED
NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE						
2	WALL	Twin 10A, 230V	EXPOSED						
PLUMBING & DRAINAGE	Nil								
FIXTURES, EQUIPMENT & LOOSE FURNITURE									
TYPE & LOCATION	NIL								
OTHERS	NIL								
OTHERS	- No exposed water-bearing pipe within the room - All building services requirement above are indicative only. Contractor to ensure statutory compliance								

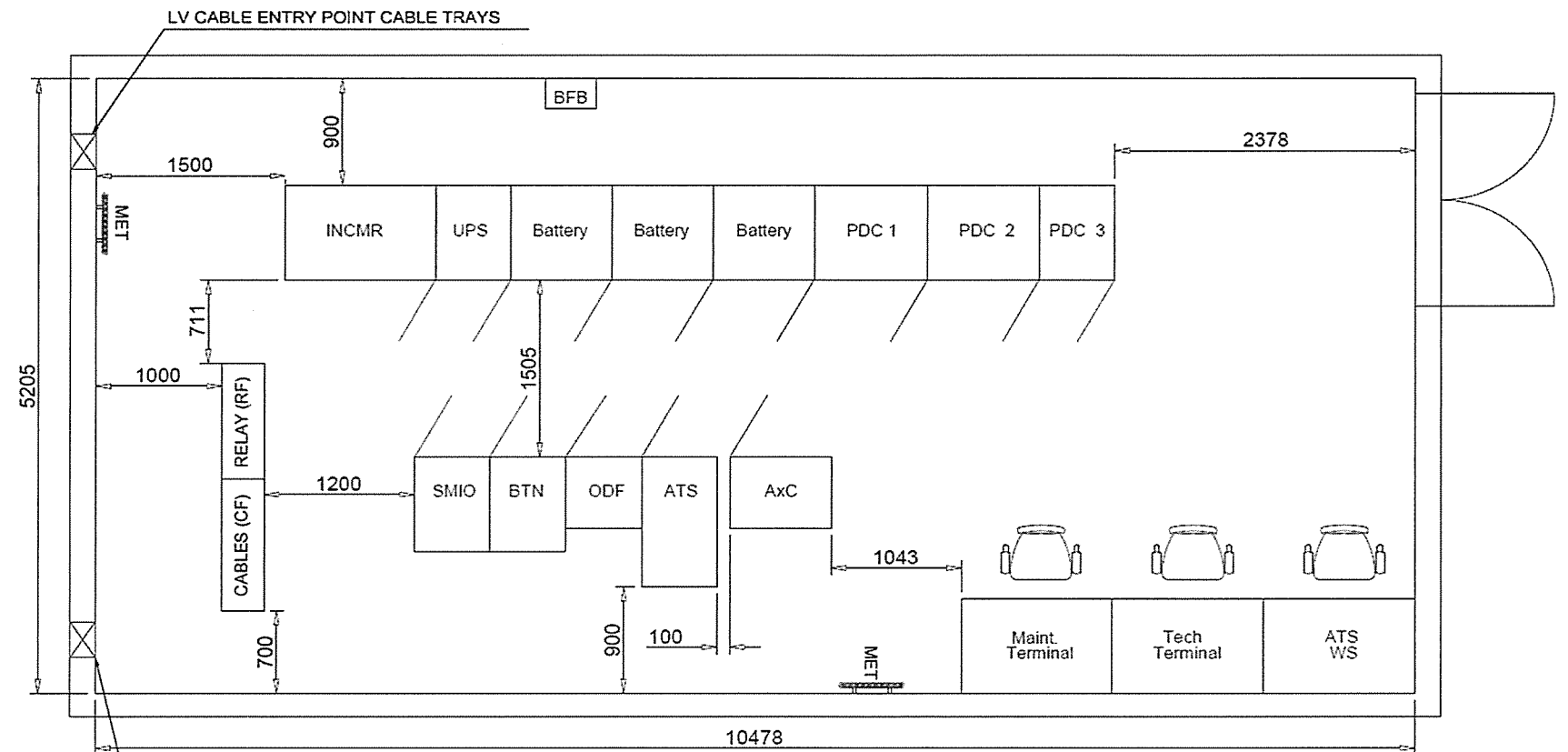
Typical Layout



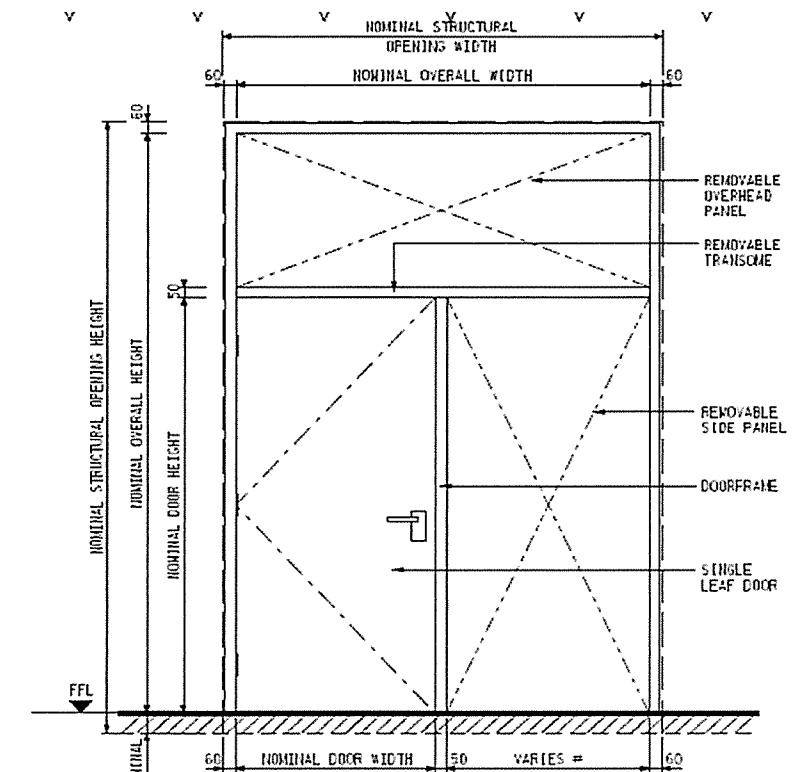
ROOM DATA SHEET

ROOM NAME		SIGNALLING EQUIPMENT ROOM	
ROOM NUMBER (To be Adopted)		100A	
FUNCTIONAL REQUIREMENTS			
FUNCTION		HOUSE SIGNALLING AND AUTOMATIC TRAIN CONTROL EQUIPMENT	
SIZE / DIMENSION		10m (W) x 6m (D) x 3.5m (H)	
[City Section] AT PLATFORM END (CLOSE TO TRACKSIDE) NOT NEAR, ABOVE OR BELOW HV POWER EQUIPMENT ROOMS			
LOCATION			
[Southwest Section] CLOSE TO TRACKSIDE. NOT NEAR, ABOVE OR BELOW HV POWER EQUIPMENT ROOMS			
CONNECTION			
DIRECT TO PLATFORM			
MATERIALS & FINISHES			
FLOOR		Resilient Tile on Access Floor	
SKIRTING		Resilient Skirting	
WALL		Epoxy Paint on Fair Faced	
CEILING		Wall Sealer Paint on Fair Faced Concrete	
OTHERS		-	
DOORS & IRONMONGERY		SET 1	
DOOR TYPE		O8A	
CLEAR OPENING REQUIRED		2400mm (H) x 2100mm (W) (nominal door width =	
DIRECTION OF SWING		SWING OUT AT 90°	
FIRE RESISTANCE		SAME AS FRP AS THE ENCLOSURE	
AIR RESISTANCE		N/A	
STC RATING		20	
LOCK FUNCTION		EACS	
ACCESSORIES		DOOR CLOSER; KICK PLATES	
EACS/SECURITY LEVEL		HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1	
OTHERS		-	
BUILDING SERVICES			
DELIVERY ROUTE SIZE		3 m (W) x 3 m (H)	
RM. NOISE LEVEL		NR80 (note 1)	
COMMUNICATIONS FACILITIES			
ECS		A/C, 25.5 °C, 50% ± 10% RH, Standby A/C, Essential power supply	
LIGHTING		1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting	
TYPE		-	
DIFFUSER		-	
LUX		Essential: 320; Emergency: 10 (note 1) Lighting Generally in accordance with AS1680 & SPR 17 Lighting to be configured to take into account rack layout	
IP		N/A	
FIRE PRC ON		-	
DETECTION		Smoke Detection / Heat Detection	
SUPPRESSION		gas suppression	
EXTINGUISHER		Yes	
SEPARATION		Yes	
SMOKE EXTRACT		-	
OTHERS		-	
ELECTRICAL/ POWER REQUIREMENTS		-	
GENERAL SOCKET		4 (Essential.)	
SPECIFIC EQUIPMENT		- 2 TP&N ISOLATING SWITCHES (EACH FORM DIFFERENT LV ESSENTIAL BUSBAR, RATING IS LOCATION SPECIFIC) - EARTHING TERMINAL	
PLUMBING & DRAINAGE		NIL	
FIXTURES, EQUIPMENT & LOOSE FURNITURE			
TYPE & LOCATION		NIL	
OTHERS		NIL	
- NO EXPOSED WATER BEARING PIPE WITHIN THE ROOM - NO MOVEMENT JOINT INSIDE THE ROOM. - YELLOW ARROW TO BE PROVIDED ON FLOOR TO INDICATE THE ESCAPE ROUTE IN CASE OF EMERGENCY. - Under-floor cable access via raised access floor - UPS BATTERY INSTALLED INSIDE THE ROOM. BS PROVISIONS TO MEET LOCAL REQUIREMENTS - dedicated room db = 1 - All building services requirement above are indicative only. Contractor to ensure statutory compliance			

Typical Layout



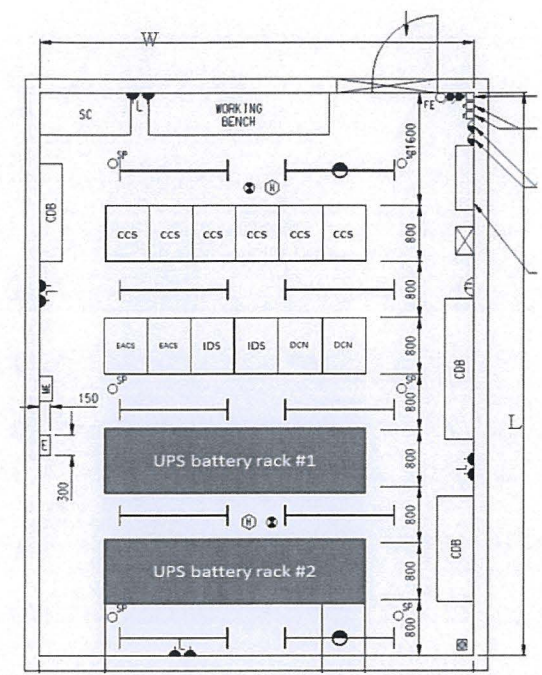
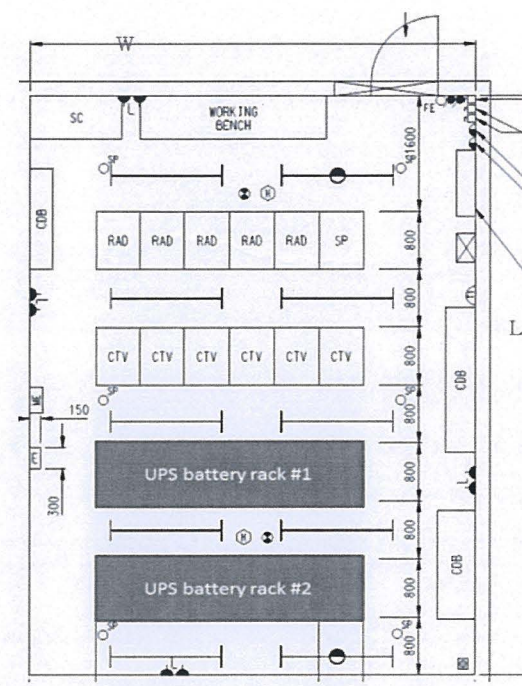
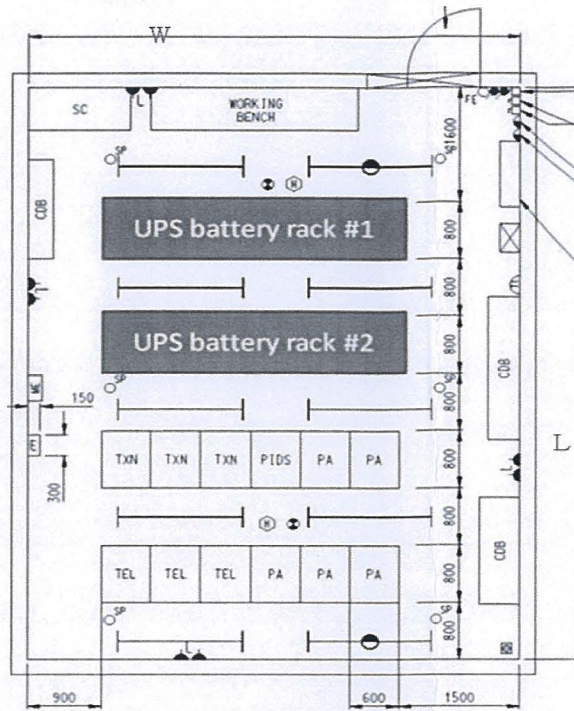
TRACKSIDE ENTRY POINT CABLE TRAYS



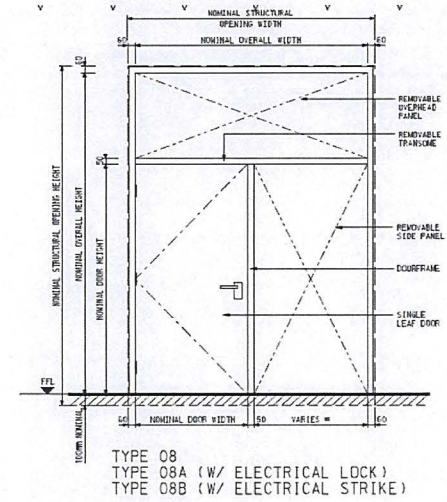
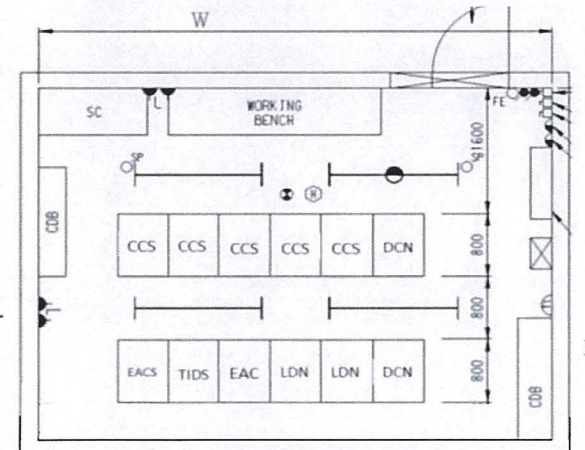
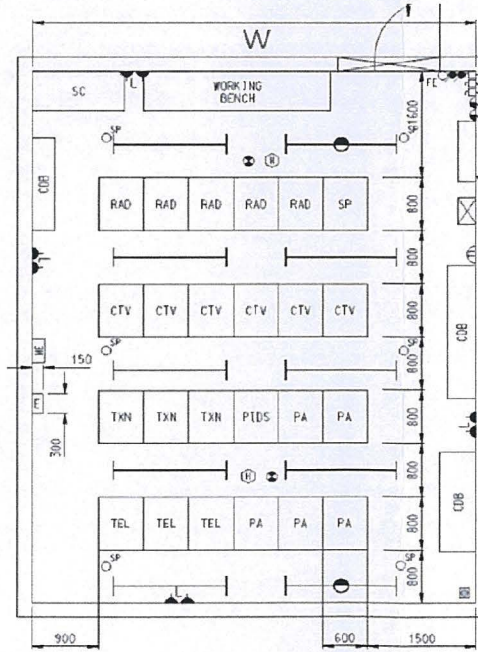
TYPE O8
TYPE O8A (W/ ELECTRICAL LOCK)
TYPE O8B (W/ ELECTRICAL STRIKE)

ROOM DATA SHEET	
ROOM NAME	TELECOM EQUIPMENT ROOM
ROOM NUMBER (To be Adopted)	200, 201, 202
FUNCTIONAL REQUIREMENTS	HOUSE TELECOM EQUIPMENT INCLUDING RADIO, COM, EACS, TIDS
FUNCTION	A. No Centralised UPS 1) City stations: Min 8m (L) x 6m (W) x 3m (H) x 3 TERs 2) Service building in southwest stations: Min 8m (L) x 6m (W) x 3m(H) x 2 TERs. 3) Service Building in Artamon, South & North Dive, see separate Room Schedule. B. With Centralised UPS 1) City stations: Min 8m (L) x 6m (W) x 3m (H) x 1 TER + Min 5.2m (L) x 6m (W) x 3m (H) x 1 TER 2) Service building in southwest stations: Min 8m (L) x 6m (W) x 3m(H) x 1 TER. 3) Service Building in Artamon, South & North Dive, see separate Room Schedule.
SIZE / DIMENSION	
LOCATION	PREFERRABLY DIRECT ABOVE CABLE TERMINATION ROOM
CONNECTION	DIRECT TO SERVICE COORIDOR
MATERIALS & FINISHES	
FLOOR	Epoxy Floor Coating on Granolithic
SKIRTING	Epoxy Floor Coating on Granolithic
WALL	Epoxy Paint on Fair Faced Concrete or Blockwork
CEILING	Wall Sealer Paint on Fair Faced Concrete
OTHERS	
DOORS & IRONMONGERY	SET 1
DOOR TYPE	O8A
CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)
DIRECTION OF SWING	Swing out at 90 degrees
FIRE RESISTANCE	SAME AS FRP AS THE ENCLOSURE
AIR RESISTANCE	N/A
STC RATING	20
LOCK FUNCTION	EACS
ACCESSORIES	Kick Plates
EACS/SECURITY LEVEL	HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1
OTHERS	
BUILDING SERVICES	
DELIVERY ROUTE SIZE	1.6 m (W) x 2.5 m (H)
RM. NOISE LEVEL	NR80
COMMUNICATIONS FACILITIES	RADIO COVERAGE RJ45 socket (digital phone) Qty 2 PABX analogue phones Qty 2 Direct Line Phones Qty 1 PSTN City Line phone Qty 1
ECS	A/C, 25.5 °C, 50% ± 10% RH, Standby-ventilation (Note 1), Essential power supply
LIGHTING	1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting
FIRE PROTECTION	DETECTION: Smoke Detection/Heat Detection SUPPRESSION: gas suppression EXTINGUISHER: Yes SEPARATION: Yes SMOKE EXTRACT: NIL OTHERS: --
ELECTRICAL/POWER REQUIREMENTS	GENERAL SOCKET: 6 SPECIFIC EQUIPMENT: - One TPN isolating switch from essential power supply - Earthing terminal - dedicated room db = 1 - All building services requirement above are indicative only. Contractor to ensure statutory compliance
PLUMBING & DRAINAGE	NIL
FIXTURES, EQUIPMENT & LOOSE FURNITURE	
TYPE & LOCATION	NIL
OTHERS	NIL
OTHERS	- No exposed water-bearing pipe within the room

A. No Centralised UPS

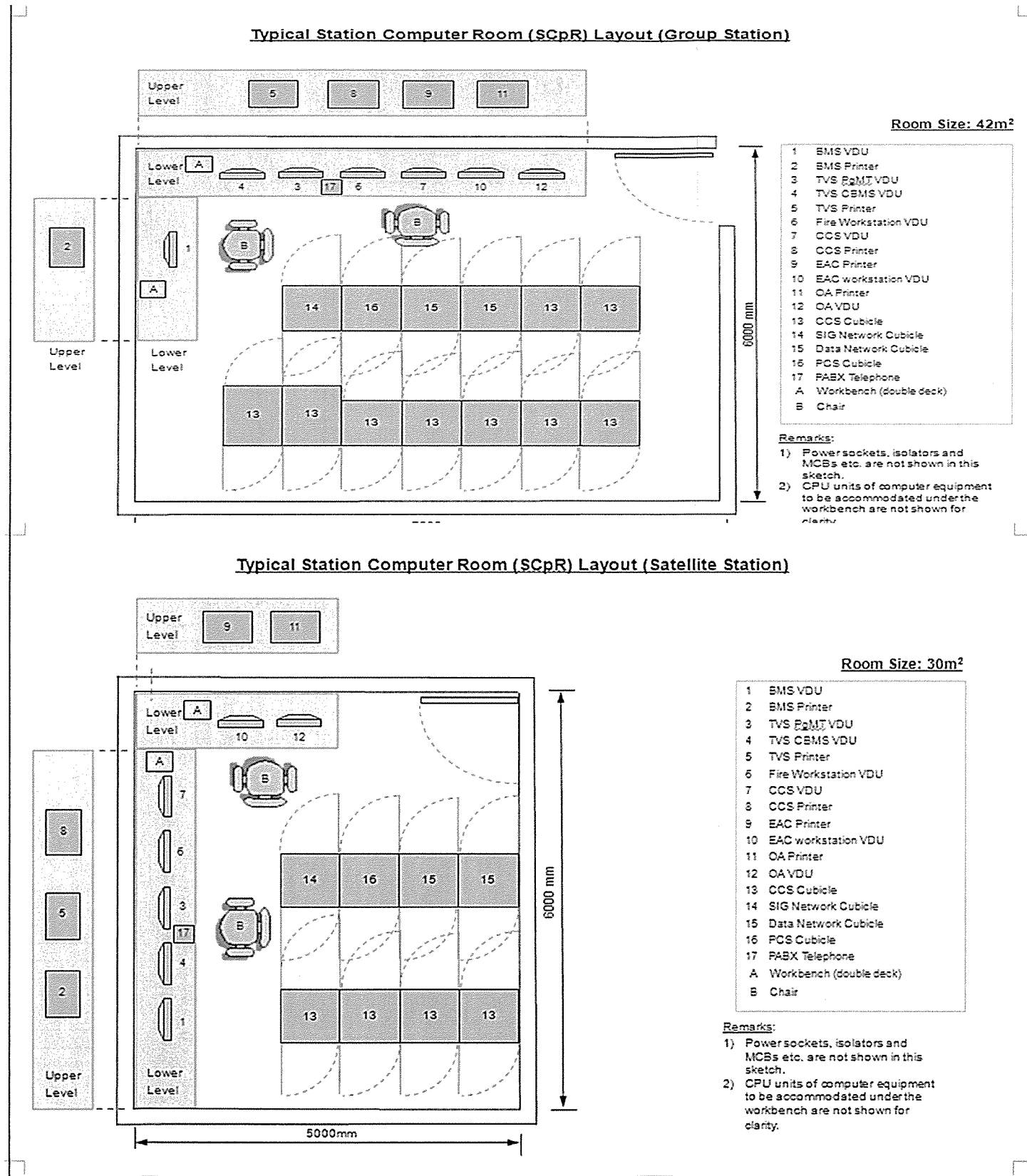


B. With Centralised UPS (2 NOS OF ROOMS ONLY IF WITH CENTRALIZED UPS IS PROVIDED BY OTHERS AND BATTERIES ARE INSTALLED OUTSIDE THE ROOMS)



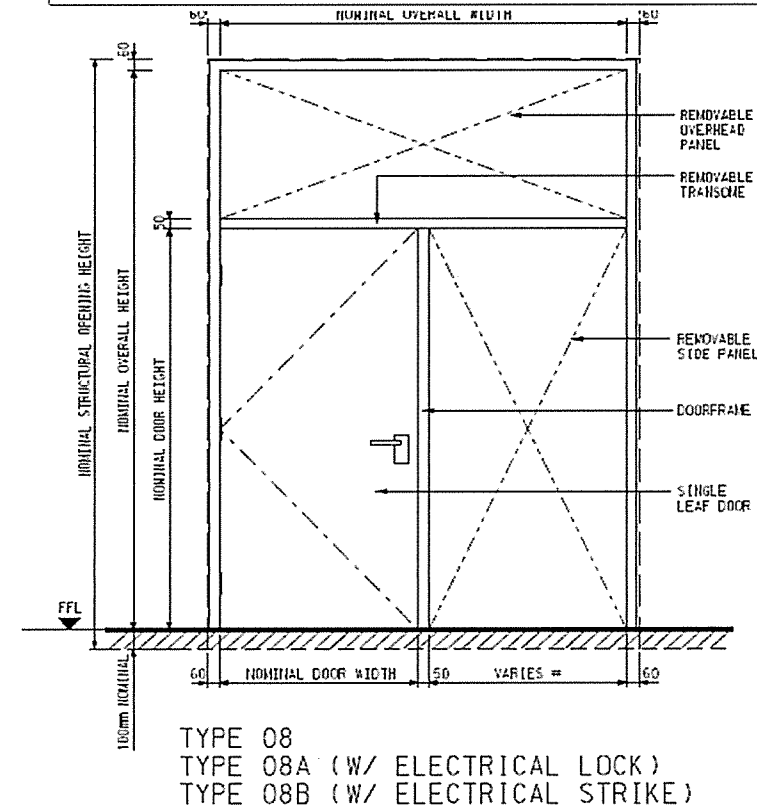
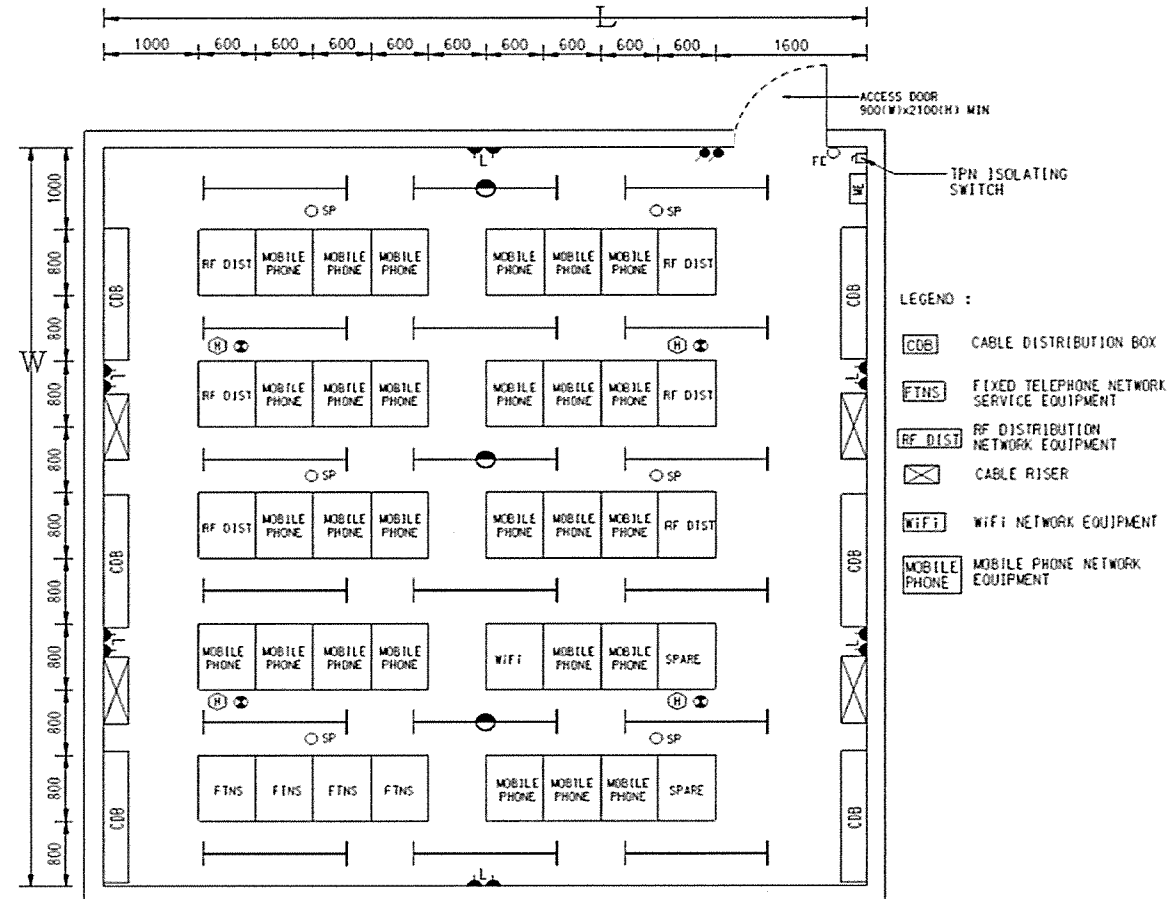
ROOM DATA SHEET	
ROOM NAME	STATION COMPUTER ROOM
ROOM NUMBER (To be Adopted)	205
FUNCTIONAL REQUIREMENTS	
FUNCTION	System equipment computer room for station controls
SIZE / DIMENSION (Note 1)	30m ² / 42m ²
LOCATION	Adjacent to Station Control Room where practicable
CONNECTION	Access through SCR preferred
MATERIALS & FINISHES	
FLOOR	Resilient tile on access floor
SKIRTING	Resilient skirting
WALL	Wall Based Paint on Plaster
CEILING	Mineral Fibre Tile
WATER TIGHTNESS*	
The complete absence of any leakage, seepage and damp patches.	
OTHERS	
- access floor to be 700mm minimum about AFFL of the adjoining concourse/platform floor - height of the raised floor shall be 580mm max.	
DOORS & IRONMONGERY	
DOOR TYPE	SET 1 05 if access is from corridor
DOOR TYPE	SET 2 03 if access is from SCR
CLEAR OPENING REQUIRED	2100mm(H) x 1050mm(W)
DIRECTION OF SWING	Swing-in at 90 degrees
FIRE RESISTANCE	Same FRP as the adjoining wall
AIR RESISTANCE	N/A
STC RATING	35
LOCK FUNCTION	EACS
ACCESSORIES	Door closer; acoustic seal if necessary; Door stop
EACS/SECURITY LEVEL	Latch operable by key outside; inside always free for exit
OTHERS	
HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1	
BUILDING SERVICES	
DELIVERY ROUTE SIZE	1.0m(W) x 2m(H)
RM. NOISE LEVEL	NR80
COMMUNICATIONS FACILITIES	
RADIO COVERAGE RJ45 socket (digital phone) Qty 2 PABX analogue phones Qty 2 Direct Line Phones Qty 1	
ECS	A/C, 25.5 °C, 50% ± 10% RH, Standby-ventilation (Note 3), Essential power supply
LIGHTING	
TYPE	FLUORESCENT
DIFFUSER	---
LUX	Essential: 300; Emergency: 10
IP	N/A
FIRE PROTECTION	
DETECTION	smoke detector
SUPPRESSION	gas suppression
EXTINGUISHER	Yes
SEPARATION	Yes
SMOKE EXTRACT	---
OTHERS	
ELECTRICAL/ POWER REQUIREMENTS	
GENERAL SOCKET	NUMBER: 2, LOCATION: WALL, SOCKET TYPE: Twin 10A, 230V, CONDUIT TYPE: Concealed
SPECIFIC EQUIPMENT	- Refer to power demand schedule for specific power requirements - Earthing terminal
PLUMBING & DRAINAGE	
NIL	
FIXTURES, EQUIPMENT & LOOSE FURNITURE	
TYPE & LOCATION	
OTHERS	
* Under floor cable access via raised floor * Earthing (terminals under the access floor) * All building services requirement above are indicative only. Contractor to ensure statutory compliance	
Note 1: 42m ² for Group Control Stations and 30m ² for Satellite Stations	
Note 2: Proposed size is based on the provision of centralised UPS with 6-hr backup in a separate room.	
(Note 3) For the Metro Station Room listed above	
- A standby ventilation system is not required for these rooms unless required by codes and standards and by Law.	
- The room must be fitted with duty cooling systems where the duty units must be connected to the central chilled water system and standby units must be connected to the separate water cooled package unit system supplied by the CSM Contractor.	

Typical Layout



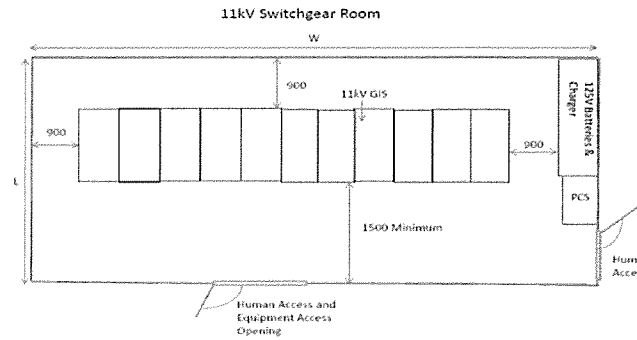
ROOM DATA SHEET				
ROOM NAME		COMMON TELECOM EQUIPMENT ROOM		
ROOM NUMBER (To be Adopted)		203		
FUNCTIONAL REQUIREMENTS				
FUNCTION		HOUSE TELECOM EQUIPMENT INCLUDING RADIO & COM		
SIZE / DIMENSION		To suit equipment sizes. Minimum 8m (L) x 9m(W). Height > 3m		
LOCATION		PREFERABLY DIRECT ABOVE CABLE TERMINATION ROOM		
CONNECTION		DIRECT TO SERVICE COORIDOR		
MATERIALS & FINISHES		WATER TIGHTNESS*		
FLOOR		Epoxy Floor Coating on Granolithic		
SKIRTING		Epoxy Floor Coating on Granolithic		
WALL		Epoxy Paint on Fair Faced Concrete or Blockwork		
CEILING		Wall Sealer Paint on Fair Faced Concrete		
OTHERS		The complete absence of any leakage, seepage and damp patches.		
DOORS & IRONMONGERY		SET 1		SET 2
DOOR TYPE		O8A		
CLEAR OPENING REQUIRED		2100mm (H) x 900mm (W)		
DIRECTION OF SWING		Swing out at 90 degrees		
FIRE RESISTANCE		SAME AS FRP AS THE ENCLOSURE		
AIR RESISTANCE		N/A		
STC RATING		20		
LOCK FUNCTION		EACS		
ACCESSORIES		Kick Plates		
EACS/SECURITY LEVEL		HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1		
OTHERS				
BUILDING SERVICES				
DELIVERY ROUTE SIZE		1.6 m (W) x 2.5 m (H)		
RM. NOISE LEVEL		NR80		
COMMUNICATIONS FACILITIES		RADIO COVERAGE RJ45 socket (digital phone) Qty 2 PABX analogue phones Qty 2 Direct Line Phones Qty 1		
ECS		A/C, 25.5 °C, 50% ± 10% RH, Standby ventilation ^(Note 1) , Essential power supply		
LIGHTING		1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting		
TYPE				
DIFFUSER				
LUX		Essential: 320; Emergency: 10		
IP		N/A		
FIRE PROTECTION		DETECTION: smoke detector SUPPRESSION: gas suppression EXTINGUISHER: Yes SEPARATION: Yes SMOKE EXTRACT: -- OTHERS: --		
ELECTRICAL/POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
		6	WALL	Twin 10A, 230V
		CONDUIT TYPE: EXPOSED		
SPECIFIC EQUIPMENT		- One TPN isolating switch from essential power supply - Earthing terminal - Dedicated Room DB = 1		
PLUMBING & DRAINAGE		NIL		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		NIL		
OTHERS		NIL		
OTHERS		- No exposed water-bearing pipe within the room - All building services requirement above are indicative only. Contractor to ensure statutory compliance		
(Note 1) For the Metro Station Rooms listed above				
- A standby ventilation system is not required for these rooms unless required by codes and standards and by Law.				
- The room must be fitted with duty cooling systems where the duty units must be connected to the central chilled water system and standby units must be connected to the separate water cooled package unit system supplied by the CSM Contractor.				

Typical Layout

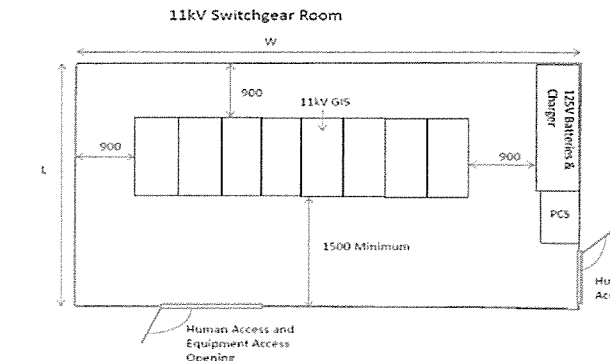


ROOM DATA SHEET	
ROOM NAME	11kV Switchgear Room
ROOM NUMBER (To be Adopted)	400A, 400B
FUNCTIONAL REQUIREMENTS	Switching for 11kV Power Supply Network
SIZE / DIMENSION	Refer to separate issued plant room schedule and comment sheet for each location, Room Height of 4m
LOCATION	Near to 11kV Transformer Room
CONNECTION	Direct to Service Corridor
MATERIALS & FINISHES	
FLOOR	Floor sealer on granolithic
SKIRTING	Floor sealer on granolithic
WALL	Fair faced concrete or blockwork
CEILING	Fair faced concrete
OTHERS	
DOORS & IRONMONGERY	SET 1 SET 2
DOOR TYPE	63A
CLEAR OPENING REQUIRED	3000mm (H) x 1500mm (W) 2100mm (H) x 900mm (W)
DIRECTION OF SWING	Swing out at 180 degrees Swing out at 180 degrees
FIRE RESISTANCE	Same FRP as the Adjoining Wall Same FRP as the Adjoining Wall
AIR RESISTANCE	N/A N/A
STC RATING	30 30
LOCK FUNCTION	EACS EACS
ACCESSORIES	Door closer; kick plates Door closer; kick plates
WATER TIGHTNESS*	
The complete absence of any leakage, seepage and damp patches.	
HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader unit Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1	
EACS/SECURITY LEVEL	
OTHERS	
BUILDING SERVICES	
DELIVERY ROUTE SIZE	2m (W) x 3m (H)
RM. NOISE LEVEL	NR 80
COMMUNICATIONS FACILITIES	
RADIO COVERAGE RJ45 socket (digital phone) Qty 1 PABX analogue phones Qty 1 Direct Line Phone Qty 1	
Ventilation system (2 duty fans each with 60% design flow) from essential power supply. No ventilation system to provide cooling. Cooling will be by air conditioning units (Note 1)	
ECS 1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting	
LIGHTING	
TYPE	DIFFUSER
LUX	Essential: 300; Emergency: 15
IP	N/A
FIRE PROTECTION	
DETECTION	smoke detector
SUPPRESSION	Gas suppression for room located below ground level, NIL for room located at or above ground level
EXTINGUISHER	Yes
SEPARATION	Yes
SMOKE EXTRACT	--
OTHERS	--
ELECTRICAL / POWER REQUIREMENTS	
GENERAL SOCKET	NUMBER: 2 LOCATION: Wall SOCKET TYPE: Twin 10A 230V CONDUIT TYPE: exposed
SPECIFIC EQUIPMENT	- Main Earth Terminal - One SP&N Wall Mounted (4-Way) MCB Distribution Board complete with 63A Incoming Switch - One 63A TPN Switch directly fed from the Essential Busbar of the LV Main Switchboard for Battery Charger - 2 x 10A Fused Connection Units from UPS Supply (for PCS)
PLUMBING & DRAINAGE	
Refer to BS Design	
FIXTURES, EQUIPMENT & LOOSE FURNITURE	
NIL	
OTHERS	
- No Water Pipe or Civil Expansion Joint inside the Room - No Water Tank above the Room - 2.1m (H) Basement for cables - Emergency Push Button shall be located away from the Lighting Switches and Door Frame to avoid Inadvertent Operation - Building services installed directly above the switchgear shall be avoided as far as possible - Electric Shock labels on the Door and Inside the Room. - All building services requirement above are indicative only. Contractor to ensure statutory compliance	
[Note 1] For the Metro Station Rooms listed above, the Room must	
- be provided with a mechanical supply and an exhaust system in accordance with Appendix B04b 3.1.4 Table 6 and include duty and standby cooling systems to provide cooling. A standby ventilation system is not required for these rooms unless required by codes and standards and by Law.	
- be fitted with duty cooling systems where the duty units must be connected to the central chilled water system and standby units must be connected to the separate water cooled package unit system supplied by the CSM Contractor.	

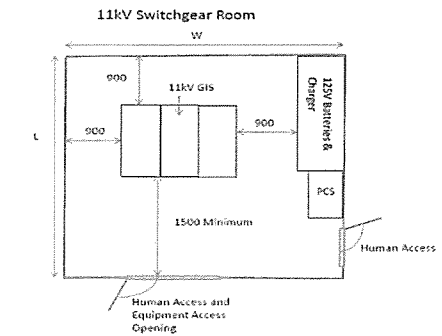
Typical Layout



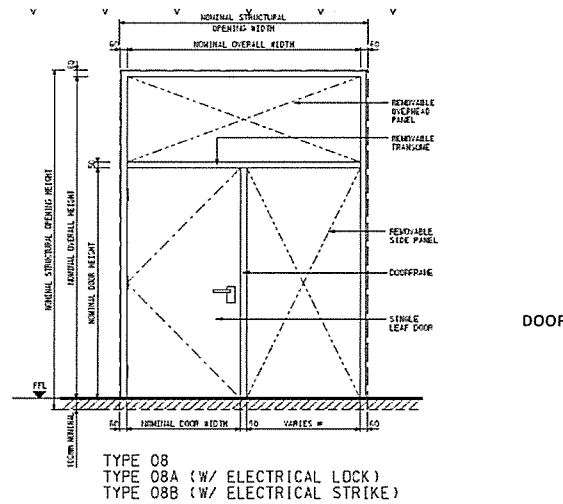
400A
Room Size of 9.3m (W) x 4.1m (L) = 38.13m² and;
400B
Room Size of 6m (W) x 4.1m (L) = 24.6m²
This design apply to southern dive where has 2 x 11kV SWITCHGEAR ROOMS (400A, 400B)



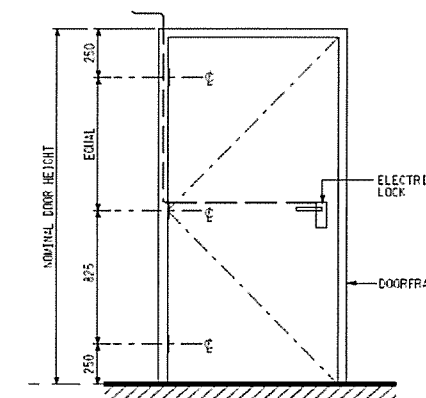
This Design (Room Size of 7.5m (W) x 4.1m (L) = 30.75m²) is for the 11kV SWITCHGEAR ROOM in ARTARMON



400A, 400B
Room Size of 4.5m (W) x 4.1m (L) = 18.45m²
This design apply to northern dive where has 2 x 11kV SWITCHGEAR ROOMS (400A & 400B)



DOOR

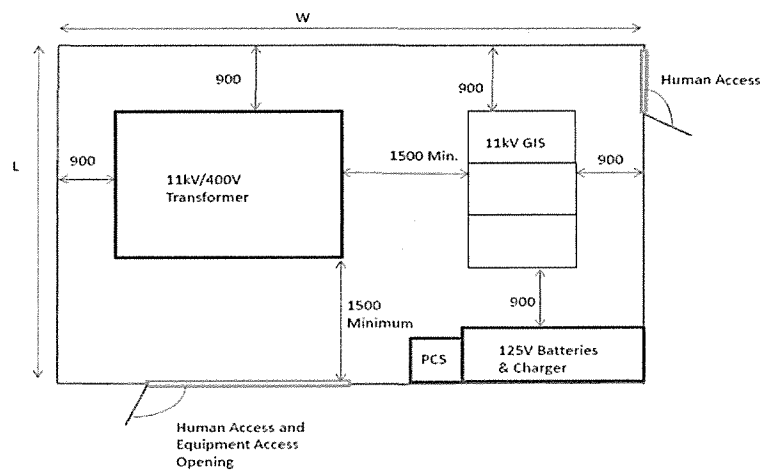


TYPE 05

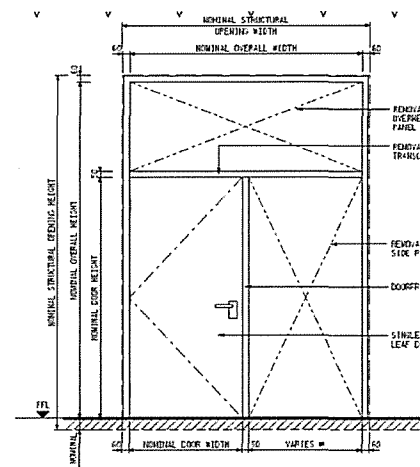
ROOM DATA SHEET	
ROOM NAME	11kV Switchboard & Transformer Room (11kV/400V)
ROOM NUMBER (To be Adopted)	400(A), 400(B), 400 (C), 400(D)
FUNCTIONAL REQUIREMENTS	
FUNCTION	Switching for 11kV Power Supply Network & Transform Voltage from 11kV to 400V
SIZE / DIMENSION	Room Height of 4m
LOCATION	Preferably Adjacent to LV Switchroom
CONNECTION	Direct to Service Corridor
MATERIALS & FINISHES	
FLOOR	Floor sealer on granolithic
SKIRTING	Floor sealer on granolithic
WALL	Fair faced concrete or blockwork
CEILING	Fair faced concrete
OTHERS	
DOORS & IRONMONGERY	
DOOR TYPE	SET 1 GSA
DOOR TYPE	SET 2 GSA
CLEAR OPENING REQUIRED	3000mm (H) x 2500mm (W)
DIRECTION OF SWING	Swing out at 180 degrees
FIRE RESISTANCE	Same FRP as the Adjoining Wall
AIR RESISTANCE	N/A
STC RATING	30
LOCK FUNCTION	EACS
ACCESSORIES	Door closer; kick plates
WATER TIGHTNESS*	
	5
The complete absence of any leakage, seepage and damp patches.	
<p>HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside.</p> <p>Local Control Unit (LCU) [Type A / Type B]</p> <p>Pin keypad Qty 1</p> <p>Break glass release unit Qty 1</p> <p>Card reader unit Qty 1</p> <p>Electric Door lock Qty 1</p> <p>Door Sensor/Reed Switch Qty 1</p>	
<p>HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside.</p> <p>Local Control Unit (LCU) [Type A / Type B]</p> <p>Pin keypad Qty 1</p> <p>Break glass release unit Qty 1</p> <p>Card reader unit Qty 1</p> <p>Electric Door lock Qty 1</p> <p>Door Sensor/Reed Switch Qty 1</p>	
EACS/SECURITY LEVEL	
OTHERS	
BUILDING SERVICES	
DELIVERY ROUTE SIZE	3m (W) x 3m (H)
RM. NOISE LEVEL	NR80
COMMUNICATIONS FACILITIES	
RADIO COVERAGE	
RI45 socket (digital phone) Qty 1 PABX analogue phones Qty 1 Direct Line Phone Qty 1	
Ventilation system from essential power supply.	
No ventilation system to provide cooling. Cooling will be by air conditioning units (Note 1) 1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting	
ECS	
No ventilation system to provide cooling. Cooling will be by air conditioning units (Note 1)	
LIGHTING	
TYPE	DIFFUSER
LUX	Essential: 300; Emergency: 15
IP	N/A
FIRE PROTECTION	
DETECTION	smoke detector
SUPPRESSION	Gas suppression for room located below ground level, NIL for room located at or above ground level
EXTINGUISHER	Yes
SEPARATION	Yes
SMOKE EXTRACT	
ELECTRICAL/POWER REQUIREMENTS	
GENERAL SOCKET	NUMBER: 2, LOCATION: Wall, SOCKET TYPE: Twin 10A, 230V, CONDUIT TYPE: Exposed
SPECIFIC EQUIPMENT	- Main Earth Terminal - One SP&N Wall Mounted (4-Way) MCB Distribution Board complete with 63A Incoming Switch - One 63A TPN Switch directly fed from the Essential Busbar of the LV Main Switchboard for Battery Charger - 2 x 10A Fused Connection Units from UPS Supply (for PCS) - double power point = 1
PLUMBING & DRAINAGE	
NIL	
FIXTURES, EQUIPMENT & LOOSE FURNITURE	
TYPE & LOCATION	
OTHERS	
- No Water Pipe or Civil Expansion Joint inside the Room - No Water Tank above the Room - 2.1m (H) Basement for cables - Emergency Push Button shall be located away from the Lighting Switches and Door Frame to avoid Inadvertent Operation - Building services installed directly above the switchgear and transformers shall be avoided as far as possible - Electric Shock labels on the Door and Inside the Room - All building services requirement above are indicative only. Contractor to ensure statutory compliance	
(Note 1) For the Metro Station Rooms listed above, the Room must	
- be provided with a mechanical supply and an exhaust system in accordance with Appendix B04b 3.1.4 Table 6 and include duty and standby cooling systems to provide cooling. A standby ventilation system is not required for these rooms unless required by codes and standards and by Law.	
- be fitted with duty cooling systems where the duty units must be connected to the central chilled water system and standby units must be connected to the separate water cooled package unit system supplied by the CSM Contractor.	

Typical Layout

11kV Switchboard & Transformer Room

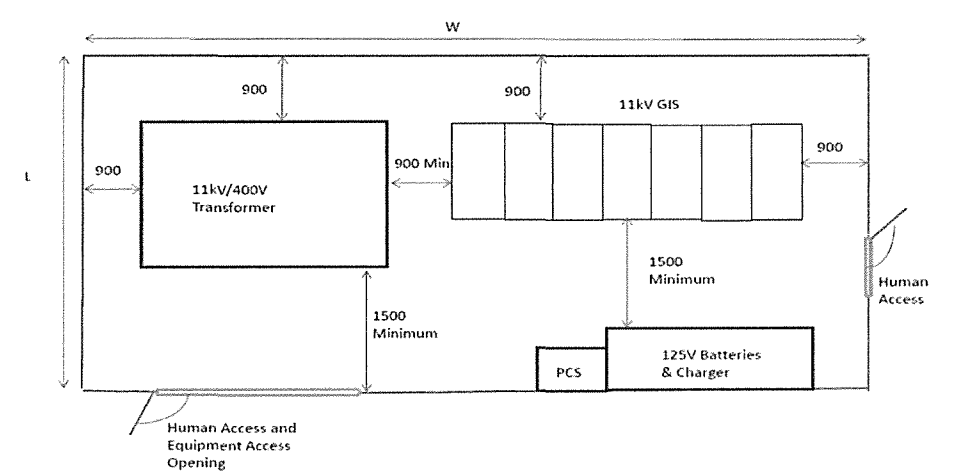


This Design (Room Size of 7.6m (W) x 4.5m (L) = 34.2m²) is for 4 x 11kV SWITCHBOARD AND TRANSFORMER ROOMS (400(A), 400(B), 400 (C) & 400(D)) in CROWS NEST, VICTORIA CROSS, BARANGAROO, MARTIN PLACE, PITT STREET AND CENTRAL

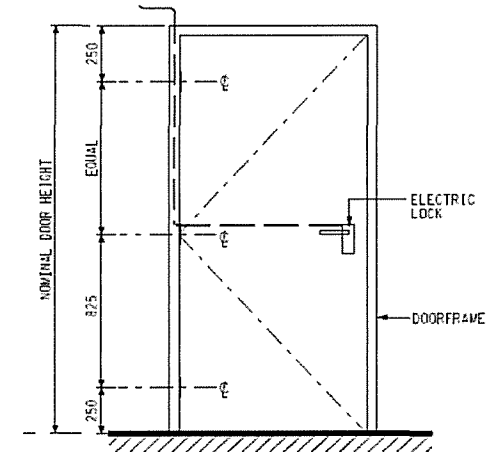


TYPE 08
TYPE 08A (W/ ELECTRICAL LOCK)
TYPE 08B (W/ ELECTRICAL STRIKE)

11kV Switchboard & Transformer Room



This Design (Room Size of 10m(W) x 4.5m (L) = 45m² for Room 400(A) and Room Size of 8.2m(W) x 4.5m(L) = 36.9m² for Room 400(B) & 400(C) and Room Size of 7.6m(W) x 4.5m(L) = 34.2m²) for Room 400 (D) is for WATERLOO

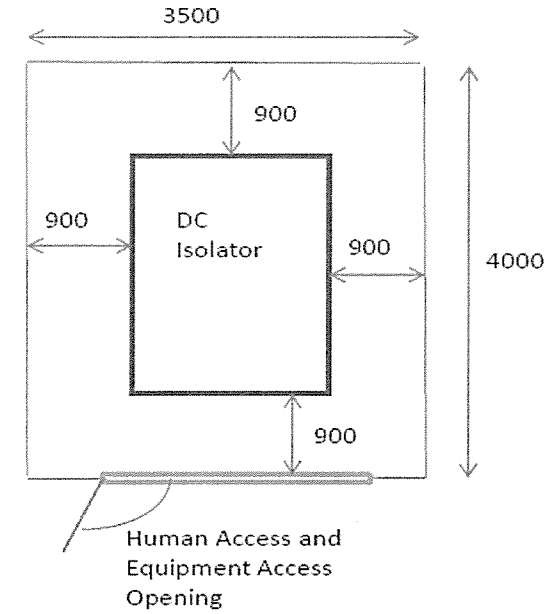


Type 5

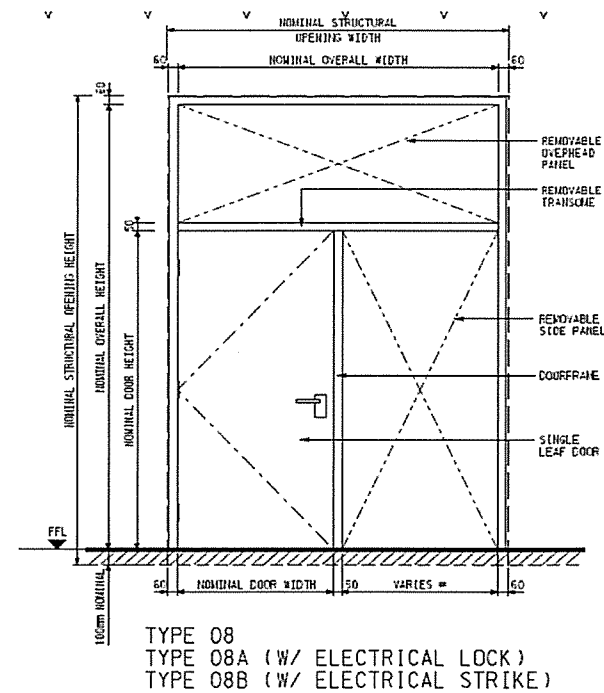
ROOM DATA SHEET					
ROOM NAME	DC ISOLATING LINKS ROOM (1500V)				
ROOM NUMBER (To be Adopted)	306A, 306B				
FUNCTIONAL REQUIREMENTS					
FUNCTION	For OHL Sectioning				
SIZE / DIMENSION	Refer to separate issued plant room schedule and comment sheet for each location, Room Height of 4m				
LOCATION	At Each End of Platform Level (Near Rectifier & DC Switchgear Room)				
CONNECTION	Direct to service corridor				
MATERIALS & FINISHES			WATER TIGHTNESS*		
FLOOR	Floor sealer on granolithic	N/A			
SKIRTING	Floor sealer on granolithic	The complete absence of any leakage, seepage and damp patches.			
WALL	Fair faced concrete or blockwork				
CEILING	Fair faced concrete				
OTHERS					
DOORS & IRONMONGERY		SET 1	SET 2		
DOOR TYPE	08A				
CLEAR OPENING REQUIRED	3000mm (H) x 2000mm (W)				
DIRECTION OF SWING	Swing out at 180 degrees				
FIRE RESISTANCE	Same FRP as the Adjoining Wall				
AIR RESISTANCE	N/A				
STC RATING	30				
LOCK FUNCTION	EACS				
ACCESSORIES	Door closer; kick plates				
EACS/SECURITY LEVEL		HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1			
BUILDING SERVICES					
DELIVERY ROUTE SIZE	1.5m (W) x 3m (H)				
RM. NOISE LEVEL	NR 80				
COMMUNICATIONS FACILITIES					
RADIO COVERAGE RJ45 socket (digital phone) Qty 1 PABX analogue phones Qty 1 Direct Line Phone Qty 1					
Ventilation system-from essential power supply.					
ECS	No ventilation system to provide cooling. Cooling will be by air conditioning units (Note 1)				
LIGHTING	TYPE	Fluorescent			
	DIFFUSER	--			
	LUX	Essential: 300; Emergency: 15			
FIRE PROTECTION	DETECTION	smoke detector			
	SUPPRESSION	Gas suppression for room located below ground level, NIL for room located at or above ground level			
	EXTINGUISHER	Yes			
	SEPARATION	Yes			
	SMOKE EXTRACT	--			
ELECTRICAL/ POWER REQUIREMENTS	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE	
	GENERAL SOCKET	2	Wall	Twin 10A, 230V	Exposed
	SPECIFIC EQUIPMENT	- Main Earth Terminal - One 20A Double Pole Isolating Switch from Essential Power Supply - 2 x 10A Fused Connection Units from UPS Supply (for PCS)			
PLUMBING & DRAINAGE	NIL				
FIXTURES, EQUIPMENT & LOOSE FURNITURE					
TYPE & LOCATION	NIL				
OTHERS	NIL				
OTHERS	- No Water Pipe or Civil Expansion Joint inside the Room - No Water Tank above the Room - 2.1m (H) cable basement or under platform void for cables. - Building services installed directly above the DC Isolator/Switch Panel shall be avoided as far as possible - Electric Shock labels on the Door and Inside the Room - All building services requirement above are indicative only. Contractor to ensure statutory compliance				
(Note 1) For the Metro Station Rooms listed above, the Room must					
- be provided with a mechanical supply and an exhaust system in accordance with Appendix B04b 3.1.4 Table 6 and include duty and standby cooling systems to provide cooling. A standby ventilation system is not required for these rooms unless required by codes and standards and by Law.					
- be fitted with duty cooling systems where the duty units must be connected to the central chilled water system and standby units must be connected to the separate water cooled package unit system supplied by the CSM Contractor.					

Typical Layout

DC Isolator Link Room

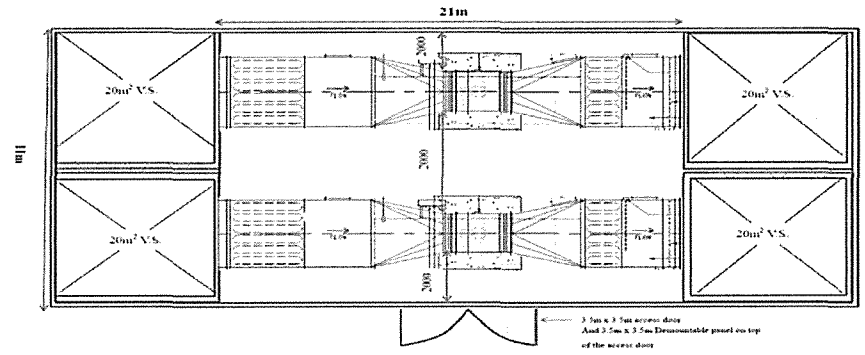


ROOM DIMENSIONS SHOWN HERE ARE FOR CITY STATIONS ONLY. (FOR ARTAMON AND SOUTHERN DIVE, REFER TO ROOM SCHEDULE)



DOOR

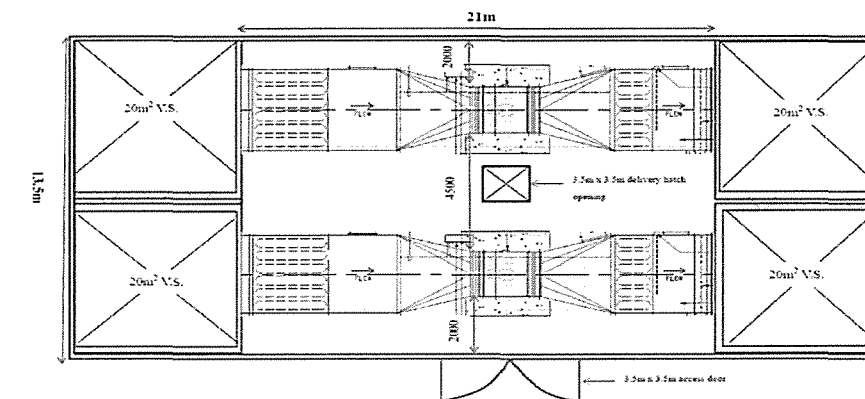
ROOM DATA SHEET	
ROOM NAME	TUNNEL VENTILATION FAN ROOM
ROOM NUMBER (To be Adopted)	602A, 602B, 602C, 602D
FUNCTIONAL REQUIREMENTS	
FUNCTION	Plant room to house TVS plant
SIZE / DIMENSION	Refer to separate issued plant room schedule
LOCATION	Close to tunnels
CONNECTION	Direct to service corridor and track
MATERIALS & FINISHES	
FLOOR	Floor sealer on granolithic
SKIRTING	Floor sealer on granolithic
WALL	Fair faced concrete or blockwork
CEILING	Fair faced concrete
OTHERS	
DOORS & IRONMONGERY	
DOOR TYPE	SET 1 10A
CLEAR OPENING REQUIRED	As shown on plans
DIRECTION OF SWING	Swing out at 180 degrees
FIRE RESISTANCE	Same FRP as the Adjoining Wall
AIR RESISTANCE	N/A
STC RATING	30
LOCK FUNCTION	Latch operable by key outside; inside always free for exit
ACCESSORIES	Door closer; kick plates
MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader unit Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1	
EACS/SECURITY LEVEL	
OTHERS	
BUILDING SERVICES	
DELIVERY ROUTE SIZE	As shown on plans or at least 3.5m (W) x 3.5m (H)
RM. NOISE LEVEL	To meet local requirement
COMMUNICATIONS FACILITIES	
ECS	Not required unless there is local requirement for ventilation provision
LIGHTING	
TYPE	Fluorescent
DIFFUSER	yes
LUX	300 Lux (control), 160 Lux (General), 10 Lux (emergency)
IP	weatherproof IP54
FIRE PROTECTION	
DETECTION	Refer to local requirement / Fire and life safety strategy or with the minimum: smoke / heat detection = 1 audible alarm=1
SUPPRESSION	sprinkler subject to FSI strategy
EXTINGUISHER	Yes
SEPARATION	Yes
SMOKE EXTRACT	--
OTHERS	--
ELECTRICAL/POWER REQUIREMENTS	
GENERAL SOCKET	NUMBER: 2, LOCATION: Wall, SOCKET TYPE: Twins 10A, 230V, CONDUIT TYPE: Exposed
SPECIFIC EQUIPMENT	- Earthing terminal
PLUMBING & DRAINAGE	
Need to provide floor drain if sprinkler is required by Fire & Life Safety Strategy	
FIXTURES, EQUIPMENT & LOOSE FURNITURE	
TYPE & LOCATION	NIL
OTHERS	NIL
OTHERS	
- Plinth as required and advised by the Designer. - Lifting Hook to be provided. - Yellow arrow to be provided. - Cat ladder to be provided inside vent shaft. - Floor of air plenum should be constructed to fall to the floor drains. - All building services requirement above are indicative only. Contractor to ensure statutory compliance	



21m (L) x 11m(W) x 6.5m (H)
2 nos. Horizontal TVF Room Layout

Remark:
• Clear plant room size excludes plenum

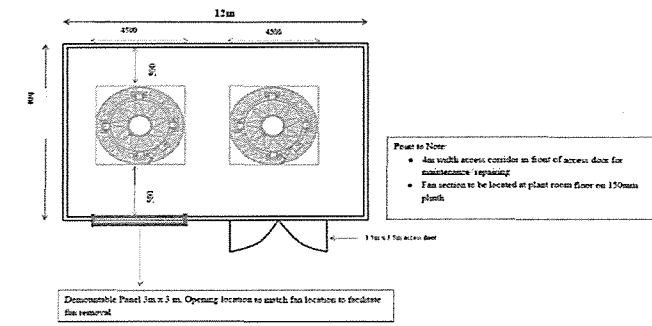
Version: no 8_24 5 2017



21m (L) x 13.5m(W) x 6m (H)
2 nos. Horizontal TVF Room Layout

Remark:
• Clear plant room size excludes plenum

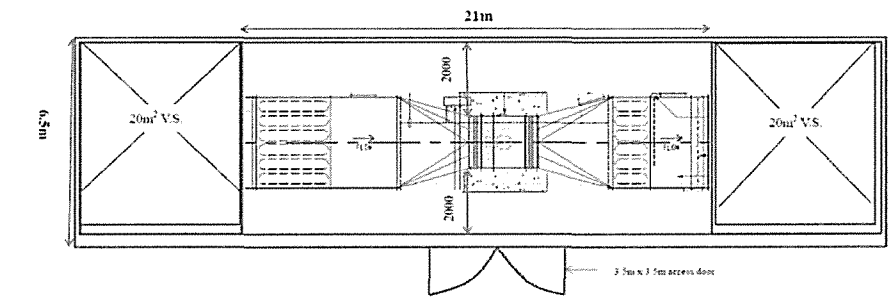
Version: no 8_24 5 2017



12m (L) x 6m(W) x 21m (H)
2 nos. Vertical TVF Room Layout

Remark: Clear plant room size excludes plenum

Version: no 8_24 5 2017

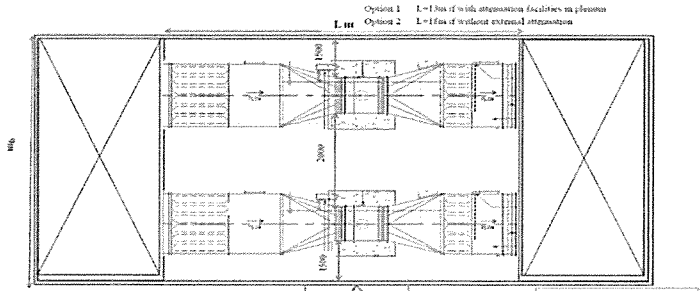


21m (L) x 6.5m(W) x 6m (H)
1 nos. Horizontal TVF Room Layout

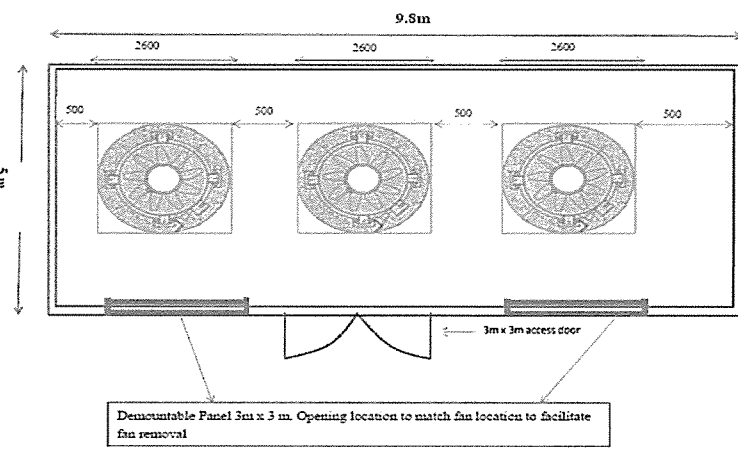
Remark: Clear plant room size excludes plenum

Version: no 8_24 5 2017

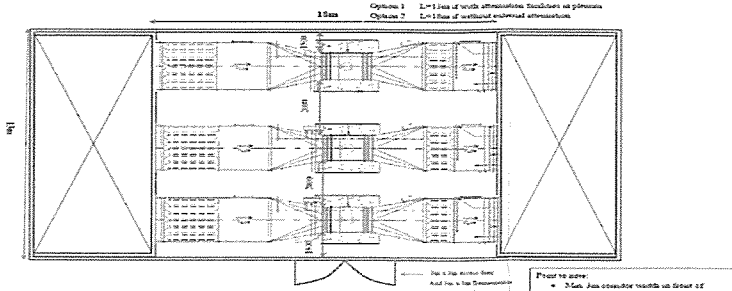
ROOM DATA SHEET	
ROOM NAME	Trackway Exhaust Fan Room
ROOM NUMBER (To be Adopted)	605A, 605B
FUNCTIONAL REQUIREMENTS	Plant room to house TEFs
SIZE / DIMENSION	Refer to separate issued plant room schedule
LOCATION	Close to station trackways
CONNECTION	Direct to service corridor and track
MATERIALS & FINISHES	
FLOOR	Floor sealer on granolithic
SKIRTING	Floor sealer on granolithic
WALL	Fair faced concrete or blockwork
CEILING	Fair faced concrete
OTHERS	
DOORS & IRONMONGERY	SET 1 SET 2
DOOR TYPE	10A
CLEAR OPENING REQUIRED	As shown on plans
DIRECTION OF SWING	Swing out at 180 degrees
FIRE RESISTANCE	Same FRP as the Adjoining Wall
AIR RESISTANCE	N/A
STC RATING	30
LOCK FUNCTION	Latch operable by key outside; inside always free for exit
ACCESSORIES	Door closer; kick plates
EACS/SECURITY LEVEL	
OTHERS	
BUILDING SERVICES	As shown on plans or at least 3m (W) x 3m (H)
DELIVERY ROUTE SIZE	To meet local requirement
RM. NOISE LEVEL	
COMMUNICATIONS FACILITIES	
ECS	Not required unless there is local requirement for ventilation provision
LIGHTING	TYPE: 1) Fluorescent 2) motion sensors 3) BMS 4) emergency lighting DIFFUSER: yes LUX: 300 Lux (control), 160 Lux (General), 10 Lux (emergency) IP: weatherproof IP54
FIRE PROTECTION	DETECTION: Refer to local requirement / Fire and life safety strategy or with the minimum: 1) Smoke Detection/Heat Detection 2) audible alarms SUPPRESSION: sprinkler subject to FSI strategy EXTINGUISHER: Yes SEPARATION: Yes SMOKE EXTRACT: -- OTHERS: --
ELECTRICAL/POWER REQUIREMENTS	GENERAL SOCKET: 2 SPECIFIC EQUIPMENT: Earthing terminal
PLUMBING & DRAINAGE	Need to provide floor drain if sprinkler is required by Fire & Life Safety Strategy
FIXTURES, EQUIPMENT & LOOSE FURNITURE	NIL
TYPE & LOCATION	NIL
OTHERS	NIL
OTHERS	- Plinth as required and advised by the Designer. - Lifting Hook to be provided. - Yellow arrow to be provided. - Cat ladder to be provided inside vent shaft. - Floor of air plenum should be constructed to fall to the floor drains. - Provision of 150mm door curb is required if no plinth is installed for equipments / with sprinklers installed and without floor drain provision. - All building services requirement above are indicative only. Contractor to ensure statutory compliance



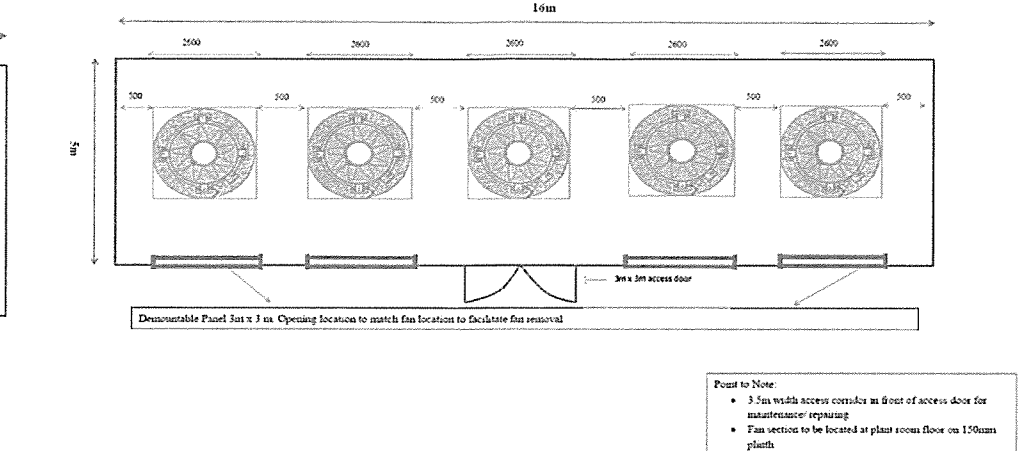
9.8m (L) x 6m (H)
2 nos. Horizontal TEF Room Layout
 Remark:
 • Clear plant room size excludes plenum
 • If for combine room for 5 nos. of TEF, please add up the width requirement
 Version no 8_24-5-2017



9.8m (L) x 5m (W) x 18m (H)
3 nos. Vertical TEF Room Layout
 Remark: Clear plant room size excludes plenum
 Version no 8_24-5-2017



16m (L) x 5m (W) x 18m (H)
5 nos. Vertical TEF Room Layout
 Remark: Clear plant room size excludes plenum
 Version no 8_24-5-2017

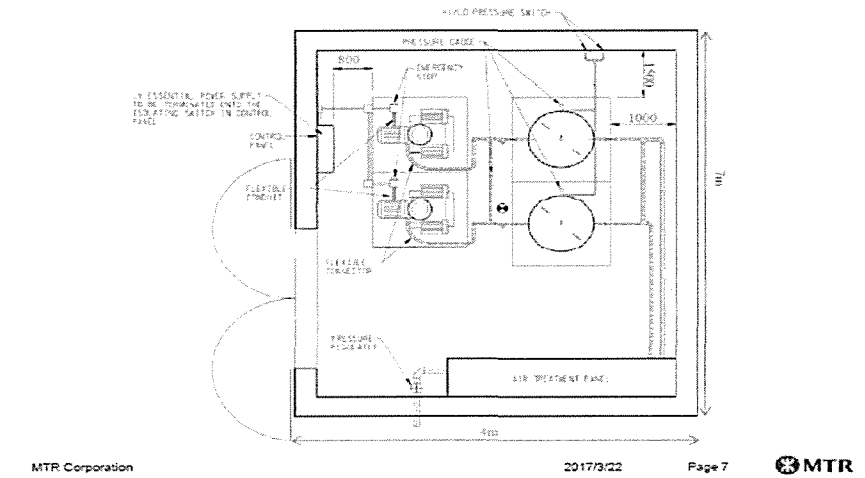


16m (L) x 5m (W) x 18m (H)
5 nos. Vertical TEF Room Layout
 Remark: Clear plant room size excludes plenum
 Version no 8_24-5-2017

ROOM DATA SHEET				
ROOM NAME		TVS Air Compressor and Receiver Room		
ROOM NUMBER (To be Adopted)		610A, 613B		
FUNCTIONAL REQUIREMENTS				
FUNCTION		Plantroom for Air Compressor / Receiver		
SIZE / DIMENSION		Refer to separate issued plant room schedule and comment sheet for each location		
LOCATION		Adjacent to TEF / TSF / TVS Fan Rooms		
CONNECTION		Direct to service corridor		
MATERIALS & FINISHES		WATER TIGHTNESS*		
FLOOR		Floor sealer on granolithic		
SKIRTING		Floor sealer on granolithic		
WALL		Fair faced concrete or blockwork		
CEILING		Fair faced concrete		
OTHERS		--		
DOORS & IRONMONGERY		SET 1		SET 2
DOOR TYPE		10A		
CLEAR OPENING REQUIRED		2100mm (H) x 900mm (W) per door		
DIRECTION OF SWING		Swing out at 180 degrees		
FIRE RESISTANCE		Same FRP as the Adjoining Wall		
AIR RESISTANCE		N/A		
STC RATING		30		
LOCK FUNCTION		Latch operable by key outside; inside always free for exit		
ACCESSORIES		Door closer; kick plates		
EACS/SECURITY LEVEL		MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1		
BUILDING SERVICES				
DELIVERY ROUTE SIZE		2m (W) x 2.1m (H)		
RM: NOISE LEVEL		Refer to local requirement		
COMMUNICATIONS FACILITIES				
ECS		By ventilation with 8 air-change per hour and maximum temperature not to exceed 40 deg C; two duty fans with 60% design flow each.		
LIGHTING		Fluorescent. 1) motions sensors 2) BMS 3) emergency lighting		
		TYPE		
		DIFFUSER		
		LUX		
		IP		
FIRE PROTECTION		smoke detection		
		SUPPRESSION		
		EXTINGUISHER		
		SEPARATION		
		SMOKE EXTRACT		
		OTHERS		
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
		2	Wall	Twins 10A, 230V
		CONDUIT TYPE		
		Exposed		
		GENERAL SOCKET		
		SPECIFIC EQUIPMENT		
		- Earthing terminal		
		- double power point = 2 numbers		
PLUMBING & DRAINAGE		Floor drain		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		NIL		
OTHERS		NIL		
OTHERS		- Plinth and lifting hook as required and advised by designer. - Yellow & black paint strip to be provided. - 150mm curb to be provided at entrance door. - All building services requirement above are indicative only. Contractor to ensure statutory compliance		

Typical Layout

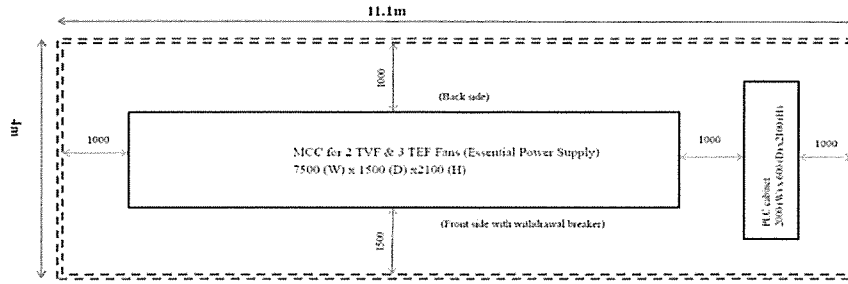
Air Compressor and Receiver Room at Central Station



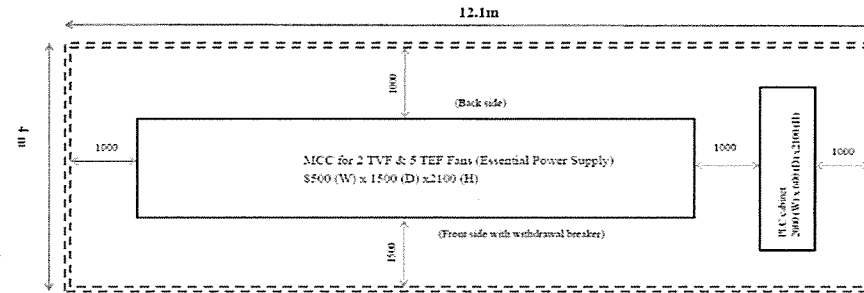
ROOM DATA SHEET	
ROOM NAME	MCC and Control Equipment Room
ROOM NUMBER (To be Adopted)	508, 509A, 509B
FUNCTIONAL REQUIREMENTS	
FUNCTION	Room for MCC / TVS Control
SIZE / DIMENSION	Refer to typical layout
LOCATION	Adjacent to TEF / TSF / TVS Fan Rooms
CONNECTION	Direct to service corridor
MATERIALS & FINISHES	
FLOOR	Floor sealer on granolithic
SKIRTING	Floor sealer on granolithic
WALL	Fair faced concrete or blockwork
CEILING	Fair faced concrete
OTHERS	
DOORS & IRONMONGERY	
DOOR TYPE	SET 1 OBA
SET 2	
CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W) Door not shown in diagram but to be provided
DIRECTION OF SWING	Swing out at 180 degrees
FIRE RESISTANCE	Same FRP as the Adjoining Wall
AIR RESISTANCE	N/A
STC RATING	20
LOCK FUNCTION	EACS
ACCESSORIES	Door closer; kick plates
EACS/SECURITY LEVEL	
OTHERS	
BUILDING SERVICES	
DELIVERY ROUTE SIZE	2m (W) x 2.5m (H)
RM. NOISE LEVEL	Refer to local requirement
COMMUNICATIONS FACILITIES	
ECS	Air-conditioning to maintain 28 deg C and back-up ventilation to be provided (Note 1)
LIGHTING	
TYPE	Fluorescent
DIFFUSER	N/A
LUX	300 Lux (control), 160 Lux (General), 30 Lux (emergency)
IP	N/A
FIRE PROTECTION	
DETECTION	smoke detection
SUPPRESSION	gas suppression
EXTINGUISHER	Yes
SEPARATION	Yes
SMOKE EXTRACT	--
OTHERS	
ELECTRICAL/ POWER REQUIREMENTS	
GENERAL SOCKET	NUMBER: 2, LOCATION: Wall, SOCKET TYPE: Twins 10A, 230V, CONDUIT TYPE: Exposed
SPECIFIC EQUIPMENT	<ul style="list-style-type: none"> - For main MCC (i.e. Directly connected to service transformer), lighting and general socket shall be fed from another power supply source. - One 125V DC Isolating switch derived from the nearest 125V DC battery charger energised from the same power source. - Earthing Terminal. - Two fused connection units from centralised UPS.
PLUMBING & DRAINAGE	
NIL	
FIXTURES, EQUIPMENT & LOOSE FURNITURE	
NIL	
TYPE & LOCATION	
NIL	
OTHERS	
<ul style="list-style-type: none"> - Floor tolerance 3mm max. under a 3m long straight edge placed on any plane surface or edge in any direction. - Lifting hook as required. - No water pipe inside the room. - No water tank above the room. - No movement joint inside the room. - Yellow arrow to be provided. - Electrical shock label to be provided. - Provision of 150mm door curb is required if no plinth is installed for equipments / with sprinklers installed and without floor drain provision. 	
<p>(Note 1) For the Metro Station Rooms listed above, the Room must</p> <ul style="list-style-type: none"> - be provided with a mechanical supply and an exhaust system in accordance with Appendix B04b 3.1.4 Table 6 and include duty and standby cooling systems to provide cooling. A standby ventilation system is not required for these rooms unless required by codes and standards and by Law. - be fitted with duty cooling systems where the duty units must be connected to the central chilled water system and standby units must be connected to the separate water cooled package unit system supplied by the CSM Contractor. 	

Typical Layout

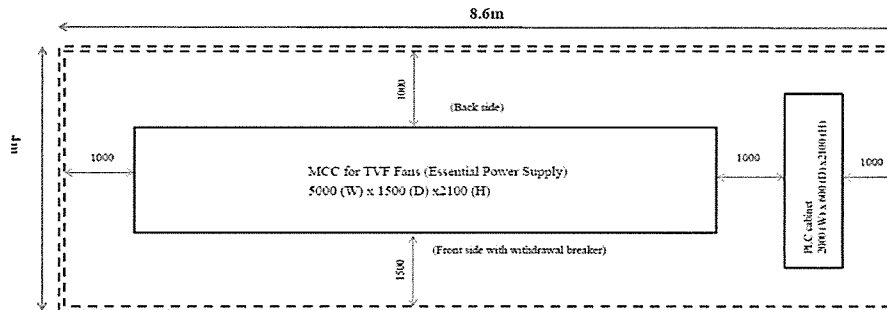
MCC AND CONTROL EQUIPMENT SHOULD BE A SHARED ROOM FOR STATION ECS AND TVS MCC & CONTROL EQUIPMENT.
SPATIAL DIMENSIONS SHOWN HERE ARE REQUIREMENT FOR TVS SYSTEM ONLY.



MCC and Control Equipment Room for 2 TVF & 3 TEF (TVS Spatial Requirement, Shared Room with ECS)



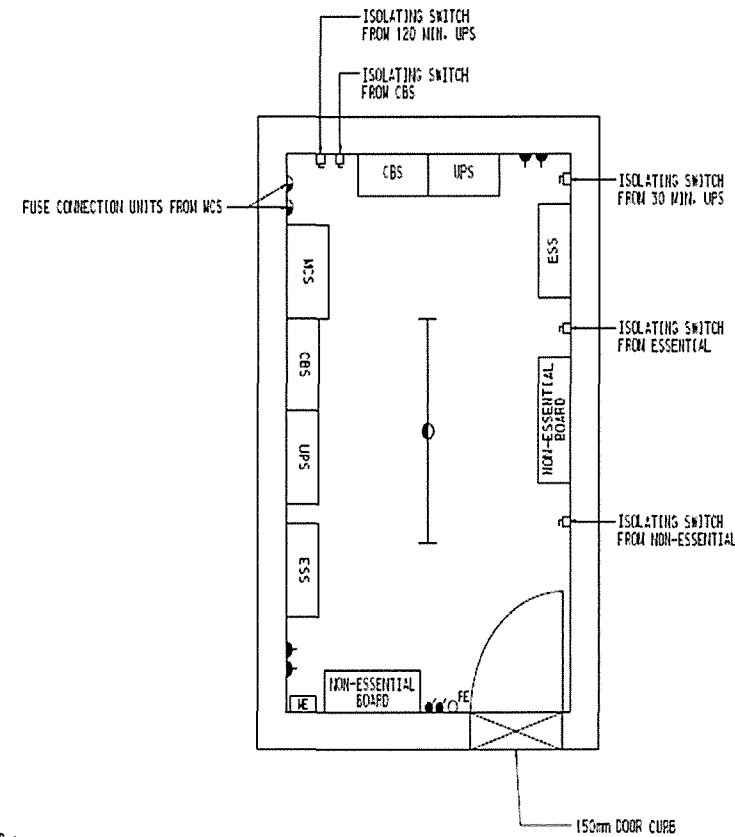
MCC and Control Equipment Room for 2 TVF & 5 TEF (TVS Spatial Requirement, Shared Room with ECS)







MCC and Control Equipment Room for TVF Fans (TVS Spatial Requirement, Shared Room with ECS)

ROOM DATA SHEET									
ROOM NAME	Trackside LV Switch Room								
ROOM NUMBER (To be Adopted)	614A, 614B								
FUNCTIONAL REQUIREMENTS									
FUNCTION	Trackside LV circuits								
SIZE / DIMENSION	3x4x3.5 (LxWxH)								
LOCATION	Two in total. One at each platform end								
CONNECTION	Direct to service corridor								
MATERIALS & FINISHES									
FLOOR	Floor sealer on granolithic								
SKIRTING	Floor sealer on granolithic								
WALL	Fair faced concrete or blockwork								
CEILING	Fair faced concrete								
OTHERS	--								
DOORS & IRONMONGERY									
DOOR TYPE	SET 1 08A								
CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)								
DIRECTION OF SWING	Swing in at 180 degrees								
FIRE RESISTANCE	Same FRP as the Adjoining Wall								
AIR RESISTANCE	N/A								
STC RATING	20								
LOCK FUNCTION	EACS								
ACCESSORIES	Door closer; kick plates								
EACS/SECURITY LEVEL	MEDIUM - Fail safe electric lock: latch retracted (or outside lever handles unlocked) electrically by Access card / remote release switch on non-security sides; alternatively, latch retracted mechanically by lever handle inside or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1								
OTHERS	--								
BUILDING SERVICES									
DELIVERY ROUTE SIZE	1.6m (W) x 2.5m (H) for LV Switchboard								
RM. NOISE LEVEL	Refer to local requirement								
COMMUNICATIONS FACILITIES	RADIO COVERAGE RJ45 socket (digital phone) Qty 1 PABX analogue phones Qty 1 Direct Line Phone Qty 1								
ECS	By ventilation with 8 air-change per hour and maximum temperature not to exceed 40 deg C; two duty fans with 60% design flow each.								
LIGHTING	TYPE 1) Fluorescent 2)BMS 3) emergency lighting 4) lighting control Lighting Generally in accordance with AS1680 & SPR 17. Lighting control via DALI system. timers, motions sensors to be documented in a lighting control document.								
	DIFFUSER N/A								
	LUX 300 Lux (control), 160 Lux (General), 10 Lux (emergency)								
	IP N/A								
FIRE PROTECTION	DETECTION smoke detector								
	SUPPRESSION gas suppression								
	EXTINGUISHER Yes								
	SEPARATION Yes								
	SMOKE EXTRACT --								
	OTHERS --								
ELECTRICAL/POWER REQUIREMENTS	<table border="1"> <thead> <tr> <th>NUMBER</th> <th>LOCATION</th> <th>SOCKET TYPE</th> <th>CONDUIT TYPE</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>Wall</td> <td>Twins 10A, 230V</td> <td>Exposed</td> </tr> </tbody> </table> <p>- Isolating switches derived from LV Essential Power Supply, LV Non-essential Power Supply, 30 min. centralized UPS. (Quantities and ratings are location specific). - Two fused connection units for CCS. Each directly derived from 30 min. centralized UPS distribution board (subject to confirmation by CCS). - Earthing terminal - double power point = 2</p>	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE	2	Wall	Twins 10A, 230V	Exposed
NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE						
2	Wall	Twins 10A, 230V	Exposed						
PLUMBING & DRAINAGE	--								
FIXTURES, EQUIPMENT & LOOSE FURNITURE									
TYPE & LOCATION	NIL								
OTHERS	NIL								
OTHERS	- No water pipe inside the room. - No water tank above the room. - 150mm curb to be provided at entrance door. - All building services requirement above are indicative only. Contractor to ensure statutory compliance								

Typical Layout



LEGEND :

-  DISTRIBUTION BOARD SUPPLIED FROM UPS SUPPLY
-  DISTRIBUTION BOARD SUPPLIED FROM CBS SUPPLY
-  DISTRIBUTION BOARD SUPPLIED FROM ESSENTIAL SUPPLY
-  DISTRIBUTION BOARD SUPPLIED FROM NON-ESSENTIAL SUPPLY

Note: Door swing should be 180 degree which is not indicated in the above drawing

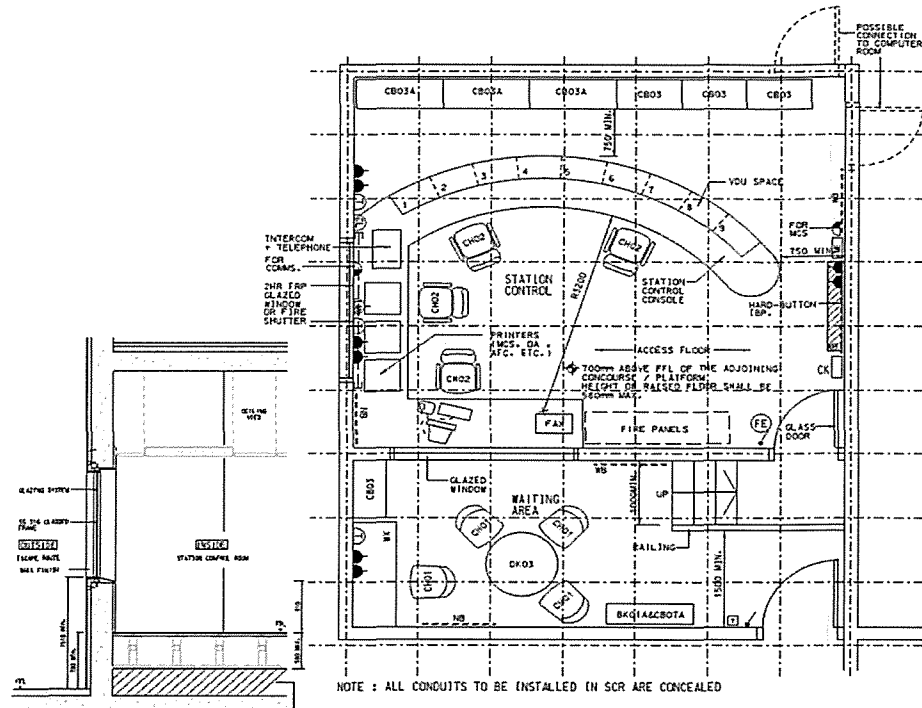
ROOM DATA SHEET	
ROOM NAME (Note 1)	STATION CONTROL ROOM
ROOM NUMBER (To be Adopted)	1009
FUNCTIONAL REQUIREMENTS	
FUNCTION (Note 2)	Station controller's office for the control and monitoring of the stations operations with separate waiting area / staff meal area
SIZE / DIMENSION (Note 3)	42 m ² for Group Station Control Room (Exclude "waiting area / staff meal area") (i.e. 42 m ² (GSCR) + 13 m ² (Waiting area / Staff Meal Area) = 55 m ²) 36 m ² for Satellite Station Control Room (Exclude "waiting area / staff meal area") (i.e. 36 m ² (SCR) + 13 m ² (Waiting area / Staff Meal Area) = 49 m ²)
LOCATION	Quick access to Sydney Metro areas
CONNECTION	Glazed opening between control and waiting area
MATERIALS & FINISHES	
FLOOR	Resilient Tile on Access Floor
SKIRTING	Resilient Skirting
WALL	Water based paint on plaster
CEILING	Fibre Cement board
OTHERS	- access floor to be 700mm minimum about AFFL of the adjoining concourse/platform floor - height of the raised floor shall be 580mm max.
DOORS & IRONMONGERY	
	SET 1
	SET 2
DOOR TYPE	05 at access to waiting area
CLEAR OPENING REQUIRED	2300mm (H) x 1050mm (W)
DIRECTION OF SWING	Swing in at 90 degrees
FIRE RESISTANCE	Same FRP as the adjoining wall
AIR RESISTANCE	--
STC RATING	35
LOCK FUNCTION	EACS
ACCESSORIES	Door closer; acoustic seal; door viewer; door stop
EACS/SECURITY LEVEL	High: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card and PIN pad / remote release switch on outsides and latch retracted mechanically by lever handle inside or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1
BUILDING SERVICES	
DELIVERY ROUTE SIZE	1m(W) x 2.3m(H) for SCR console delivery
RM. NOISE LEVEL	NR40
COMMUNICATIONS FACILITIES	
ECS	A/C with independent room fresh supply air pressurized relative to adjacent area (both system from essential power supply). The A/C unit shall not be located at public areas.
LIGHTING	1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting
	DIFFUSER Yes
	LUX Essential: 320 Nominal, 500 Desktop; Emergency: 10
	IP --
FIRE PROTECTION	DETECTION smoke detectors
	SUPPRESSION recycling pre-action sprinkler and equivalent provisions to local regulation
	EXTINGUISHER Yes
	SEPARATION Yes
	SMOKE EXTRACT --
	OTHERS --
ELECTRICAL/POWER REQUIREMENTS	NUMBER LOCATION SOCKET TYPE CONDUIT TYPE
	GENERAL SOCKET 4 WALL twins 10A, 230V Consealed
	SPECIFIC EQUIPMENT - One wall-mounted power socket outlet at high level from essential power supply for digital clock (by COM) - Electrical provisions for system panels and consoles - One power socket from essential supply for COM - Earthing terminal - double power point = 4 numbers - dedicated power DB = 1 number
PLUMBING & DRAINAGE	Floor drain
FIXTURES, EQUIPMENT & LOOSE FURNITURE	
TYPE & LOCATION	See indicative room layout
OTHERS	First-aid kit; room sign
OTHERS	- NO EXPOSED WATER BEARING PIPE WITHIN THE ROOM - Under-floor cable access via raised access floor - All building services requirement above are indicative only. Contractor to ensure statutory compliance

Note 1 Noted that "Station Control Room" is used in reference design whereas 'Station Management Room' is used in SMNW. Preferred to use "Station Control Room" which should be confirmed by O&M.

Note 2 Separate waiting area is required for Group Control Station, i.e. Central and Barangaroo

Note 3 55m² for Group Control Stations and 36m² for Satellite Stations

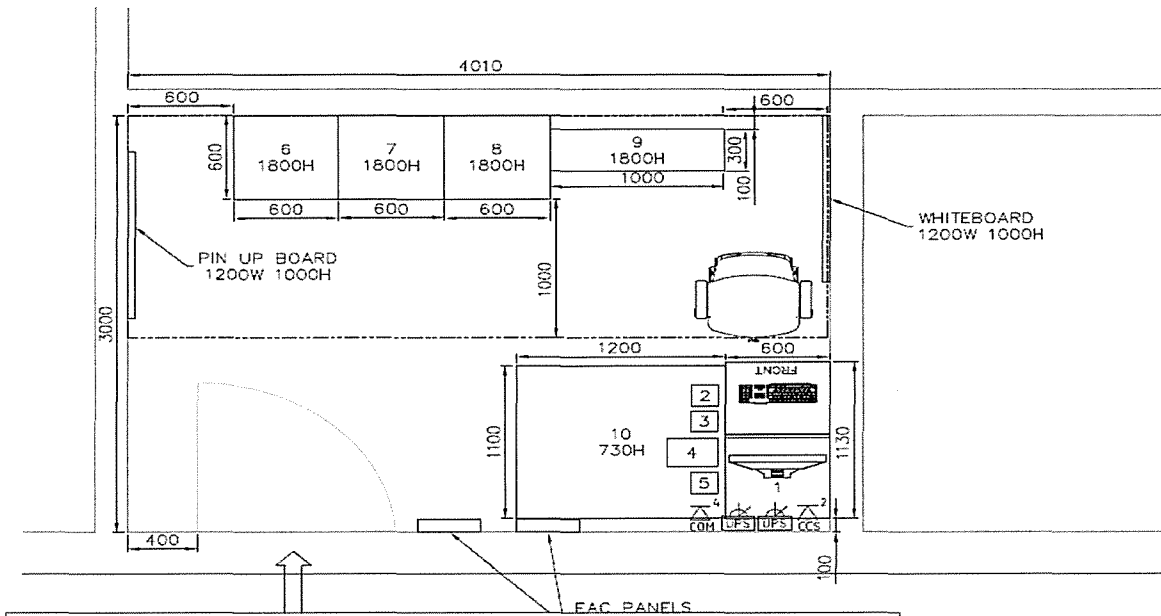
Typical Layout



ROOM DATA SHEET

ROOM NAME		FIRE CONTROL ROOM			
ROOM NUMBER (To be Adopted)		704			
FUNCTIONAL REQUIREMENTS					
FUNCTION		Accommodating local fire equipment controls			
SIZE / DIMENSION		12m2			
LOCATION		Ground/ Street level			
CONNECTION		-			
MATERIALS & FINISHES		WATER TIGHTNESS*			
FLOOR	Resilient Tile on Access Floor		The complete absence of any leakage, seepage and damp patches.		
SKIRTING	Resilient Skirting				
WALL	Water Based Paint on Plaster				
CEILING	Fibre Cement Board				
OTHERS		-			
DOORS & IRONMONGERY		SET 1		SET 2	
DOOR TYPE		5			
CLEAR OPENING REQUIRED		2100mm (H) x 900 mm (W)			
DIRECTION OF SWING		SWING IN AT 90°			
FIRE RESISTANCE		SAME AS FRP AS THE ENCLOSURE			
AIR RESISTANCE		N/A			
STC RATING		35			
LOCK FUNCTION		EACS			
ACCESSORIES		Door closer; door stop			
EACS/SECURITY LEVEL		HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1			
OTHERS		-			
BUILDING SERVICES					
DELIVERY ROUTE SIZE		-			
RM. NOISE LEVEL		NR50			
COMMUNICATIONS FACILITIES		Radio coverage RJ45 socket (digital phone) Qty 1 PABX analogue phones Qty 1 Direct Line Phones Qty 1 RJ45 LAN Ports = 3			
ECS		A/C 25.5 °C, 50% ± 10% RH, with independent room fresh supply air pressurized relative to adjacent area (both systems from essential power supply). The A/C unit shall not be located at public areas.			
LIGHTING		TYPE: Low brightness fluorescent luminaires Motion Sensors BMS emergency lighting DIFFUSER: YES LUX: Essential: 320 Nominal, 500 Desktop; Emergency: 10 IP: N/A			
FIRE PROTECTION		DETECTION: Smoke Detection/Heat SUPPRESSION: NIL EXTINGUISHER: Yes SEPARATION: Yes SMOKE EXTRACT: -- OTHERS: --			
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE
GENERAL SOCKET		1	WALL	twins 10A, 230V	Consealed
SPECIFIC EQUIPMENT		- One wall-mounted power socket outlet at high level from essential power supply for digital clock (by COM) - Electrical provisions for system panels and consoles - One power socket from essential supply for COM - EARTHING TERMINAL - double power points = 2			
PLUMBING & DRAINAGE		NIL			
FIXTURES, EQUIPMENT & LOOSE FURNITURE					
TYPE & LOCATION		See indicative room layout			
OTHERS		Room sign			
OTHERS		- NO EXPOSED WATER BEARING PIPE WITHIN THE ROOM - FRL 120/120/120 with direct egress to a road or open space and a change in level of no more than 300mm - All building services requirement above are indicative only. Contractor to ensure statutory compliance			

Typical Layout



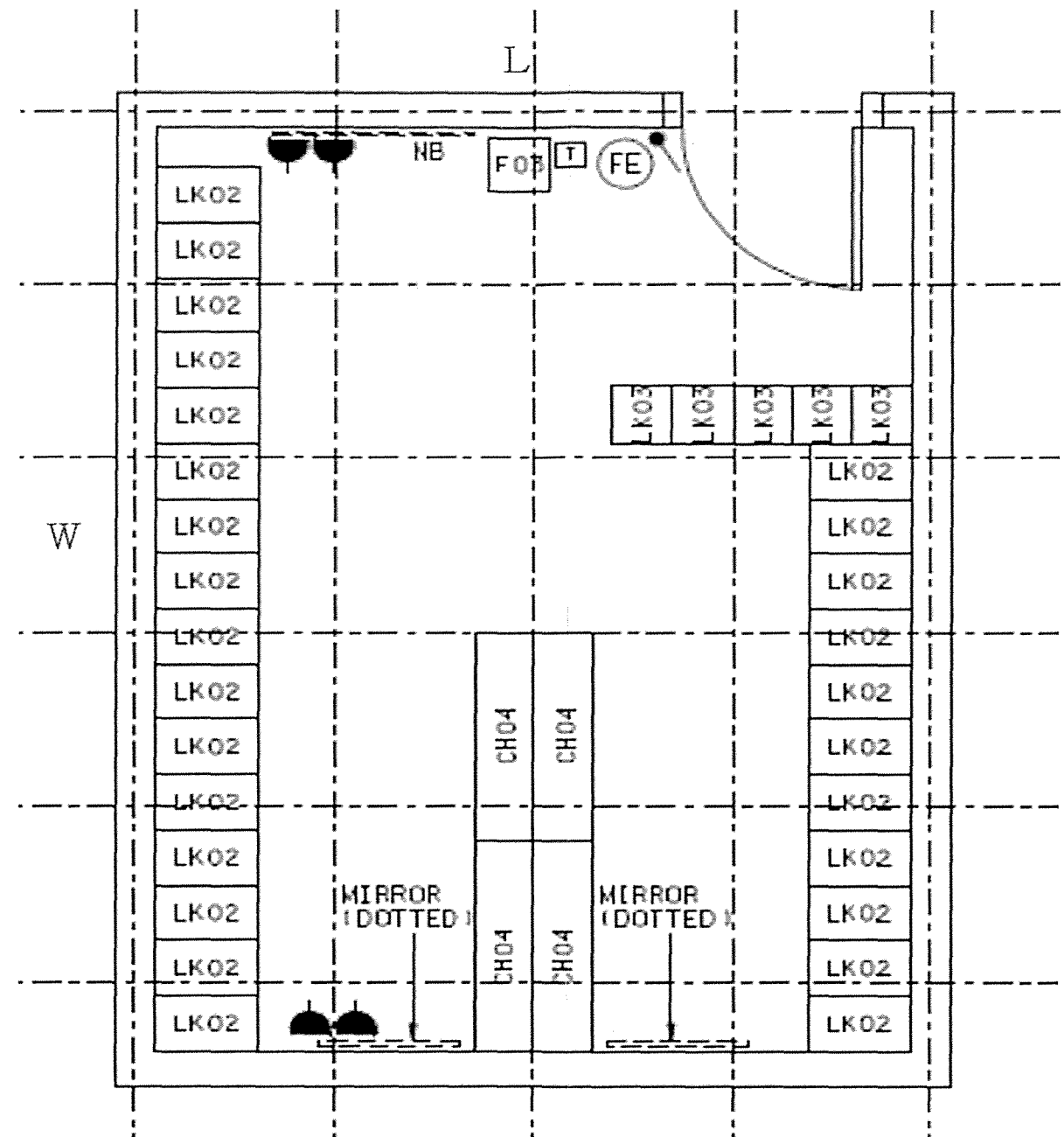
- LEGEND:**
- | SYMBOL | DESCRIPTION |
|--------|---|
| 1. | CCS WS VDU 1. |
| 2. | DIRECT LINE (COM). |
| 3. | PABX TELEPHONE (COM). |
| 4. | PA BACK UP PANEL. |
| 5. | RADIO HANDSET & CHARGER (RAD). |
| 6. | FIRE INDICATION PANEL. |
| 7. | SOUND SYSTEM AND INTERCOM SYSTEM EMERGENCY PANEL. |
| 8. | FIRE FAN CONTROL PANEL. |
| 9. | EMERGENCY VENTILATION PANEL. |
| 10. | MAP PLANNING TABLE. |

- SYMBOL DESCRIPTION**
- | | |
|--|---|
| | MAINTENANCE AND ACCESS CLEARANCE REQUIRED. |
| | WALL MOUNTED UPS BACKED DOUBLE GPO TO BE INSTALLED 300mm ABOVE GROUND AND EQUALLY SPACED. |
| | WALL MOUNTED X PORT LAN SOCKET FOR CCS TO BE INSTALLED 500mm ABOVE GROUND AND EQUALLY SPACED. |
| | WALL MOUNTED X PORT LAN SOCKET FOR COM TO BE INSTALLED 500mm ABOVE GROUND AND EQUALLY SPACED. |

ROOM DATA SHEET

ROOM NAME		Staff Locker Room (Male / Female)			
ROOM NUMBER (To be Adopted)		1002A, 1002B			
FUNCTIONAL REQUIREMENTS					
FUNCTION		Locker room for station staff			
SIZE / DIMENSION		L(m) x W(m) = 8 m2 (2m x 4m)			
LOCATION		within station staff area and adjacent to multipurpose meeting room			
CONNECTION		--			
MATERIALS & FINISHES					
FLOOR		Resilient Tile		WATER TIGHTNESS*	
SKIRTING		Resilient Skirting			
WALL		Masonry paint on fair faced concrete or blockwork (To door height). Wall sealer paint on fair faced concrete or blockwork (Above door)			
CEILING		Water resistant plasterboard			
OTHERS		The complete absence of any leakage, seepage and damp patches.			
DOORS & IRONMONGERY					
DOOR TYPE		SET 1		SET 2	
CLEAR OPENING REQUIRED		2100mm (H) x 900mm (W)			
DIRECTION OF SWING		Swing in at 90 degrees			
FIRE RESISTANCE		Same FRP as the adjoining wall			
AIR RESISTANCE		-			
STC RATING		20			
LOCK FUNCTION		Latch operable by key outside; inside always free for exit			
ACCESSORIES		Door closer; door stop			
EACS/SECURITY LEVEL		MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1			
OTHERS		--			
BUILDING SERVICES					
DELIVERY ROUTE SIZE		--			
RM. NOISE LEVEL		--			
COMMUNICATIONS FACILITIES					
ECS		RADIO COVERAGE			
LIGHTING		Normal A/C			
TYPE		1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting			
DIFFUSER		--			
LUX		200 Lux, 10 Lux emergency			
IP		--			
FIRE PROTECTION		DETECTION: smoke / heat detection			
		SUPPRESSION: sprinklers			
		EXTINGUISHER: Yes			
		SEPARATION: Yes			
		SMOKE EXTRACT: --			
		OTHERS: --			
ELECTRICAL/POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE
		2	WALL	twins 10A, 230V	Concealed
		SPECIFIC EQUIPMENT: double power point = 2 numbers 1 Powerpoint near mirror (nominal 1200 high) 1 Powerpoint near coat hooks(300 above floor)			
PLUMBING & DRAINAGE		Floor drain			
FIXTURES, EQUIPMENT & LOOSE FURNITURE					
TYPE & LOCATION		See indicative room layout			
OTHERS		Room sign			
OTHERS		- All building services requirement above are indicative only. Contractor to ensure statutory compliance			

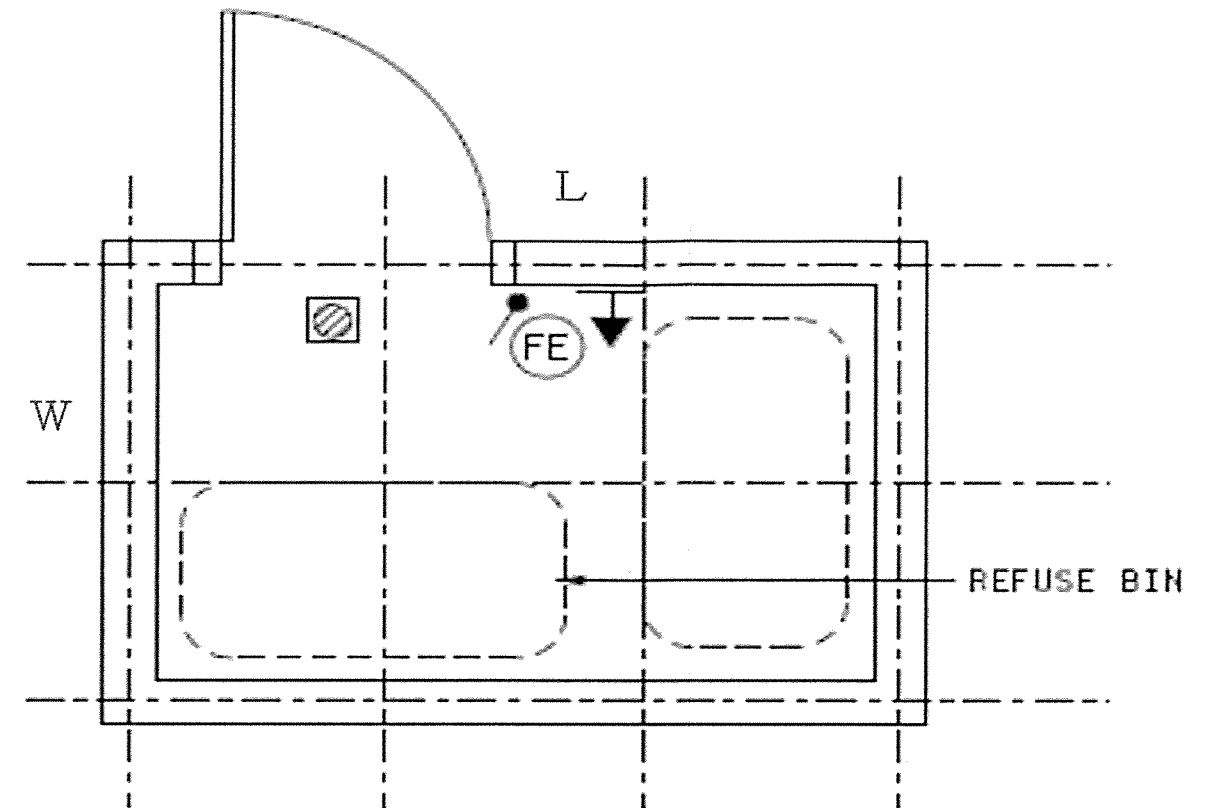
Typical Layout



ROOM DATA SHEET				
ROOM NAME		Multipurpose Room		
ROOM NUMBER (To be Adopted)		1003		
FUNCTIONAL REQUIREMENTS				
FUNCTION		Meal, resting and presentation area for station staff		
SIZE / DIMENSION		15 m2 (Except for Central and Campsie: 30 m2 for 20 ppl)		
LOCATION		Concourse level within station staff area and adjacent to staff locker room		
CONNECTION		1003		
MATERIALS & FINISHES				
FLOOR		Resilient Tile		WATER TIGHTNESS*
SKIRTING		Resilient Skirting		
WALL		Water Based Paint on Plaster		
CEILING		Fibre cement board		
OTHERS		--		
DOORS & IRONMONGERY		SET 1		SET 2
DOOR TYPE		1		
CLEAR OPENING REQUIRED		2100mm (H) x 900mm (W)		
DIRECTION OF SWING		Swing in at 90 degrees		
FIRE RESISTANCE		Same FRP as the adjoining wall		
AIR RESISTANCE		-		
STC RATING		20		
LOCK FUNCTION		Latch operable from either side when unlocked; latch locked/unlocked by key outside; inside always free for exit.		
ACCESSORIES		Door closer; door stop		
EACS/SECURITY LEVEL		NIL		
OTHERS		--		
BUILDING SERVICES				
DELIVERY ROUTE SIZE		--		
RM. NOISE LEVEL		--		
COMMUNICATIONS FACILITIES				
ECS		Normal A/C		
LIGHTING		1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting		
DIFFUSER		--		
LUX		320 lux, 10 lux emergency		
IP		Lighting Generally in accordance with AS1680. Lighting control via DALI system. timers, motions sensors to be documented in a lighting control document. Room to include override pannel for dimming and manual control.		
FIRE PROTECTION		smoke /heat detection		
DETECTION		sprinklers		
SUPPRESSION		Yes		
EXTINGUISHER		Yes		
SEPARATION		--		
SMOKE EXTRACT		--		
OTHERS		--		
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
GENERAL SOCKET		2	WALL	twins 10A, 230V
SPECIFIC EQUIPMENT		double power point = 2 numbers		
PLUMBING & DRAINAGE		Floor drain		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		--		
OTHERS		Room sign		
OTHERS		- All building services requirement above are indicative only. Contractor to ensure statutory compliance		

ROOM DATA SHEET				
ROOM NAME		Refuse Room		
ROOM NUMBER (To be Adopted)		1004A		
FUNCTIONAL REQUIREMENTS				
FUNCTION		Refuse storage and collection		
SIZE / DIMENSION		L (m) x H(m) = 11 m2 except for Central station which will share existing Refuse room with Sydney Train		
LOCATION		Street / Ground level with direct access to lift		
CONNECTION		--		
MATERIALS & FINISHES				
FLOOR		Vitrified Ceramic Floor tile		WATER TIGHTNESS*
SKIRTING		Vitrified Ceramic Floor tile, square top coved		
WALL		Vitrified Ceramic wall tile		
CEILING		Wall sealer paint on fair faced concrete		
OTHERS		--		
DOORS & IRONMONGERY				
DOOR TYPE		SET 1		SET 2
DOOR TYPE		1		
CLEAR OPENING REQUIRED		2100mm (H) x 1050mm (W)		
DIRECTION OF SWING		Swing out at 90 degrees		
FIRE RESISTANCE		-		
AIR RESISTANCE		-		
STC RATING		20		
LOCK FUNCTION		Latch operable by key outside; inside always free for exit		
ACCESSORIES		Door closer; armour plate; door stop		
EACS/SECURITY LEVEL		NIL		
OTHERS		--		
BUILDING SERVICES				
DELIVERY ROUTE SIZE		--		
RM. NOISE LEVEL		--		
COMMUNICATIONS FACILITIES				
ECS		RADIO COVERAGE		
LIGHTING		Ventilation (segregated exhaust system)		
TYPE		1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting		
DIFFUSER		yes		
LUX		160 Lux, 10 Lux emergency		
IP		weatherproof IP54		
FIRE PROTECTION		DETECTION		
SUPPRESSION		smoke / heat detection		
EXTINGUISHER		sprinklers		
SEPARATION		Yes		
SMOKE EXTRACT		Yes		
OTHERS		--		
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
GENERAL SOCKET		1	WALL	twins 10A, 230V
SPECIFIC EQUIPMENT		double power point = 1 number		
PLUMBING & DRAINAGE		Cleansing water supply and floor drain		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		See indicative room layout		
OTHERS		Room sign		
OTHERS		-All building services requirement above are indicative only. Contractor to ensure statutory compliance		

Typical Layout



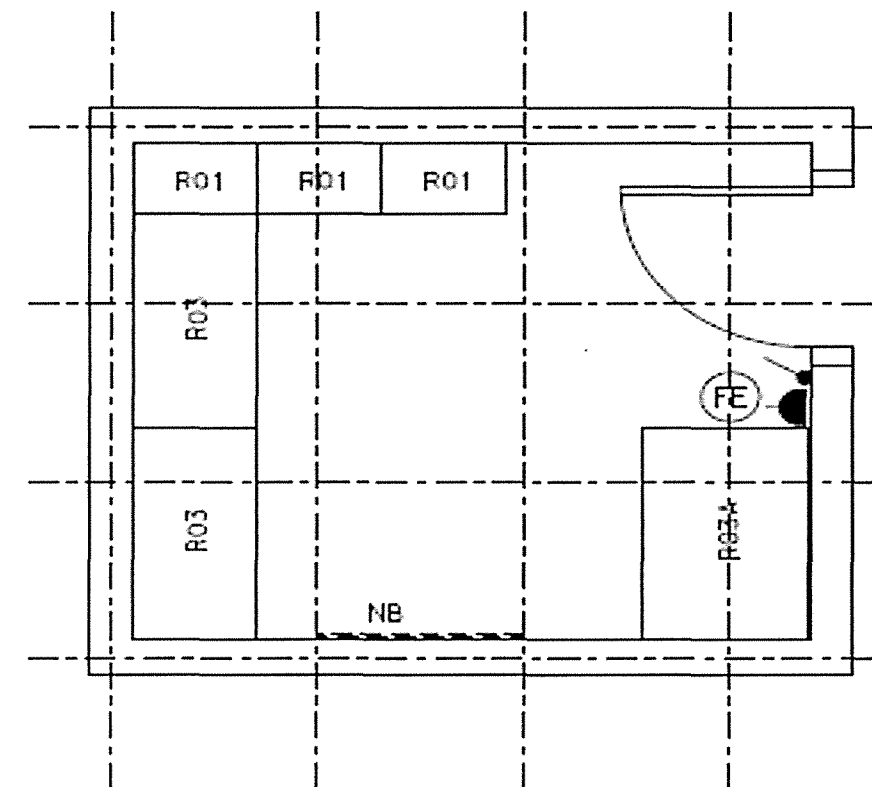
ROOM DATA SHEET				
ROOM NAME		Bin Room		
ROOM NUMBER (To be Adopted)		1004B		
FUNCTIONAL REQUIREMENTS				
FUNCTION		Storage of rubbish bins		
SIZE / DIMENSION		5 m2		
LOCATION		Concourse back of house area and accessible to platform and refuse room at ground via lift		
CONNECTION		--		
MATERIALS & FINISHES				WATER TIGHTNESS*
FLOOR		Vitrified Ceramic Floor tile		The complete absence of any leakage, seepage and damp patches.
SKIRTING		Vitrified Ceramic Floor tile, square top coved		
WALL		Vitrified Ceramic wall tile		
CEILING		Wall sealer paint on fair faced concrete		
OTHERS		--		
DOORS & IRONMONGERY		SET 1	SET 2	
DOOR TYPE		1		
CLEAR OPENING REQUIRED		2100mm (H) x 1050mm (W)		
DIRECTION OF SWING		Swing out at 90 degrees		
FIRE RESISTANCE		-		
AIR RESISTANCE		-		
STC RATING		20		
LOCK FUNCTION		Latch operable by key outside; inside always free for exit		
ACCESSORIES		Door closer; armour plate; door stop		
EACS/SECURITY LEVEL		NIL		
OTHERS		--		
BUILDING SERVICES				
DELIVERY ROUTE SIZE		--		
RM. NOISE LEVEL		--		
COMMUNICATIONS FACILITIES				
ECS		RADIO COVERAGE		
LIGHTING		Ventilation (segregated exhaust system)		
TYPE		1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting		
DIFFUSER		yes		
LUX		min. 160 Lux, 10 Lux emergency		
IP		weatherproof IP54		
FIRE PROTECTION		DETECTION		
SUPPRESSION		Smoke Detection/Heat Detection		
EXTINGUISHER		sprinklers		
SEPARATION		Yes		
SMOKE EXTRACT		--		
OTHERS		--		
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
GENERAL SOCKET				
SPECIFIC EQUIPMENT		double power point = 1 number		
PLUMBING & DRAINAGE		Floor drain		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		NIL		
OTHERS		Room sign		
OTHERS		- All building services requirement above are indicative only. Contractor to ensure statutory compliance		

ROOM DATA SHEET				
ROOM NAME		Platform Cleaning Machine Room		
ROOM NUMBER (To be Adopted)		1006		
FUNCTIONAL REQUIREMENTS				
FUNCTION		Storage of platform cleaning machine		
SIZE / DIMENSION		12 m2		
LOCATION		Adjacent to cleaner store with direct access to lift		
CONNECTION		3m circulation required externally at the door to allow machine turning		
MATERIALS & FINISHES				WATER TIGHTNESS*
FLOOR		Floor sealer on granolithic		The complete absence of any leakage, seepage and damp patches.
SKIRTING		Floor sealer on granolithic		
WALL		Wall sealer paint on fair faced concrete or blockwork		
CEILING		Wall sealer paint on fair faced concrete or blockwork		
OTHERS		--		
DOORS & IRONMONGERY		SET 1	SET 2	
DOOR TYPE		10		
CLEAR OPENING REQUIRED		2100mm(H) x 2100mm(W)		
DIRECTION OF SWING		Swing in at 90 degrees		
FIRE RESISTANCE		Same FRP as the adjoining wall		
AIR RESISTANCE		NIL		
STC RATING		20		
LOCK FUNCTION		Latch operable by key outside; inside always free for exit		
ACCESSORIES		Door closer; armour plates; door stop		
EACS/SECURITY LEVEL		MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1		
OTHERS		--		
BUILDING SERVICES				
DELIVERY ROUTE SIZE		--		
RM. NOISE LEVEL		--		
COMMUNICATIONS FACILITIES				
ECS		RADIO COVERAGE		
LIGHTING		Ventilation system		
TYPE		Flourescent		
DIFFUSER		--		
LUX		min. 160 Lux, 10 Lux emergency		
IP		--		
FIRE PROTECTION		smoke detectors		
DETECTION		sprinklers		
SUPPRESSION		Yes		
EXTINGUISHER		Yes		
SEPARATION		--		
SMOKE EXTRACT		--		
OTHERS		--		
ELECTRICAL/POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
GENERAL SOCKET		2	Wall	Twins 10A 230V
SPECIFIC EQUIPMENT		Concealed		
PLUMBING & DRAINAGE		Floor drain		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		NIL		
OTHERS		Room sign		
OTHERS		- All building services requirement above are indicative only. Contractor to ensure statutory compliance		

ROOM DATA SHEET

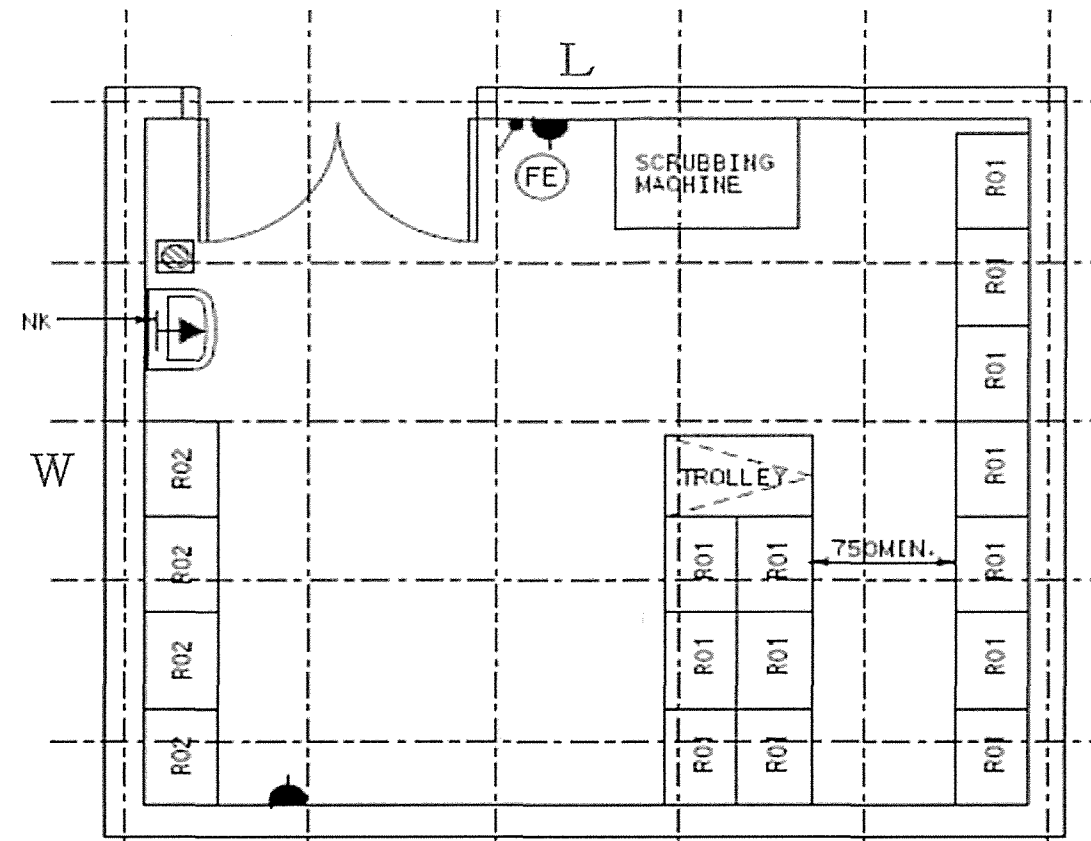
ROOM NAME		Presentation Store Room			
ROOM NUMBER (To be Adopted)		1006A			
FUNCTIONAL REQUIREMENTS					
FUNCTION		Storage of presentation material for staff presentation			
SIZE / DIMENSION		10 m2			
LOCATION		Back of house staff area			
CONNECTION		Adjacent to cleaners store			
MATERIALS & FINISHES					
FLOOR		Floor sealer on granolithic		WATER TIGHTNESS*	
SKIRTING		Floor sealer on granolithic			
WALL		Masonry paint on fair faced concrete or blockwork to door height; Wall sealer paint on fair faced concrete or blockwork above door			
CEILING		Wall sealer paint on fair faced concrete			
OTHERS		--			
DOORS & IRONMONGERY		SET 1		SET 2	
DOOR TYPE		1			
CLEAR OPENING REQUIRED		2100mm (H) x 900mm (W)			
DIRECTION OF SWING		Swing in at 90 degrees			
FIRE RESISTANCE		Same FRP as the adjoining wall			
AIR RESISTANCE		NIL			
STC RATING		20			
LOCK FUNCTION		Latch operable by key outside; inside always free for exit			
ACCESSORIES		Door closer; armour plate; door stop			
EACS/SECURITY LEVEL		MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1			
OTHERS		--			
BUILDING SERVICES					
DELIVERY ROUTE SIZE		--			
RM. NOISE LEVEL		--			
COMMUNICATIONS FACILITIES					
ECS		RADIO COVERAGE			
LIGHTING		Ventilation system			
TYPE		1) FLUORESCENT 2) local switch 3) motion sensor			
DIFFUSER		--			
LUX		min. 160 Lux, 10 Lux emergency			
IP		--			
FIRE PROTECTION		DETECTION smoke detectors			
		SUPPRESSION sprinklers			
		EXTINGUISHER Yes			
		SEPARATION Yes			
		SMOKE EXTRACT --			
		OTHERS --			
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE
GENERAL SOCKET		2	WALL	twins 10A, 230V	Concealed
SPECIFIC EQUIPMENT		--			
PLUMBING & DRAINAGE		Floor drain			
FIXTURES, EQUIPMENT & LOOSE FURNITURE					
TYPE & LOCATION		See indicative room layout			
OTHERS		Room sign			
OTHERS		- All building services requirement above are indicative only. Contractor to ensure statutory compliance			

Typical Layout



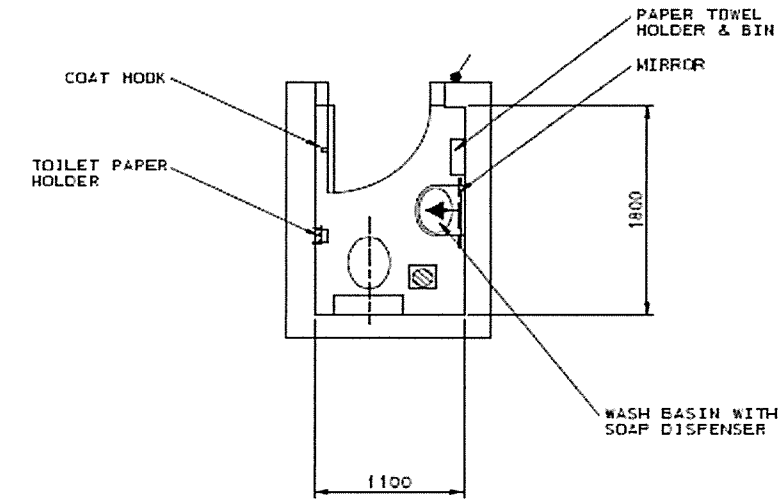
ROOM DATA SHEET				
ROOM NAME		Cleaners store		
ROOM NUMBER (To be Adopted)		1007A, 1007B		
FUNCTIONAL REQUIREMENTS				
FUNCTION		Storage area for cleaning tools		
SIZE / DIMENSION		4m (L) x 2.5m (W) = 10 m ²		
LOCATION		one is adjacent to station staff toilet and one is adjacent to public toilets		
CONNECTION		Adjacent to toilets		
MATERIALS & FINISHES				
FLOOR		Vitrified Ceramic Floor tile		WATER TIGHTNESS*
SKIRTING		Vitrified Ceramic Floor tile, square top covered		
WALL		Vitrified Ceramic wall tile		
CEILING		Wall sealer paint on fair faced concrete		
OTHERS		Glazed ceramic tiles splash back above slop sink		
DOORS & IRONMONGERY				
DOOR TYPE		SET 1	SET 2	
CLEAR OPENING REQUIRED		2100mm (H) x 1500mm (W)		
DIRECTION OF SWING		Swing in at 90 degrees		
FIRE RESISTANCE		Same FRP as the adjoining wall		
AIR RESISTANCE		NIL		
STC RATING		20		
LOCK FUNCTION		Latch operable by key outside; inside always free for exit		
ACCESSORIES		Door closer; flush bolts and sockets; armour plates; door stop		
EACS/SECURITY LEVEL		MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1		
OTHERS		--		
BUILDING SERVICES				
DELIVERY ROUTE SIZE		--		
RM. NOISE LEVEL		--		
COMMUNICATIONS FACILITIES				
ECS		RADIO COVERAGE		
LIGHTING		Ventilation system		
TYPE		1) motion sensor 2) BMS 3) lighting control		
DIFFUSER		Lighting Generally in accordance with SPR 17. Lighting control via DALI system. timers, motions sensors to be documented in a lighting control document.		
LUX		min. 160 Lux, 10 Lux emergency		
IP		--		
FIRE PROTECTION		DETECTION smoke / heat detection		
SUPPRESSION		NIL		
EXTINGUISHER		Yes		
SEPARATION		Yes		
SMOKE EXTRACT		--		
OTHERS		--		
ELECTRICAL/POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
GENERAL SOCKET		2	Wall	10A 230V
SPECIFIC EQUIPMENT		double power point = 1		
PLUMBING & DRAINAGE		Floor drain, cleansing water supply with sink and fittings		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		See indicative room layout		
OTHERS		Room sign		
OTHERS		-All building services requirement above are indicative only. Contractor to ensure statutory compliance		

Typical Layout



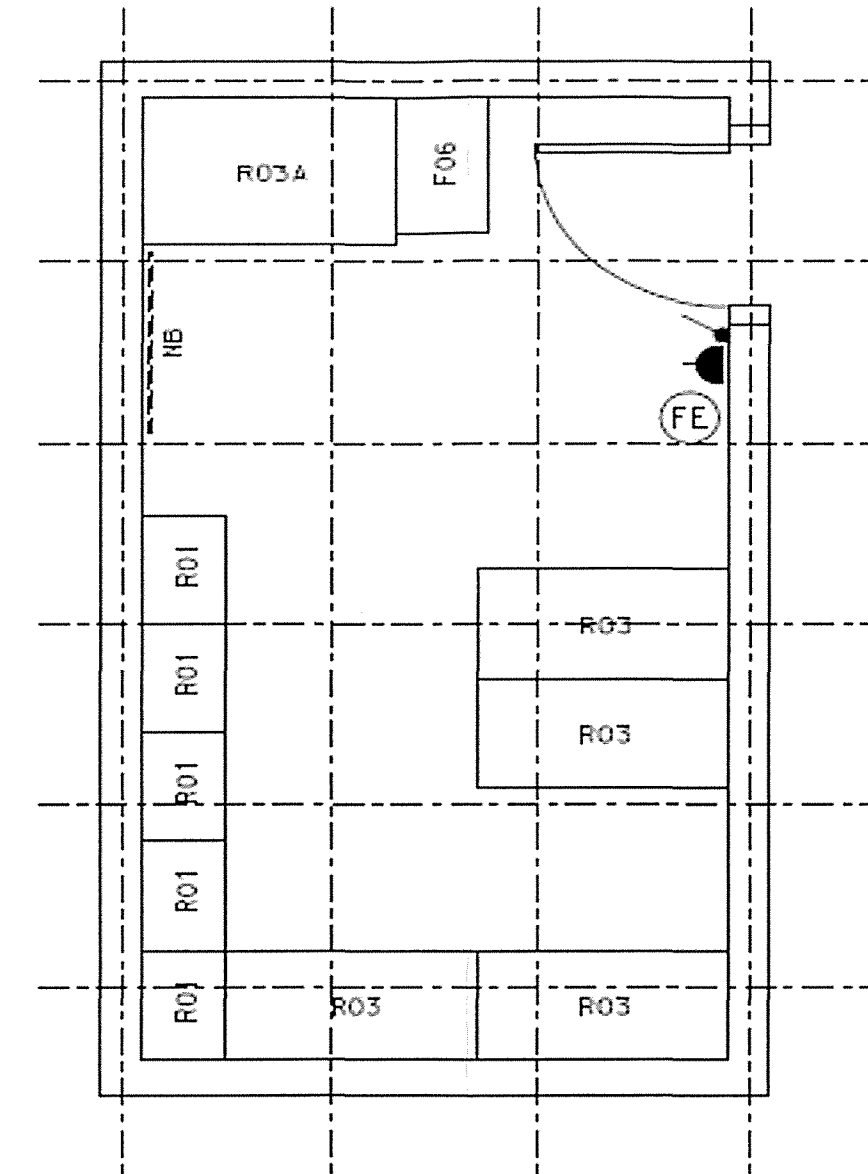
ROOM DATA SHEET				
ROOM NAME		Station Staff WC		
ROOM NUMBER (To be Adopted)		1008A, 1008B		
FUNCTIONAL REQUIREMENTS				
FUNCTION		Lavatory for station staff		
SIZE / DIMENSION		7 m2		
LOCATION		Concourse within station staff area		
CONNECTION		Adjacent to staff locker room		
MATERIALS & FINISHES				
FLOOR		Vitrified Ceramic Floor tile		WATER TIGHTNESS* The complete absence of any leakage, seepage and damp patches.
SKIRTING		Vitrified Ceramic Floor tile, square top coved		
WALL		Vitrified Ceramic wall tile		
CEILING		Water resistant plasterboard		
OTHERS		--		
DOORS & IRONMONGERY				
DOOR TYPE		SET 1		SET 2
DOOR TYPE		1		
CLEAR OPENING REQUIRED		2100mm (H) x 900mm (W)		
DIRECTION OF SWING		Swing in at 90 degrees		
FIRE RESISTANCE		Same FRP as the adjoining wall		
AIR RESISTANCE		NIL		
STC RATING		20		
LOCK FUNCTION		Latch operable by key outside; inside always free for exit with thumb-turn to disable normal key operation except emergency key.		
ACCESSORIES		Door closer; door stop		
EACS/SECURITY LEVEL		NIL		
OTHERS		--		
BUILDING SERVICES				
DELIVERY ROUTE SIZE		--		
RM. NOISE LEVEL		--		
COMMUNICATIONS FACILITIES				
ECS		RADIO COVERAGE Ventilation (segregated exhaust system)		
LIGHTING		TYPE 1) FLUORESCENT 2) local switch 3) motion sensor		
		DIFFUSER --		
		LUX min. 200 Lux, 10 Lux emergency		
		IP --		
FIRE PROTECTION		DETECTION smoke detectors		
		SUPPRESSION sprinklers		
		EXTINGUISHER Yes		
		SEPARATION Yes		
		SMOKE EXTRACT --		
		OTHERS --		
ELECTRICAL/POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
		SPECIFIC EQUIPMENT double power point = 1		
PLUMBING & DRAINAGE		Floor drains, water supply with basin		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		See indicative room layout		
OTHERS		Room sign		
OTHERS		- All building services requirement above are indicative only. Contractor to ensure statutory compliance		

Typical Layout



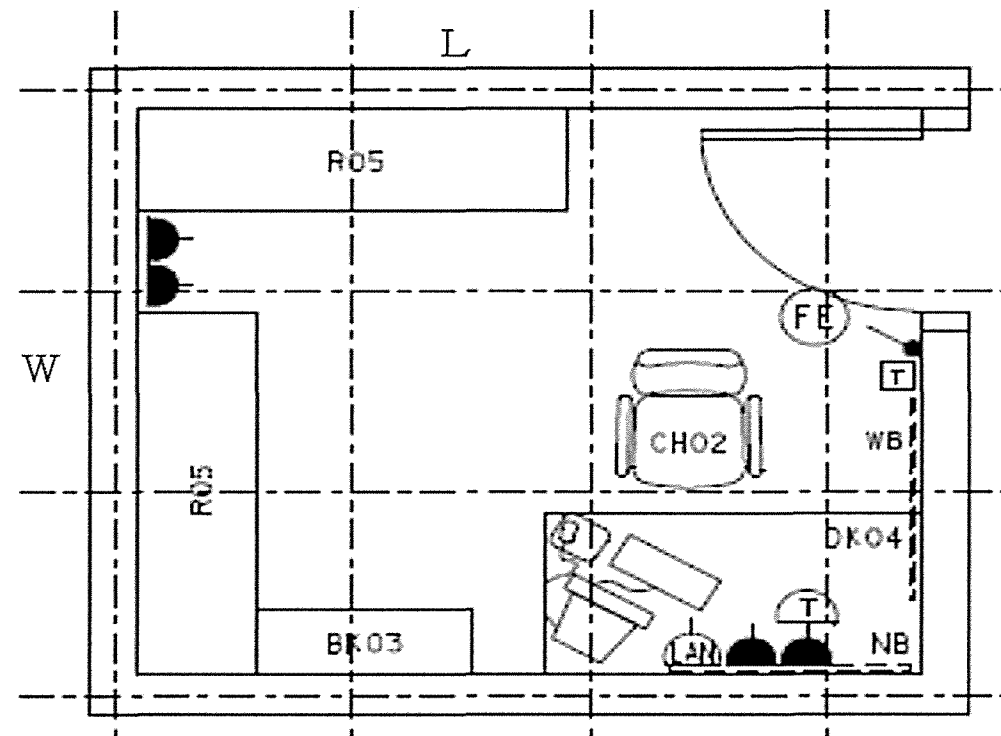
ROOM DATA SHEET					
ROOM NAME		Store Room			
ROOM NUMBER (To be Adopted)		1016			
FUNCTIONAL REQUIREMENTS					
FUNCTION		For stationery and consumable items storage			
SIZE / DIMENSION		20 m2			
LOCATION		Concourse within station staff area			
CONNECTION		--			
MATERIALS & FINISHES			WATER TIGHTNESS*		
FLOOR		Floor sealer on granolithic			
SKIRTING		Floor sealer on granolithic			
WALL		Masonry paint on fair faced concrete or blockwork to door height; Wall sealer paint on fair faced concrete or blockwork above door			
CEILING		Wall sealer paint on fair faced concrete or blockwork			
OTHERS		--			
DOORS & IRONMONGERY		SET 1		SET 2	
DOOR TYPE		1			
CLEAR OPENING REQUIRED		2100mm (H) x 1050mm (W)			
DIRECTION OF SWING		Swing in at 90 degrees			
FIRE RESISTANCE		Same FRP as the adjoining wall			
AIR RESISTANCE		NIL			
STC RATING		20			
LOCK FUNCTION		Latch operable by key outside; inside always free for exit			
ACCESSORIES		Door closer; armour plates; door stop			
EACS/SECURITY LEVEL		MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1			
OTHERS					
BUILDING SERVICES					
DELIVERY ROUTE SIZE		--			
RM. NOISE LEVEL		--			
COMMUNICATIONS FACILITIES			RADIO COVERAGE		
ECS			Ventilation system		
LIGHTING		1) FLUORESCENT 2) local switch 3) motion sensor			
TYPE					
DIFFUSER		--			
LUX		min. 200 lux, 10 Lux emergency			
IP		--			
FIRE PROTECTION		DETECTION smoke detectors			
		SUPPRESSION sprinklers			
		EXTINGUISHER Yes			
		SEPARATION Yes			
		SMOKE EXTRACT --			
		OTHERS --			
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE
		2	WALL	twins 10A, 230V	Concealed
SPECIFIC EQUIPMENT		Double Power Point= 1 number			
PLUMBING & DRAINAGE		Floor drain			
FIXTURES, EQUIPMENT & LOOSE FURNITURE					
TYPE & LOCATION		See indicative room layout			
OTHERS		Room sign			
OTHERS		- All building services requirement above are indicative only. Contractor to ensure statutory compliance			

Typical Layout



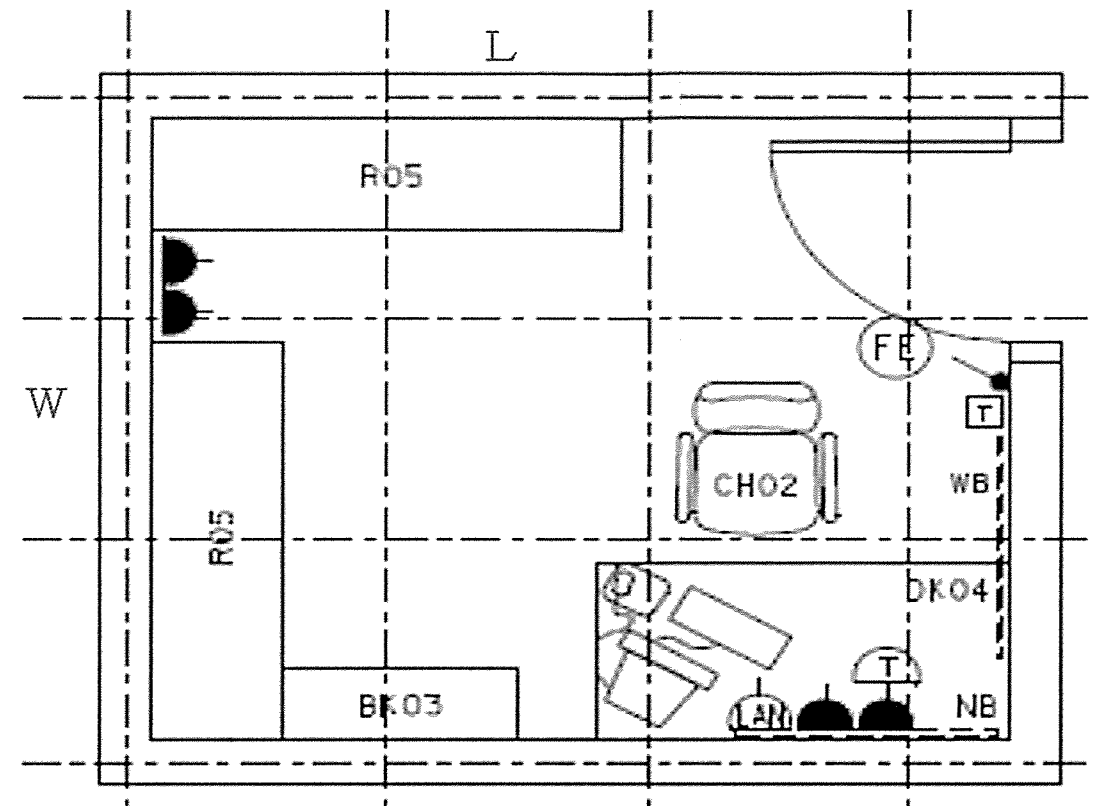
ROOM DATA SHEET					
ROOM NAME		Maintenance office			
ROOM NUMBER (To be Adopted)		1017A			
FUNCTIONAL REQUIREMENTS					
FUNCTION		Office for maintenance staff			
SIZE / DIMENSION		4m (L) x 3m (W) = 12m2			
LOCATION		Concourse within station staff area			
CONNECTION		Adjacent to maintenance store room			
MATERIALS & FINISHES					
FLOOR		Resilient Tile		WATER TIGHTNESS*	
SKIRTING		Resilient Skirting			
WALL		Water based paint on plaster			
CEILING		Fibre cement board			
OTHERS					
DOORS & IRONMONGERY		SET 1		SET 2	
DOOR TYPE		1			
CLEAR OPENING REQUIRED		2100mm (H) x 900mm (W)			
DIRECTION OF SWING		Swing in at 90 degrees			
FIRE RESISTANCE		Same FRP as the adjoining wall			
AIR RESISTANCE		NIL			
STC RATING		35			
LOCK FUNCTION		Latch operable from either side when unlocked; latch locked / unlocked by key outside or by thumb-turn inside.			
ACCESSORIES		Door closer; acoustic seal; door stop			
EACS/SECURITY LEVEL		MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1			
OTHERS					
BUILDING SERVICES					
DELIVERY ROUTE SIZE		--			
RM. NOISE LEVEL		--			
COMMUNICATIONS FACILITIES					
Radio coverage					
RJ45 socket (digital phone) Qty 2					
RJ45 LAN Ports = 8					
PA speaker = 1					
ECS					
Ventilation system					
LIGHTING		1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting			
DIFFUSER		--			
LUX		320			
IP		--			
FIRE PROTECTION					
DETECTION					
Smoke Detection/Heat Detection					
SUPPRESSION					
sprinklers					
EXTINGUISHER					
Yes					
SEPARATION					
Yes					
SMOKE EXTRACT					
--					
OTHERS					
--					
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE
GENERAL SOCKET		5	WALL	twins 10A, 230V	Concealed
SPECIFIC EQUIPMENT		--			
PLUMBING & DRAINAGE					
Floor drain					
FIXTURES, EQUIPMENT & LOOSE FURNITURE					
TYPE & LOCATION		See indicative room layout			
OTHERS					
Room sign					
OTHERS					
- All building services requirement above are indicative only. Contractor to ensure statutory compliance					

Typical Layout



ROOM DATA SHEET					
ROOM NAME	Maintenance store room				
ROOM NUMBER (To be Adopted)	1017E				
FUNCTIONAL REQUIREMENTS					
FUNCTION	Storage of material and equipment for maintenance				
SIZE / DIMENSION	2.5m (L) x 2m (W) = 5 m ²				
LOCATION	Concourse within station staff area				
CONNECTION	Adjacent to maintenance office				
MATERIALS & FINISHES					
FLOOR	Granolithic		WATER TIGHTNESS*		
SKIRTING	Granolithic				
WALL	Masonry paint on fair faced concrete or blockwork				
CEILING	Wall sealer paint on fair faced concrete				
OTHERS	The complete absence of any leakage, seepage and damp patches.				
DOORS & IRONMONGERY					
		SET 1	SET 2		
DOOR TYPE	2				
CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)				
DIRECTION OF SWING	Swing in at 90 degrees				
FIRE RESISTANCE	Same FRP as the adjoining wall				
AIR RESISTANCE	NIL				
STC RATING	35				
LOCK FUNCTION	Latch operable by key outside; inside always free for exit				
ACCESSORIES	Door closer and coordinator; armour plate; door stop				
EACS/SECURITY LEVEL					
		MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1			
OTHERS					
BUILDING SERVICES					
DELIVERY ROUTE SIZE					
RM. NOISE LEVEL					
COMMUNICATIONS FACILITIES					
Radio coverage					
RJ45 socket (digital phone) Qty 1					
RJ45 LAN Ports = 1					
ECS					
Ventilation system					
LIGHTING					
TYPE		1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting			
DIFFUSER		See Fire and life safety strategy			
LUX		min. 160			
IP		See Fire and life safety strategy			
FIRE PROTECTION					
DETECTION		smoke / heat detection			
SUPPRESSION		sprinklers			
EXTINGUISHER		Yes			
SEPARATION		Yes			
SMOKE EXTRACT		--			
OTHERS		--			
ELECTRICAL/POWER REQUIREMENTS					
		NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE
GENERAL SOCKET		2	WALL	twins 10A, 230V	Concealed
SPECIFIC EQUIPMENT		--			
PLUMBING & DRAINAGE					
Floor drain					
FIXTURES, EQUIPMENT & LOOSE FURNITURE					
TYPE & LOCATION					
See indicative room layout					
OTHERS					
Room sign					
OTHERS					
- All building services requirement above are indicative only. Contractor to ensure statutory compliance					

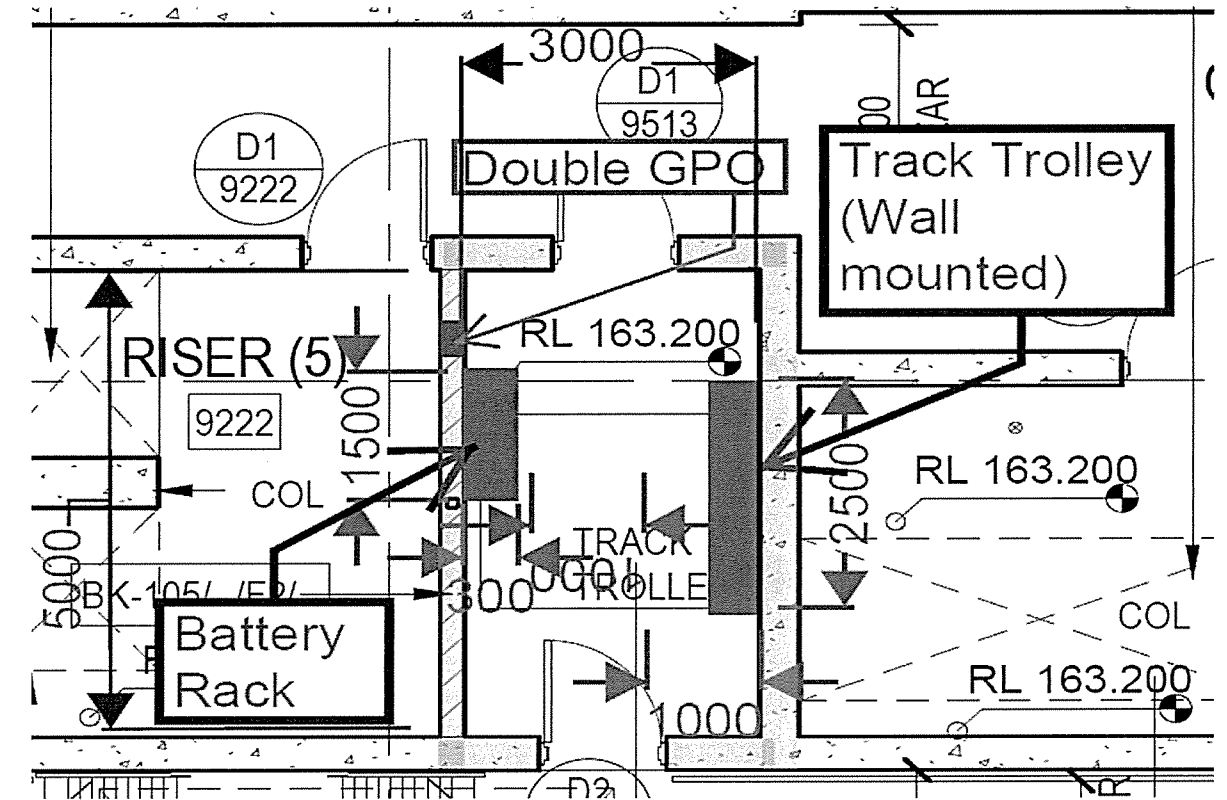
Typical Layout



ROOM DATA SHEET

ROOM NAME		Emergency track trolley room		
ROOM NUMBER (To be Adopted)		1025		
FUNCTIONAL REQUIREMENTS				
FUNCTION		Storage area of trolley for emergency purpose		
SIZE / DIMENSION		5(m) x 3(m) = 15 m ²		
LOCATION		Back of house at end of platform		
CONNECTION		--		
MATERIALS & FINISHES		WATER TIGHTNESS*		
FLOOR	Floor sealer on granolithic	The complete absence of any leakage, seepage and damp patches.		
SKIRTING	Floor sealer on granolithic			
WALL	Wall sealer paint on fair faced concrete or blockwork			
CEILING	Wall sealer paint on fair faced concrete or blockwork			
OTHERS				
DOORS & IRONMONGERY		SET 1	SET 2	
DOOR TYPE		1		
CLEAR OPENING REQUIRED		c		
DIRECTION OF SWING		See diagram		
FIRE RESISTANCE		Same FRP as the adjoining wall		
AIR RESISTANCE		NIL		
STC RATING		20		
LOCK FUNCTION	Latch operable by key outside; inside always free for exit			
ACCESSORIES	Door closer; armour plates; door stop			
EACS/SECURITY LEVEL	MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1			
OTHERS				
BUILDING SERVICES				
DELIVERY ROUTE SIZE		--		
RM. NOISE LEVEL		--		
COMMUNICATIONS FACILITIES				
		RADIO COVERAGE		
ECS	Independent ventilation system for battery charging (2 duty fans each 60% of design flow) to comply with local statutory requirement.			
LIGHTING	TYPE	Fluorescent		
	DIFFUSER	N/A		
	LUX	300 lux (control area), 160 lux (general area) 10 lux emergency.		
	IP	N/A		
FIRE PROTECTION	DETECTION	smoke detectors		
	SUPPRESSION	sprinklers		
	EXTINGUISHER	Yes		
	SEPARATION	Yes		
	SMOKE EXTRACT	--		
ELECTRICAL/ POWER REQUIREMENTS	GENERAL SOCKET	NUMBER	LOCATION	SOCKET TYPE
		2	WALL	twins 10A, 230V
	SPECIFIC EQUIPMENT	- One S&PN - One wall-mounted fuse connection unit at high level from essential power supply for digital clock (by COM) - Electrical provisions for system panels and consoles - One fuse connection unit from essential supply for COM - Earthing terminal		
PLUMBING & DRAINAGE		Floor drain		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		See indicative room layout		
OTHERS		Room sign		
OTHERS		- All building services requirement above are indicative only. Contractor to ensure statutory compliance		

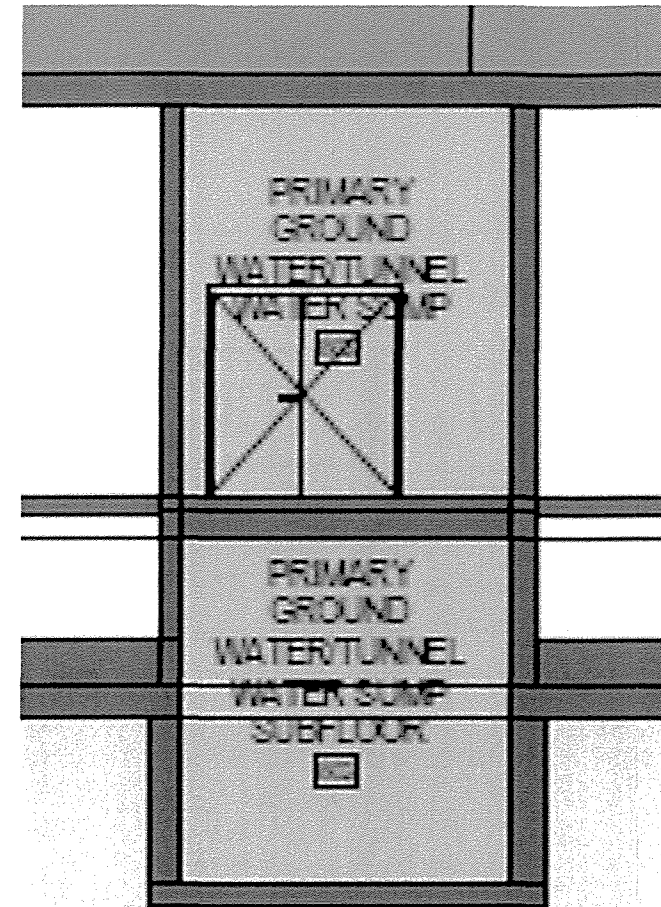
Typical Layout



ROOM DATA SHEET

ROOM DATA SHEET	
ROOM NAME	Primary Tunnel Water Sump Secondary Tunnel Water Sump
ROOM NUMBER (To be Adopted)	802 803
FUNCTIONAL REQUIREMENTS	
FUNCTION	Maintenance area for Tunnel Groundwater Sump (Sub-floor) not including station box ground water seepage.
SIZE / DIMENSION	Primary Tunnel Water Sump = 4m(W) x 4m(L) x 4m(H) Secondary Tunnel Water Sump = 3m(W) x 3m(L) x 4m(H)
LOCATION	Primary Sump at South Platform End / Secondary Sump at North Platform End
CONNECTION	Tunnel Groundwater Sump (Subfloor) down below
MATERIALS & FINISHES	
FLOOR	Floor sealer on granolithic
SKIRTING	Floor sealer on granolithic
WALL	Wall sealer paint on fair faced concrete or blockwork
CEILING	Wall sealer paint on fair faced concrete or blockwork
OTHERS	--
DOORS & IRONMONGERY	SET 1
DOOR TYPE	9A
CLEAR OPENING REQUIRED	2100mm (H) x 1500mm (W)
DIRECTION OF SWING	Swing out at 180 degrees
FIRE RESISTANCE	Same FRP as the Adjoining Wall
AIR RESISTANCE	N/A
STC RATING	30
LOCK FUNCTION	EACS
ACCESSORIES	Door closer; kick plates
EACS/SECURITY LEVEL	MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1
OTHERS	--
BUILDING SERVICES	
DELIVERY ROUTE SIZE	2 m wide corridor outside room for pump delivery
RM. NOISE LEVEL	--
COMMUNICATIONS FACILITIES	Radio coverage
ECS	Ventilation system (from non-essential power supply)
LIGHTING	TYPE 1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting
	DIFFUSER yes
	LUX Essential: 320 Nominal, 500 Desktop; Emergency: 10
	IP Weatherproof IP54
FIRE PROTECTION	DETECTION As per Fire and Life Safety Strategy
	SUPPRESSION smoke detectors
	EXTINGUISHER sprinklers
	SEPARATION Yes
	SMOKE EXTRACT Yes
	OTHERS --
ELECTRICAL/ POWER REQUIREMENTS	NUMBER LOCATION SOCKET TYPE CONDUIT TYPE
	GENERAL SOCKET 2 Wall twins 10A, 230V Concealed
	SPECIFIC EQUIPMENT - One wall-mounted fuse connection unit at high level from essential power supply for digital clock (by COM) - Electrical provisions for system panels and consoles - One fuse connection unit from essential supply for COM - EARTHING TERMINAL - double power points = 2
PLUMBING & DRAINAGE	Cleansing water supply
FIXTURES, EQUIPMENT & LOOSE FURNITURE	
TYPE & LOCATION	1. 4 Nos of Safety Harness Anchor Points at Floor Level
OTHERS	--
OTHERS	- All building services requirement above are indicative only. Contractor to ensure statutory compliance

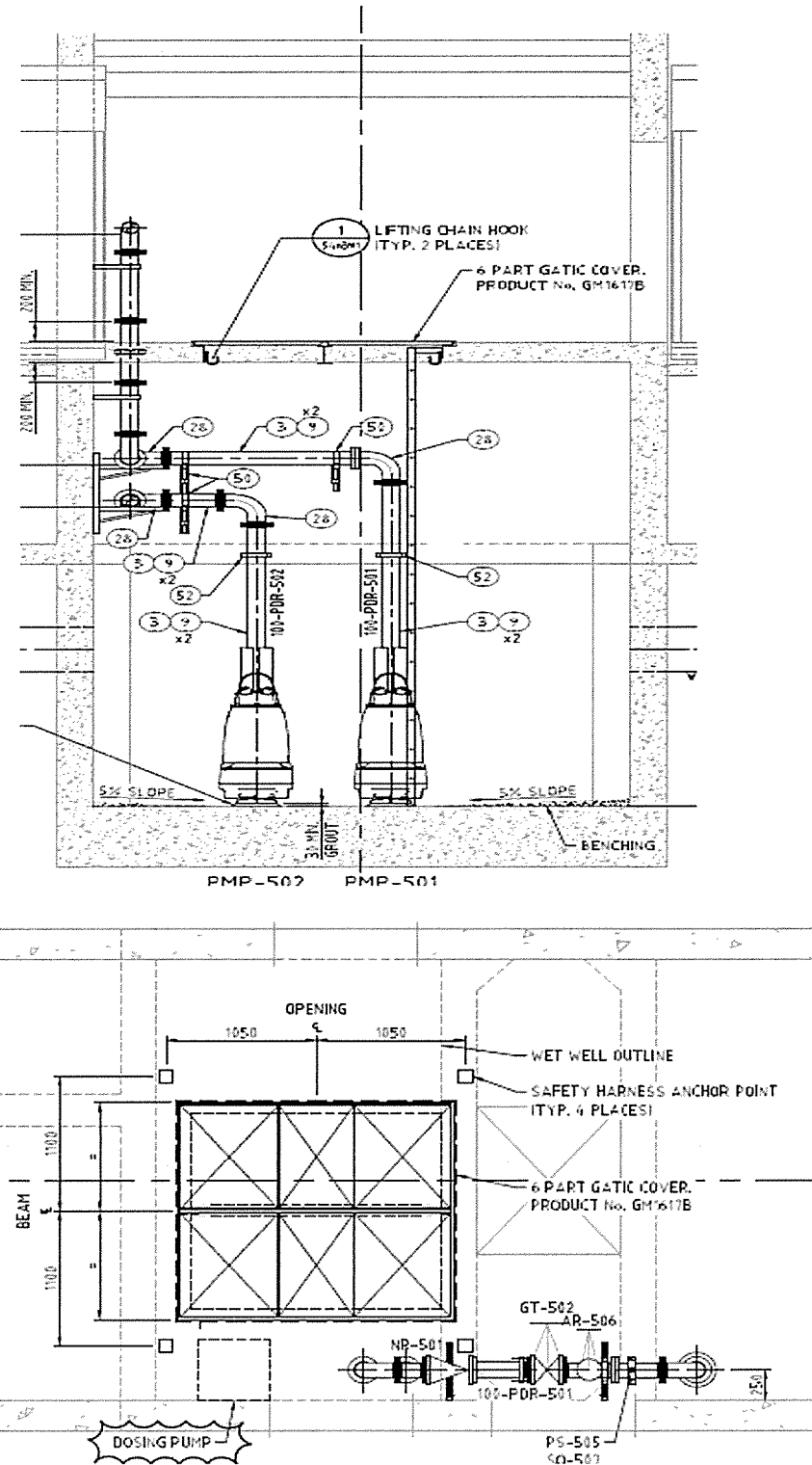
Typical Layout



ROOM DATA SHEET

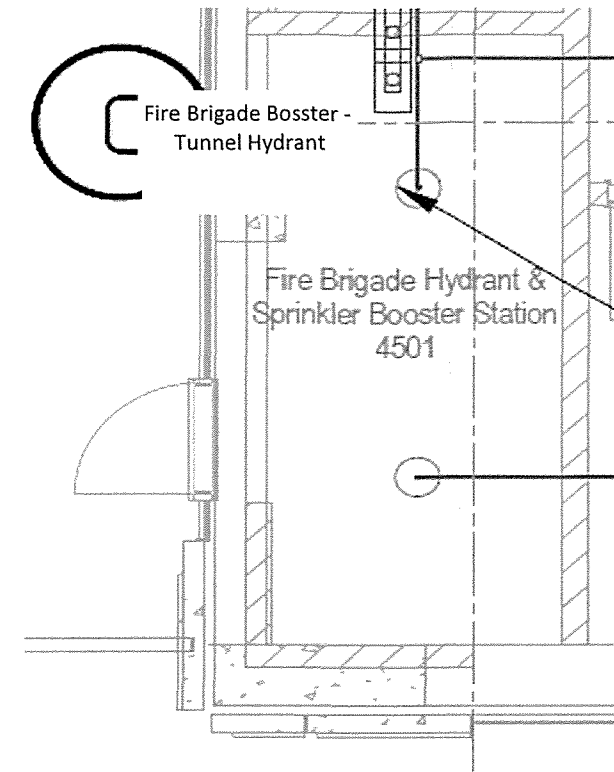
ROOM NAME		Primary Tunnel Water Sump (Subfloor) / Secondary Tunnel Water Sump (Subfloor)			
ROOM NUMBER (To be Adopted)		802S / 803S			
FUNCTIONAL REQUIREMENTS					
FUNCTION		To pump water from the sump at the designated flow rate and pressure through the rising main to discharge			
SIZE / DIMENSION		Primary Tunnel Water Sump (Subfloor) = 4m(W) x 4m(L) x 4m(H) Secondary Tunnel Water Sump (Subfloor) = 3m(W) x 3m(L) x 4m(H)			
LOCATION		Primary at South Platform End / Secondary at North Platform End			
CONNECTION		Tunnel Groundwater Sump (Directly above at Platform Level)			
MATERIALS & FINISHES					
FLOOR		Floor sealer on granolithic		WATER TIGHTNESS*	
SKIRTING		Floor sealer on granolithic		Refer to SWTC	
WALL		Wall sealer paint on fair faced concrete or blockwork		Refer to SWTC	
CEILING		Wall sealer paint on fair faced concrete or blockwork		Refer to SWTC	
OTHERS		Floor with 5% benching			
DOORS & IRONMONGERY					
DOOR TYPE		SET 1		SET 2	
		2m x 2m opening with gratic covers at floor level			
CLEAR OPENING REQUIRED		N/A			
DIRECTION OF SWING		N/A			
FIRE RESISTANCE		N/A			
AIR RESISTANCE		N/A			
STC RATING		N/A			
LOCK FUNCTION		N/A			
ACCESSORIES		N/A			
EACS/SECURITY LEVEL		N/A			
OTHERS		--			
BUILDING SERVICES					
DELIVERY ROUTE SIZE		Lifting chain hook for lifting pumps			
RM: NOISE LEVEL		--			
COMMUNICATIONS FACILITIES					
ECS		Ventilation system (for non-essential power supply)			
LIGHTING		--			
TYPE		--			
DIFFUSER		--			
LUX		--			
IP		--			
FIRE PROTECTION		As per Fire and Life Safety Strategy			
DETECTION		As per Fire and Life Safety Strategy			
SUPPRESSION		Refer to FS provision of sump pump room			
EXTINGUISHER		Yes			
SEPARATION		Yes			
SMOKE EXTRACT		--			
OTHERS		--			
ELECTRICAL/ POWER REQUIREMENTS		NUMBER		LOCATION	
GENERAL SOCKET		NIL			
SPECIFIC EQUIPMENT				SOCKET TYPE	
PLUMBING & DRAINAGE		NIL			
FIXTURES, EQUIPMENT & LOOSE FURNITURE					
TYPE & LOCATION		See indicative diagram			
OTHERS		NIL			
OTHERS		1. Stainless steel access ladder with safety hoop for access to bottom level. 2. All building services requirement above are indicative only. Contractor to ensure statutory compliance			

Typical Layout



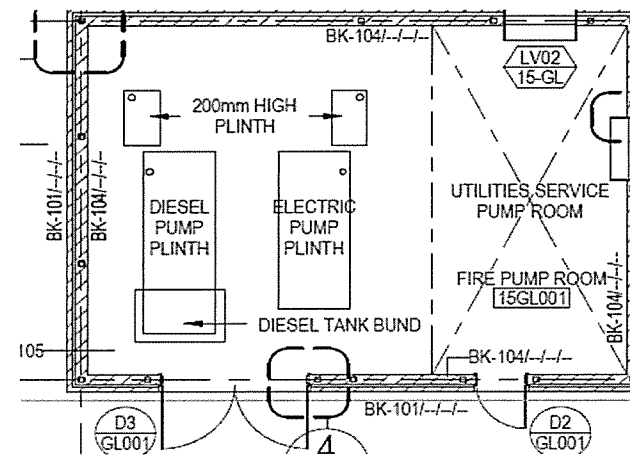
ROOM DATA SHEET				
ROOM NAME		Fire Bridgade Booster - Tunnel Hydrant		
ROOM NUMBER (To be Adopted)		7C1		
FUNCTIONAL REQUIREMENTS				
FUNCTION		1. Emergency Response Team to use as appropriate in emergency situations.		
SIZE / DIMENSION		To suit equipment size		
LOCATION		1. Surface level accessible outside of station by fire bridgage 2. Next to water metre cupboard and water main connection 3. Minimum 10 m from substation / electrical rooms		
CONNECTION		--		
MATERIALS & FINISHES		WATER TIGHTNESS*		
FLOOR		Floor sealer on granolithic		
SKIRTING		Floor sealer on granolithic		
WALL		Wall sealer paint on fair faced concrete or blockwork		
CEILING		Wall sealer paint on fair faced concrete or blockwork		
OTHERS		--		
DOORS & IRONMONGERY		SET 1		SET 2
DOOR TYPE		1		Equipment
CLEAR OPENING REQUIRED		2100mm (H) x 900mm (W)		
DIRECTION OF SWING		Swing out at 90 degrees		
FIRE RESISTANCE		Same FRP as the adjoining wall		
AIR RESISTANCE		NIL		
STC RATING		NIL		
LOCK FUNCTION		NIL		
ACCESSORIES		NIL		
EACS/SECURITY LEVEL		MEDIUM: Panic Exit Device, Local Control Unit, card reader unit, electric door lock, door sensor/reed switch		Panic Exit Device
OTHERS		--		
BUILDING SERVICES				
DELIVERY ROUTE SIZE		--		
RM. NOISE LEVEL		--		
COMMUNICATIONS FACILITIES		Radio coverage		
ECS		Ventilation system		
LIGHTING		TYPE 1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting		
		DIFFUSER yes		
		LUX Essential: 320 Nominal, Emergency: 10		
		IP weatherproof IP54		
FIRE PROTECTION		DETECTION smoke detectors		
		SUPPRESSION NIL		
		EXTINGUISHER Yes		
		SEPARATION Yes		
		SMOKE EXTRACT --		
		OTHERS --		
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
		1	Wall	twins 10A, 230V
		CONDUIT TYPE Consealed		
PLUMBING & DRAINAGE		floor drain with 150mm diameter drainage outlet		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		See indicative room layout		
OTHERS		Room sign		
OTHERS		- All building services requirement above are indicative only. Contractor to ensure statutory compliance		

Typical Layout



ROOM DATA SHEET					
ROOM NAME		Trackside Fire Services Pump Room 1			
ROOM NUMBER (To be Adopted)		702			
FUNCTIONAL REQUIREMENTS					
FUNCTION		For fuel replacement and maintenance			
SIZE / DIMENSION		6m(W) x 6m(L) x 4m(H)			
LOCATION		1. Surface level accessible outside of station by fire bridgeway 2. Next to Fire Water Storage Tank 3. At same station end as Fire Control Room			
CONNECTION					
MATERIALS & FINISHES					
FLOOR		Floor sealer on granolithic		WATER TIGHTNESS*	
SKIRTING		Floor sealer on granolithic			
WALL		Wall sealer paint on fair faced concrete or blockwork			
CEILING		Wall sealer paint on fair faced concrete or blockwork			
OTHERS					
DOORS & IRONMONGERY		SET 1		SET 2	
DOOR TYPE		09			
CLEAR OPENING REQUIRED		2100mm (H) x 1500mm (W)			
DIRECTION OF SWING		Swing out at 180 degrees			
FIRE RESISTANCE		Same FRP as the Adjoining Wall			
AIR RESISTANCE		N/A			
STC RATING		30			
LOCK FUNCTION		Latch operable by key outside; inside always free for exit			
ACCESSORIES		Door closer; kick plates			
EACS/SECURITY LEVEL		MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1			
OTHERS		--			
BUILDING SERVICES					
DELIVERY ROUTE SIZE		2 m wide corridor outside room for pump delivery			
RM. NOISE LEVEL		--			
COMMUNICATIONS FACILITIES		RADIO COVERAGE RJ45 socket (digital phone) Qty 1 PABX analogue phones Qty 1 Direct Line Phones Qty 1 RJ45 LAN Ports = 3			
ECS		Ventilation system (2 duty fans each 60% design flow) from essential supply			
LIGHTING		TYPE 1) FLUORESCENT 2) local switch 3) motion sensor 4) emergency lighting			
		DIFFUSER		yes	
		LUX		Essential: 320 Nominal, 500 Desktop; Emergency: 10	
		IP		weatherproof IP54	
FIRE PROTECTION		DETECTION		smoke detectors	
		SUPPRESSION		NIL	
		EXTINGUISHER		Yes	
		SEPARATION		Yes	
		SMOKE EXTRACT		--	
		OTHERS		--	
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE
		2	Wall	twins 10A, 230V	Consealed
		SPECIFIC EQUIPMENT - One wall-mounted fuse connection unit at high level from essential power supply for digital clock (by COM) - Electrical provisions for system panels and consoles - One fuse connection unit from essential supply for COM - EARTHING TERMINAL - double power points = 2			
PLUMBING & DRAINAGE		floor drain with 150mm diameter drainage outlet; cleansing water supply.			
FIXTURES, EQUIPMENT & LOOSE FURNITURE					
TYPE & LOCATION		See indicative room layout			
OTHERS		Room sign			
OTHERS		- All building services requirement above are indicative only. Contractor to ensure statutory compliance - plinth and lifting hooks as required, curb at entrance door, safety railing on top of water tank adjacent to cat ladder			

Typical Layout



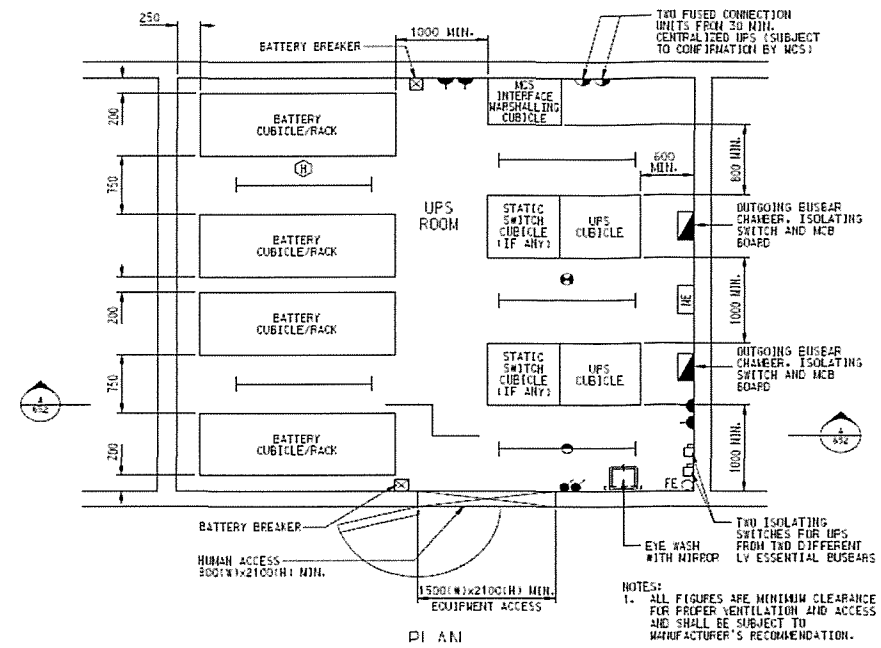
ROOM DATA SHEET

ROOM NAME		Centralised UPS Room			
ROOM NUMBER (To be Adopted)		420A & 420B			
FUNCTIONAL REQUIREMENTS					
FUNCTION		Room for UPS and Batteries			
SIZE / DIMENSION		14m(L) x 14m (W), headroom 4m			
LOCATION		Preferably adjacent to LV main switch Room or close to Communication rooms			
CONNECTION		Direct to service corridor			
MATERIALS & FINISHES					
FLOOR		Floor sealer on granolithic		WATER TIGHTNESS* The complete absence of any leakage, seepage and damp patches.	
SKIRTING		Floor sealer on granolithic			
WALL		Fair faced concrete or blockwork			
CEILING		Fair faced concrete			
OTHERS					
DOORS & IRONMONGERY					
		SET 1		SET 2	
DOOR TYPE		08A			
CLEAR OPENING REQUIRED		2100mm (H) x 900mm (W)			
DIRECTION OF SWING		Swing out at 180 degrees			
FIRE RESISTANCE		Same FRP as the Adjoining Wall			
AIR RESISTANCE		N/A			
STC RATING		20			
LOCK FUNCTION		EACS			
ACCESSORIES		Door closer; kick plates			
EACS/SECURITY LEVEL		Medium :Fail safe electric lock: latch retracted (or outside lever handles unlocked) electrically by Access card / remote release switch on non-security sides: alternatively, latch retracted mechanically by lever handle inside or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1			
OTHERS					
BUILDING SERVICES					
DELIVERY ROUTE SIZE		1.5m (W) x 2.5m (H)			
RM. NOISE LEVEL		Refer to local requirement			
COMMUNICATIONS FACILITIES					
		RADIO COVERAGE PABX analogue phones Qty 1			
ECS					
		Independent ventilation system (2 duty fans each 60% of design flow) to comply with local statutory requirement. Package split type A/C as backup provisions. No ventilation system to provide cooling. Cooling will be by air conditioning units (Note 1)			
LIGHTING		Fluorescent			
		TYPE			
		DIFFUSER			
		LUX			
		300 lux (control area), 160 lux (general area) 10 lux emergency.			
		IP			
		N/A			
FIRE PROTECTION		smoke detectors			
		SUPPRESSION			
		gas suppression			
		EXTINGUISHER			
		Yes			
		SEPARATION			
		Yes			
		SMOKE EXTRACT			
		--			
		OTHERS			
		--			
ELECTRICAL/ POWER REQUIREMENTS		NUMBER		LOCATION	
		2		WALL	
		SOCKET TYPE		CONDUIT TYPE	
		twins 10A, 230V		Consealed	
		SPECIFIC EQUIPMENT			
		2 TPN isolating switches derived from two different LV essential busbars for UPS, Earthing terminal			
PLUMBING & DRAINAGE					
NIL					
FIXTURES, EQUIPMENT & LOOSE FURNITURE					
TYPE & LOCATION		See indicative room layout			
OTHERS		Room sign			
OTHERS		PCS equipment may be installed / No water pipe or civil expansion joint inside the room / No water tank above the room All building services requirement above are indicative only. Contractor to ensure statutory compliance			

(Note 1) For the Metro Station Rooms listed above, the Room must

- be provided with a mechanical supply and an exhaust system in accordance with Appendix B04b 3.1.4 Table 6 and include duty and standby cooling systems to provide cooling. A standby ventilation system is not required for these rooms unless required by codes and standards and by Law.

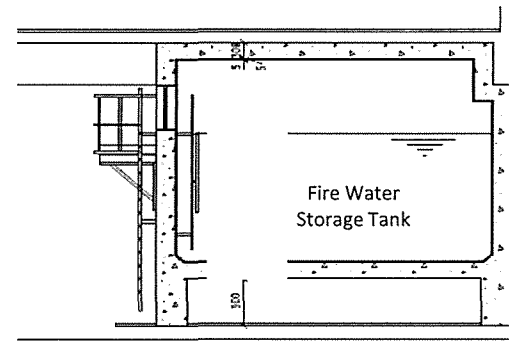
- be fitted with duty cooling systems where the duty units must be connected to the central chilled water system and standby units must be connected to the separate water cooled package unit system supplied by the CSM Contractor. A back up exhaust system connected to the UPS to be provided to operate in the event of a power failure by the CSM Contractor.



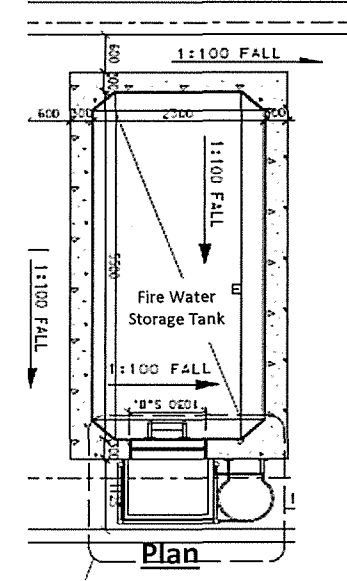
ROOM DATA SHEET

ROOM NAME		Fire Water Storage Tank Room	
ROOM NUMBER (To be Adopted)		705	
FUNCTIONAL REQUIREMENTS			
FUNCTION		To store water for tunnel hydrant	
SIZE / DIMENSION		5m (W) x 5m(D) x 4m (H) size and quantity of water tank should be reviewe by BS/fire engineer to ensure statutory compliance	
LOCATION		Next to Fire Pump Room	
CONNECTION		--	
MATERIALS & FINISHES		WATER TIGHTNESS*	
FLOOR		Floor sealer on granolithic Refer to SWTC	
SKIRTING		Floor sealer on granolithic Refer to SWTC	
WALL		Wall sealer paint on fair faced concrete or blockwork Refer to SWTC	
CEILING		Wall sealer paint on fair faced concrete or blockwork Refer to SWTC	
OTHERS		--	
DOORS & IRONMONGERY		SET 1	
DOOR TYPE		N/A	
CLEAR OPENING REQUIRED		See diagram	
DIRECTION OF SWING		N/A	
FIRE RESISTANCE		Same FRP as the Adjoining Wall	
AIR RESISTANCE		N/A	
STC RATING		N/A	
LOCK FUNCTION		NIL	
ACCESSORIES		NIL	
EACS/SECURITY LEVEL		NIL	
OTHERS		--	
BUILDING SERVICES			
DELIVERY ROUTE SIZE		--	
RM. NOISE LEVEL		--	
COMMUNICATIONS FACILITIES		--	
ECS		--	
LIGHTING	TYPE	fluorescent luminaires, emergency lighting	
	DIFFUSER	yes	
	LUX	Essential: 320 Nominal, Emergency: 10	
	IP	weatherproof IP54	
FIRE PROTECTION	DETECTION	NIL	
	SUPPRESSION	NIL	
	EXTINGUISHER	NIL	
	SEPARATION	Yes	
	SMOKE EXTRACT	--	
ELECTRICAL/ POWER REQUIREMENTS	GENERAL SOCKET	NUMBER	LOCATION
	SPECIFIC EQUIPMENT	--	
PLUMBING & DRAINAGE		NIL	
FIXTURES, EQUIPMENT & LOOSE FURNITURE			
TYPE & LOCATION		See indicative room layout	
OTHERS		- Room sign - Minimum headroom of 1500mm shall be maintained over the top of water tank.	
OTHERS		1. Stainless steel access ladder with safety hoop for access to bottom level. 2. All building services requirement above are indicative only. Contractor to ensure statutory compliance	

Typical Layout



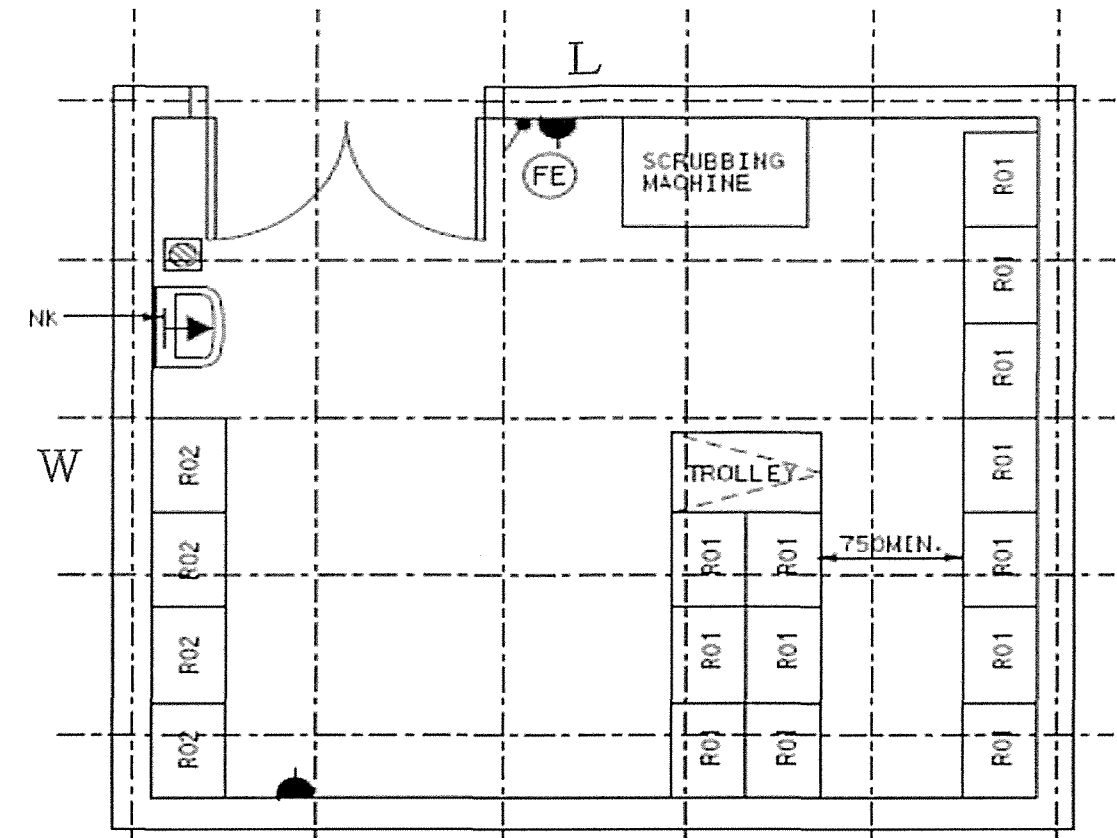
Section



Plan

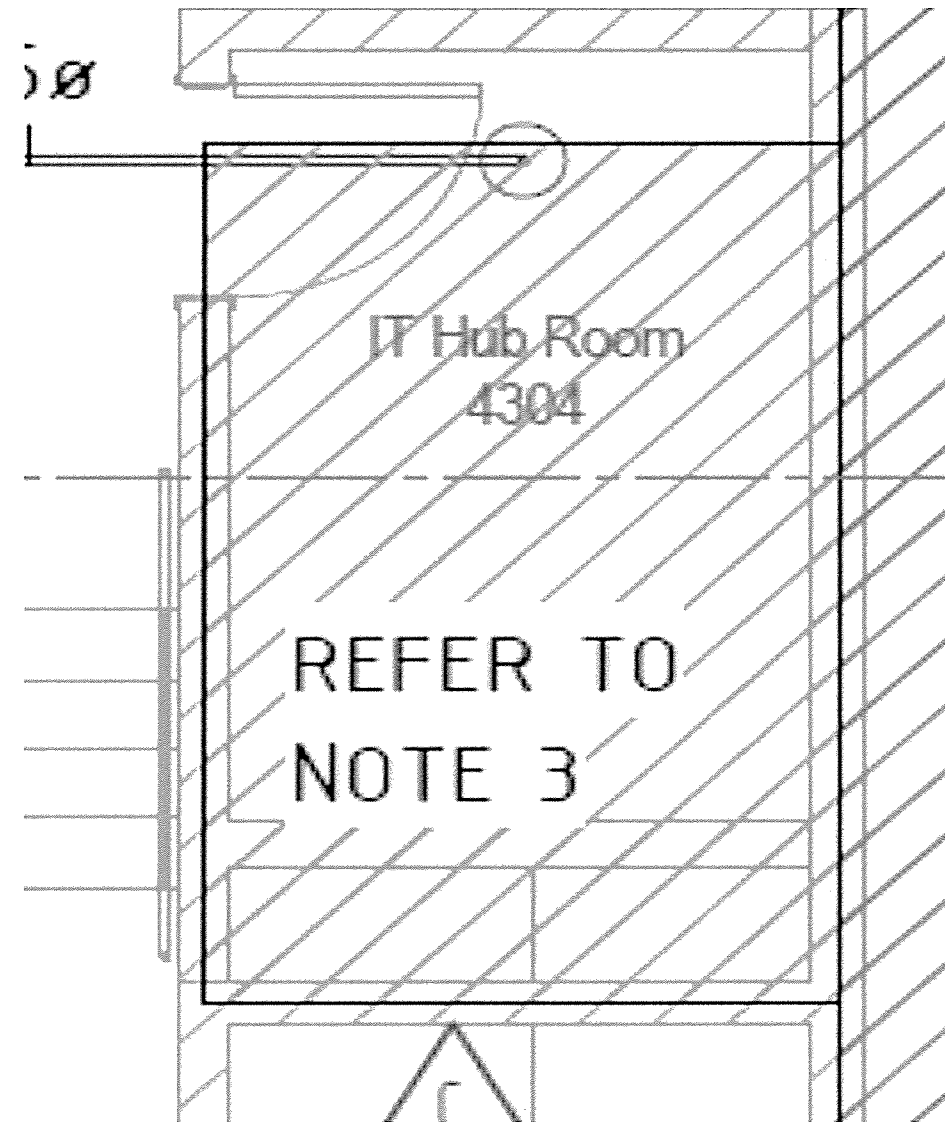
ROOM DATA SHEET				
ROOM NAME		Chemical Store Room		
ROOM NUMBER (To be Adopted)		1005A		
FUNCTIONAL REQUIREMENTS				
FUNCTION		Storage area for chemical		
SIZE / DIMENSION		4m (L) x 2.5m (W) = 10 m ²		
LOCATION		Adjacent to station plant rooms		
CONNECTION		--		
MATERIALS & FINISHES				
FLOOR		Floor sealer on granolithic		WATER TIGHTNESS*
SKIRTING		Floor sealer on granolithic		
WALL		Wall sealer paint on fair faced concrete or blockwork		
CEILING		Wall sealer paint on fair faced concrete or blockwork		
OTHERS		Glazed ceramic tiles splash back above slop sink		
DOORS & IRONMONGERY		SET 1		SET 2
DOOR TYPE		9A		
CLEAR OPENING REQUIRED		2100mm (H) x 1500mm (W)		
DIRECTION OF SWING		Swing in at 90 degrees		
FIRE RESISTANCE		Same FRP as the Adjoining Wall		
AIR RESISTANCE		-		
STC RATING		20		
LOCK FUNCTION		Latch operable by key outside; inside always free for exit		
ACCESSORIES		Door closer; flush bolts and sockets; armour plates; door stop		
EACS/SECURITY LEVEL		MEDIUM: Local Control Unit (LCU) [Type A / Type B] Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1		
OTHERS		--		
BUILDING SERVICES				
DELIVERY ROUTE SIZE		--		
RM: NOISE LEVEL		--		
COMMUNICATIONS FACILITIES				
ECS		RADIO COVERAGE		
LIGHTING		Ventilation (segregated system) to meet the hazard class of chemical to local regulation		
TYPE		1) FLUORESCENT 2) local switch 3) motion sensor		
DIFFUSER		yes		
LUX		min. 160 Lux, 10 Lux emergency		
IP		Required for explosion proof class to local regulation		
FIRE PROTECTION		DETECTION smoke / heat detection		
SUPPRESSION		sprinkler or equivalent provisions to local regulations		
EXTINGUISHER		Yes		
SEPARATION		Yes		
SMOKE EXTRACT		--		
OTHERS		--		
ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
GENERAL SOCKET		2	WALL	twins 10A, 230V
SPECIFIC EQUIPMENT		double power point = 1		
PLUMBING & DRAINAGE		water points and floor drain		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		See indicative room layout		
OTHERS		Room sign		
OTHERS		-All building services requirement above are indicative only. Contractor to ensure statutory compliance		

Typical Layout



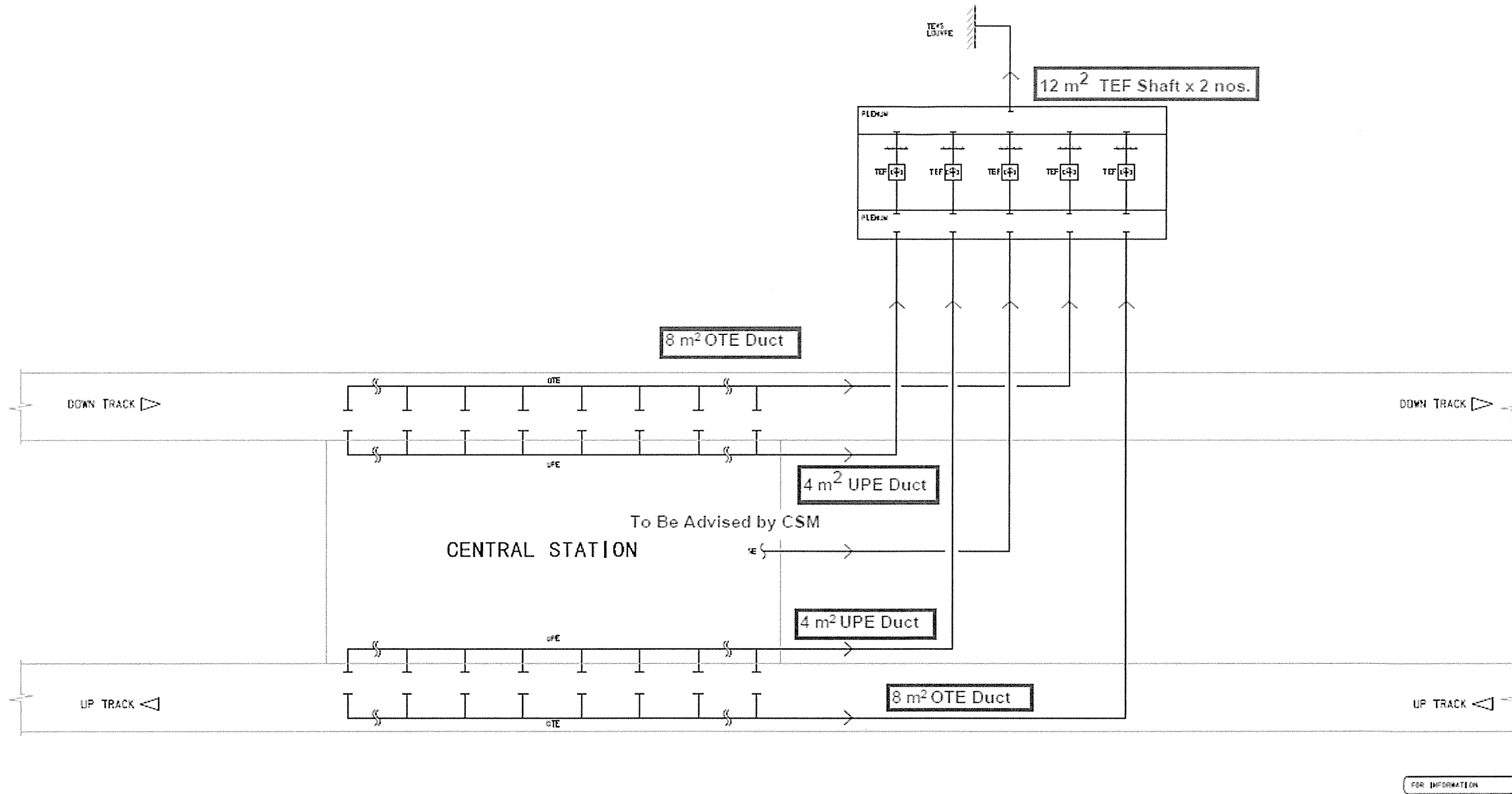
ROOM DATA SHEET				
ROOM NAME		IT Hub Room (Not required by Systemwide E&M)		
ROOM NUMBER (To be Adopted)		304		
FUNCTIONAL REQUIREMENTS				
FUNCTION		1. Maintenance staff to provide scheduled preventive maintenance and inspections 2. Technician to address problems and replace equipments 3. At same station end as Fire Control Room		
SIZE / DIMENSION		3m(W) x 3m(L) x 3.5m (H)		
LOCATION				
CONNECTION		--		
MATERIALS & FINISHES		WATER TIGHTNESS*		
FLOOR		Floor sealer on granolithic		
SKIRTING		Floor sealer on granolithic		
WALL		Wall sealer paint on fair faced concrete or blockwork		
CEILING		Wall sealer paint on fair faced concrete or blockwork		
OTHERS		--		
DOORS & IRONMONGERY		SET 1		SET 2
DOOR TYPE		05A		
CLEAR OPENING REQUIRED		2100mm(H) x 1050mm(W)		
DIRECTION OF SWING		Swing-in at 90 degrees		
FIRE RESISTANCE		Same FRP as the adjoining wall		
AIR RESISTANCE		N/A		
STC RATING		35		
LOCK FUNCTION		EACS		
ACCESSORIES		Door closer; acoustic seal if necessary;		
EACS/SECURITY LEVEL		HIGH: Fail safe electric lock: latch retracted (or lever handles unlocked) electrically by Access card / remote release switch on both sides alternatively, latch retracted mechanically by thumb-turn or by key outside. Local Control Unit (LCU) [Type A / Type B] Pin keypad Qty 1 Break glass release unit Qty 1 Card reader uni Qty 1 Electric Door lock Qty 1 Door Sensor/Reed Switch Qty 1		
OTHERS		--		
BUILDING SERVICES				
DELIVERY ROUTE SIZE		--		
RM: NOISE LEVEL		--		
COMMUNICATIONS FACILITIES		RADIO COVERAGE PABX analogue phones Qty 1		
ECS		A/C, 25.5 °C, 50% ± 10% RH, Standby ventilation ^(Note 1) , Essential power supply		
LIGHTING		FLUORESCENT		
TYPE		--		
DIFFUSER		--		
LUX		Essential: 300; Emergency: 10		
IP		N/A		
FIRE PROTECTION		Smoke detection / heat detection and audio alarm		
DETECTION		--		
SUPPRESSION		NIL		
EXTINGUISHER		Yes		
SEPARATION		Yes		
SMOKE EXTRACT		--		
OTHERS		--		
ELECTRICAL/POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE
GENERAL SOCKET		2	WALL	twins 10A, 230V
SPECIFIC EQUIPMENT		Double Power Point		
PLUMBING & DRAINAGE		NIL		
FIXTURES, EQUIPMENT & LOOSE FURNITURE				
TYPE & LOCATION		See indicative room layout		
OTHERS		Room sign		
OTHERS		-All building services requirement above are indicative only. Contractor to ensure statutory compliance		
(Note 1) For the Metro Station Rooms listed above				
- A standby ventilation system is not required for these rooms unless required by codes and standards and by Law.				
- The room must be fitted with duty cooling systems where the duty units must be connected to the central chilled water system and standby units must be connected to the separate water cooled package unit system supplied by the CSM Contractor.				

Typical Layout



Trackway Exhaust System

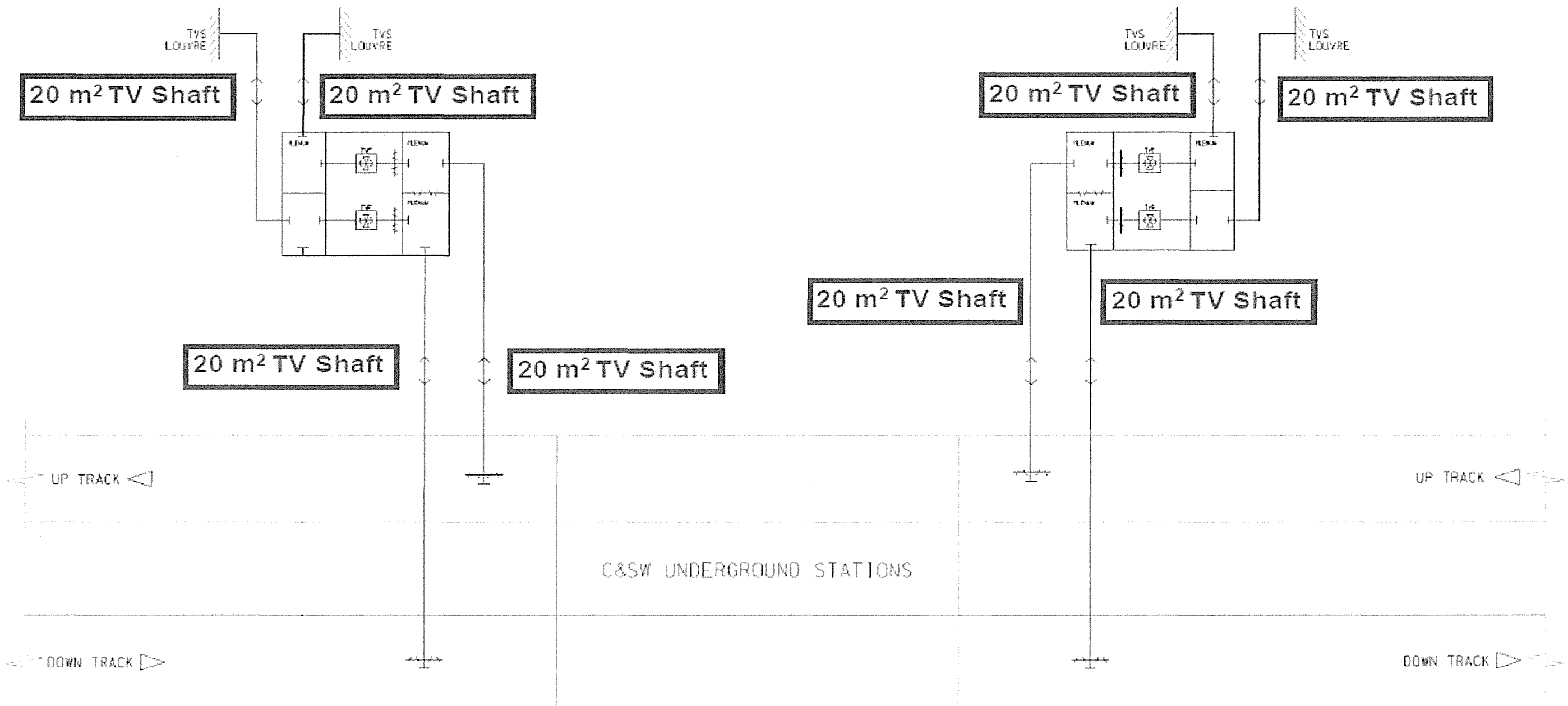
- ABBREVIATIONS:**
 OTE OVER TRACK EXHAUST
 SE SMOKE EXTRACTION
 TEF TRACKWAY EXHAUST FAN
 TEVS TRACKWAY EXHAUST VENTILATION SHAFT
 UPE UNDER PLATFORM EXHAUST



-All building services requirement above are indicative only. Contractor to ensure statutory compliance

Tunnel Ventilation System

ABBREVIATIONS:
 TVF TUNNEL VENTILATION FAN
 TVS TUNNEL VENTILATION SHAFT

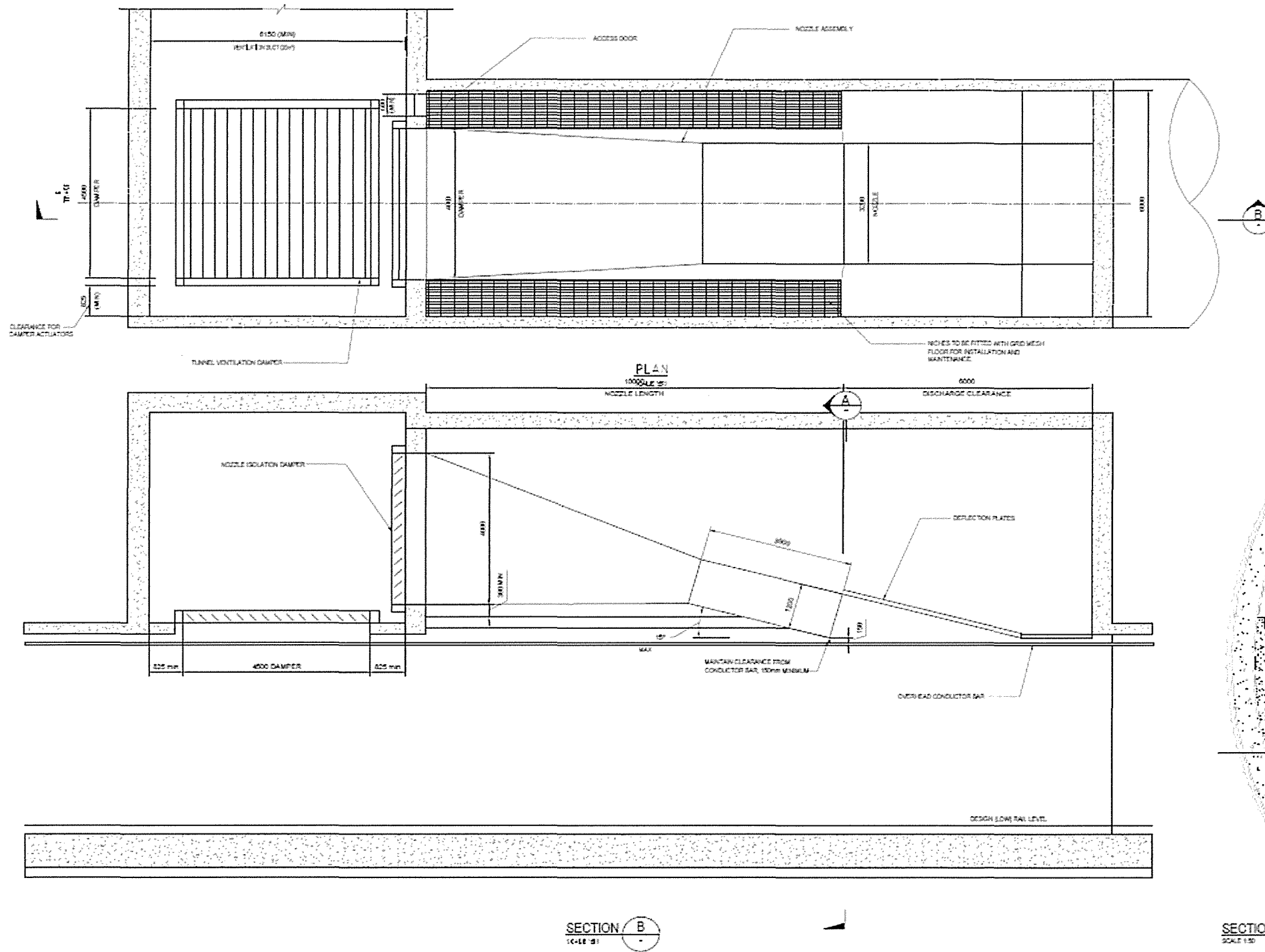


A 20 m² Draught Relief Shaft near TVF Fan Room and with connection to both up-track and down-track tunnels shall also be provided at the two ends of Central Station (Total 2 numbers of Shafts)

NO INFORMATION

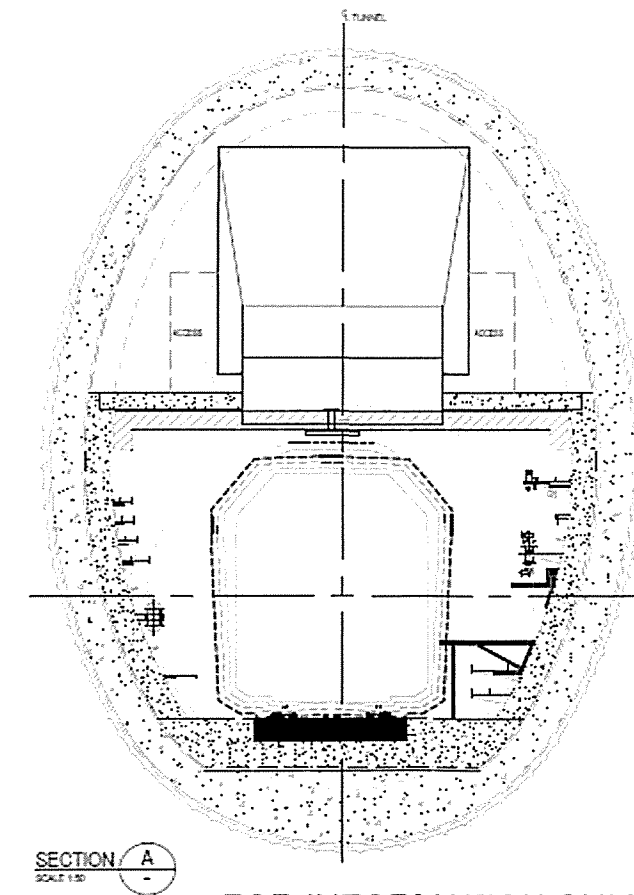
-All building services requirement above are indicative only. Contractor to ensure statutory compliance

Central Station Main Works: SWTC Appendix F3 - Metro Station Works - Room Schedule
Tunnel Nozzle (To be made of Reinforced Concrete)



NOTES:

- 1 THIS DRAWING OUTLINES AN INDICATIVE ARRANGEMENT FOR A TUNNEL VENTILATION NOZZLE.
- 2 ALL DIMENSIONS ARE NOMINAL.
- 3 DAMPER GASKETS ARE INTERNAL TO DAMPER FRAME.
- 4 MESH GAWWAY OVER NOZZLE AND DAMPER TO BE PROVIDED WHERE REQUIRED FOR ACCESS (NOT SHOWN FOR CLARITY).
- 5 A SUBSTITUTED NOZZLE FIT MAY BE CONSIDERED IF HIGH VELOCITY FLOW ACROSS THE CONDUCTOR BAR IS PROBLEMATIC. ALTERNATIVELY COWLING ON CONDUCTOR BAR MAY BE REQUIRED.
- 6 SUPPORT NOT SHOWN TO BE DEVELOPED AT LATER DETAIL.
- 7 NOT FOR CONSTRUCTION.
- 8 NOZZLE DIMENSIONS SHOWN ARE INDICATIVE FOR 120m³/s FLOW WITH A DISCHARGE VELOCITY = 30m/s.
- 9 CONNECTION TO NOZZLE IS INDICATIVE AND WILL BE DEPENDANT ON INDIVIDUAL STATION ARRANGEMENT.



-All building services requirement above are indicative only. Contractor to ensure statutory compliance

F03 - Metro Station - Room Data 5

-All building services requirement above are indicative only. Contractor to ensure statutory compliance

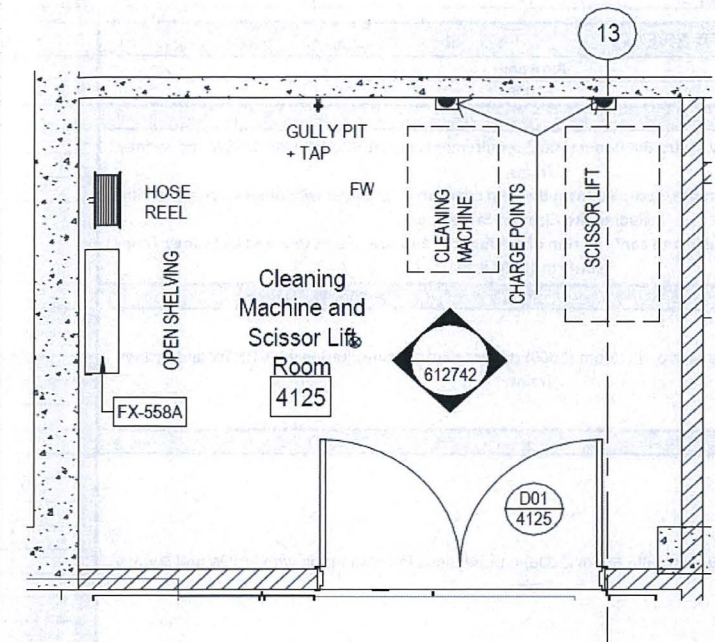
F03 - Metro Station - Room Data Sheets

A	B	C	D	E	F	G	H	I	J	K	L
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule										
2											
3	Room & Area Summary - Sydney Trains								Revisions		
4	Sheet	Ref. No.	Room Requirement		Room Name	Area (m ²)	Comments		5/06/2017	14/06/2017	
Mandatory			Subject to Contractor design								
5											
6	Communications										
7	1	F200		TBD	Concourse Telecommunications Room	20 m ²			A	B	
8	2	F201		TBD	Communications Equipment Room CENA 5	41 m ²			A	B	
9	3	F202		TBD	Communications Equipment Room CENA 2	27 m ²			A	B	
10	4	-		TBD	Communications Equipment Room CENA 42	TBD			A	B	
11	Electrical										
12	5	F400		TBD	HV Switchgear Room (11kV)	16 m ²			A	B	
13	6	F401		TBD	11kV Transformer Room (11kV / 415V)	16 m ²			A	B	
14	7	F402		TBD	LV Main Switch Room (415V MSB)	27 m ²			A	B	
15	Mechanical										
16	8	F507		TBD	Concourse Ventilation Fan Room	88 m ²			A	B	
17	Fire										
18	9	F700		TBD	Gas Suppression Equipment Room	12 m ²			A	B	
19	10	F704	YES		Fire Control Room (existing)	As Per Existing			A	B	
20	11	-		TBD	Eastern Hydrant and Sprinkler Zone Pump Room	TBD			A	B	
21	Hydraulics										
22	12	F808		TBD	Hot Water Plant Room	3 m ²			A	B	
23	Staff Facilities										
24	13	-	YES		MEWP Store Room	12 m ²			A	B	
25	14	F1006	YES		Bin Room	5 m ²			A	B	
26	15	F1007	YES		Chemical Store Room	9 m ²			A	B	
27	16	F1008	YES		Platform Cleaning Machine Room	12 m ²			A	B	
28	17	F1009	YES		Cleaners Store Room	10 m ²			A	B	
29	18	F1011	YES		Station Staff WC	7 m ²			A	B	
30	19	F1014	YES		Station Store Room	20 m ²			A	B	
31	20	F1015	YES		Maintenance Office – Customer Service Rep.	12 m ²			A	B	
32	21	F1016	YES		Maintenance Store Room	5 m ²			A	B	
33	22	-	YES		Multi-Purpose Meeting Room	74 m ²			A	B	
34	23	-	YES		Platform 16/17 Stand-by Guard Room	12 m ²	Facilities likely to require multiple rooms.		A	B	
35	24	-	YES		Platform 18/19 Stand-by Guard Room	12 m ²	Facilities likely to require multiple rooms.		A	B	
36	25	-	YES		Platform 20/21 Stand-by Guard Room	12 m ²	Facilities likely to require multiple rooms.		A	B	
37	26	-	YES		Platform 22/23 Stand-by Guard Room	12 m ²	Facilities likely to require multiple rooms.		A	B	
38	27	-	YES		Remote Stand-by Guard Room	TBD	Room added following amendments to staff spaceproofing numbers for platform Stand-by Guard Rooms		-	B	
39	Public Facilities										
40	28	F1103	YES		Male Public WC	3 m ²			A	B	
41	29	F1104	YES		Female Public WC	3 m ²			A	B	
42	30	F1105	YES		Accessible Public WC	6 m ²			A	B	
43	31	F1106	YES		Parenting Room	8 m ²			A	B	
44											
45											
46											
47	F04 - Central Station - Room Data Sheets										

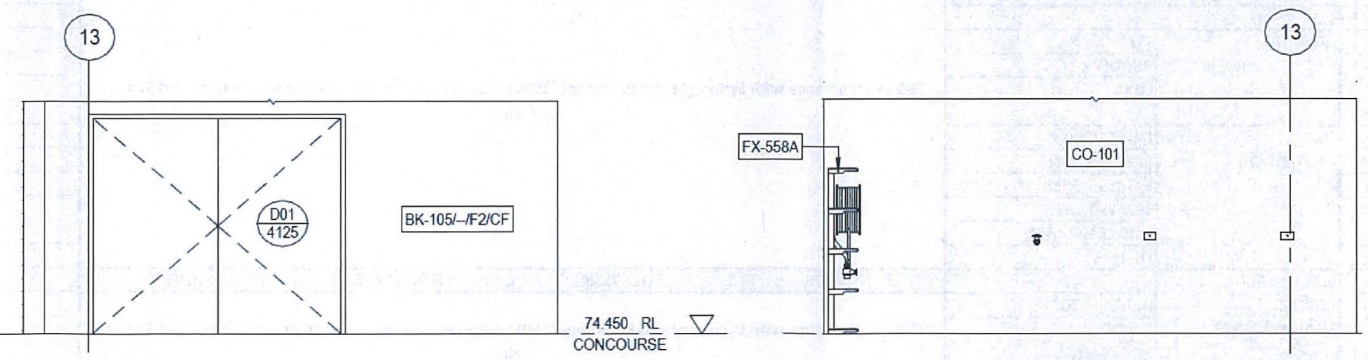
A	B	C	D	E	F	G					
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule										
2											
3	ROOM DATA SHEET										
4	ROOM NAME	Fire Control Room (existing)									
5	ROOM NUMBER	F704									
6	FUNCTIONAL REQUIREMENTS										
7	FUNCTION	As per existing room unless newer standards dictate greater provisions.									
8	SIZE / DIMENSION										
9	LOCATION										
10	CONNECTION										
11	MATERIALS & FINISHES						WATER TIGHTNESS*				
12	FLOOR	As per existing room unless newer standards dictate greater provisions.									
13	SKIRTING										
14	WALL										
15	CEILING										
16	OTHERS										
17	DOORS & IRONMONGERY	SET 1		SET 2							
18	DOOR TYPE	As per existing room unless newer standards dictate greater provisions.									
19	CLEAR OPENING REQUIRED										
20	DIRECTION OF SWING										
21	FIRE RESISTANCE										
22	AIR RESISTANCE										
23	STC RATING										
24	LOCK FUNCTION										
25	ACCESSORIES										
26	SAMS/SECURITY LEVEL										
27	OTHERS										
28	BUILDING SERVICES										
29	DELIVERY ROUTE SIZE	As per existing room unless newer standards dictate greater provisions.									
30	RM: NOISE LEVEL										
31	COMMUNICATIONS FACILITIES										
32	ECS										
33	LIGHTING						TYPE				
34							DIFFUSER				
35							LUX				
36							IP				
37	FIRE						DETECTION				
38	PROTECTION						SUPPRESSION				
39							EXTINGUISHER				
40							SEPARATION				
41							SMOKE EXTRACT				
42							OTHERS				
43	ELECTRICAL/							NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE
44	POWER	GENERAL SOCKET	As per existing room unless newer standards dictate greater provisions.								
45	REQUIREMENTS	SPECIFIC EQUIPMENT									
46	PLUMBING & DRAINAGE										
47	FIXTURES, EQUIPMENT & LOOSE FURNITURE										
48	TYPE & LOCATION	As per existing room unless newer standards dictate greater provisions.									
49	OTHERS										
50	OTHERS										
51											
52											
53	* Water Tightness Control Requirements										
54	Class	Description									
55	I	Free from all visible leakage, seepage, and damp patches									
56	II	Leakage shall be restricted to minor damp patches with no visible flow of water.									
57	III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.									
58	"damp" means wet with no visible film of water										
59	F04 - Central Station - Room Data Sheets										

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T										
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																												
2																													
3	ROOM DATA SHEET																												
4	ROOM NAME	MEWP Store																											
5	ROOM NUMBER																												
6	FUNCTIONAL REQUIREMENTS																												
7	FUNCTION	TBD in accordance with Sydney Metro MEWP Store (1000) requirements in consultation with TfNSW and Sydney Trains.																											
8	SIZE / DIMENSION	1 x adjacent to new Eastern Entrance or in the North-South Concourse.																											
9	LOCATION	Review amalgamation of room with the Platform Cleaning Machine Room (F1008) as per the Metro Northwest layout. Room amalgamation, size and access subject to confirmation of the number of machines required by Sydney Trains.																											
10	CONNECTION																												
11	MATERIALS & FINISHES									WATER TIGHTNESS*																			
12	FLOOR	TBD in accordance with Sydney Metro MEWP Store (1000) requirements in consultation with TfNSW and Sydney Trains.																											
13	SKIRTING																												
14	WALL	TBD in accordance with Sydney Metro MEWP Store (1000) requirements in consultation with TfNSW and Sydney Trains.																											
15	CEILING																												
16	OTHERS																												
17	DOORS & IRONMONGERY									SET 1										SET 2									
18	DOOR TYPE																												
19	CLEAR OPENING REQUIRED																												
20	DIRECTION OF SWING																												
21	FIRE RESISTANCE																												
22	AIR RESISTANCE	TBD in accordance with Sydney Metro MEWP Store (1000) requirements in consultation with TfNSW and Sydney Trains.																											
23	STC RATING																												
24	LOCK FUNCTION																												
25	ACCESSORIES																												
26	SAMS/SECURITY LEVEL																												
27	OTHERS																												
28	BUILDING SERVICES																												
29	DELIVERY ROUTE SIZE																												
30	RM. NOISE LEVEL																												
31	COMMUNICATIONS FACILITIES																												
32	ECS																												
33	LIGHTING	TYPE	TBD in accordance with Sydney Metro MEWP Store (1000) requirements in consultation with TfNSW and Sydney Trains.																										
34		DIFFUSER																											
35		LUX																											
36		IP																											
37	FIRE PROTECTION	DETECTION																											
38		SUPPRESSION																											
39		EXTINGUISHER																											
40		SEPARATION																											
41		SMOKE EXTRACT																											
42		OTHERS																											
43	ELECTRICAL/POWER REQUIREMENTS	GENERAL SOCKET	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE	TBD in accordance with Sydney Metro MEWP Store (1000) requirements in consultation with TfNSW and Sydney Trains.																						
44		SPECIFIC EQUIPMENT																											
45	PLUMBING & DRAINAGE																												
46	Match Metro Male Public WC (1103) requirements																												
47	TYPE & LOCATION	TBD in accordance with Sydney Metro MEWP Store (1000) requirements in consultation with TfNSW and Sydney Trains.																											
48	OTHERS																												
49	OTHERS																												
50	OTHERS																												
51																													
52																													
53	* Water Tightness Control Requirements																												
54	Class	Description																											
55	I	Free from all visible leakage, seepage, and damp patches																											
56	II	Leakage shall be restricted to minor damp patches with no visible flow of water.																											
57	III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m2 per day overall and 0.24 l/day on any separate square metre.																											
58	"damp" means wet with no visible film of water																												
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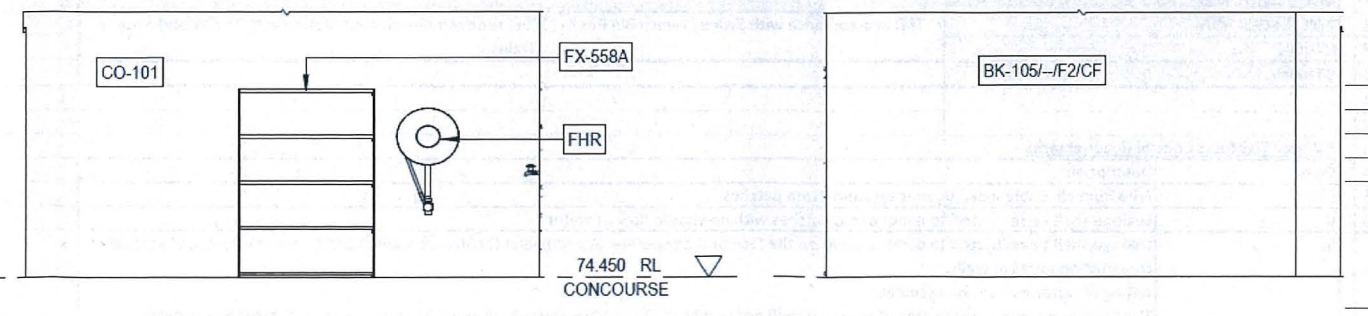
Example Layout (NTS) - Metro Northwest - Norwest Station - NWRLOTS-NRT-NRW-AD-DWG-612742_1.E.01.REV



1 1-50 4125 - PLAN
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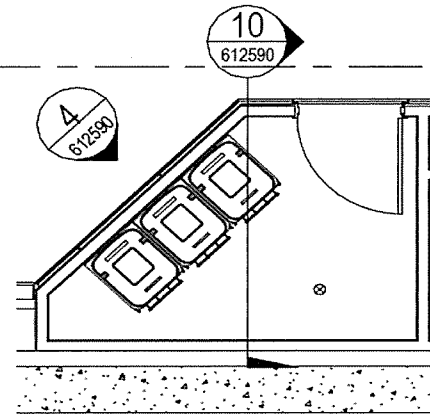
4 4125 - ELEVATION 3
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5 4125 - ELEVATION 4
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																			
2																				
3	ROOM DATA SHEET																			
4	ROOM NAME	Bin Room																		
5	ROOM NUMBER	F1006																		
6	FUNCTIONAL REQUIREMENTS																			
7	FUNCTION	TBD in accordance with Sydney Metro Bin Room (1006) requirements in consultation with TfNSW and Sydney Trains.																		
8	SIZE / DIMENSION																			
9	LOCATION	1 x adjacent to new Eastern Entrance, accessed from the paid concourse - grouped with other cleaning facilities including the Cleaners Store Room.																		
10	CONNECTION	Review room size and access subject to confirmation of the number and size of bins required by Sydney Trains (confirm 1100 Litre).																		
11	MATERIALS & FINISHES									WATER TIGHTNESS*										
12	FLOOR	TBD in accordance with Sydney Metro Bin Room (1006) requirements in consultation with TfNSW and Sydney Trains.																		
13	SKIRTING																			
14	WALL																			
15	CEILING																			
16	OTHERS																			
17	DOORS & IRONMONGERY	SET 1									SET 2									
18	DOOR TYPE																			
19	CLEAR OPENING REQUIRED																			
20	DIRECTION OF SWING																			
21	FIRE RESISTANCE																			
22	AIR RESISTANCE	TBD in accordance with Sydney Metro Bin Room (1006) requirements in consultation with TfNSW and Sydney Trains.																		
23	STC RATING																			
24	LOCK FUNCTION																			
25	ACCESSORIES																			
26	SAMS/SECURITY LEVEL																			
27	OTHERS																			
28	BUILDING SERVICES																			
29	DELIVERY ROUTE SIZE																			
30	RM. NOISE LEVEL																			
31	COMMUNICATIONS FACILITIES																			
32	ECS																			
33	LIGHTING	TYPE	TBD in accordance with Sydney Metro Bin Room (1006) requirements in consultation with TfNSW and Sydney Trains.																	
34		DIFFUSER																		
35		LUX																		
36		IP																		
37	FIRE PROTECTION	DETECTION																		
38		SUPPRESSION																		
39		EXTINGUISHER																		
40		SEPARATION																		
41		SMOKE EXTRACT																		
42		OTHERS																		
43	ELECTRICAL/POWER REQUIREMENTS	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE	TBD in accordance with Sydney Metro Bin Room (1006) requirements in consultation with TfNSW and Sydney Trains.														
44		GENERAL SOCKET																		
45		SPECIFIC EQUIPMENT																		
46	PLUMBING & DRAINAGE																			
47	Match Metro Male Public WC (1103) requirements																			
48	TYPE & LOCATION	TBD in accordance with Sydney Metro Bin Room (1006) requirements in consultation with TfNSW and Sydney Trains.																		
49	OTHERS																			
50	OTHERS																			
51																				
52																				
53	* Water Tightness Control Requirements																			
54	Class	Description																		
55	I	Free from all visible leakage, seepage, and damp patches																		
56	II	Leakage shall be restricted to minor damp patches with no visible flow of water.																		
57	III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.																		
58	"damp" means wet with no visible film of water																			
59																				
60																				

Example Layout (NTS) - Metro Northwest - Norwest Station - NWRLOTS-NRT-NRW-AT-DWG-612590_1.C.01.REV



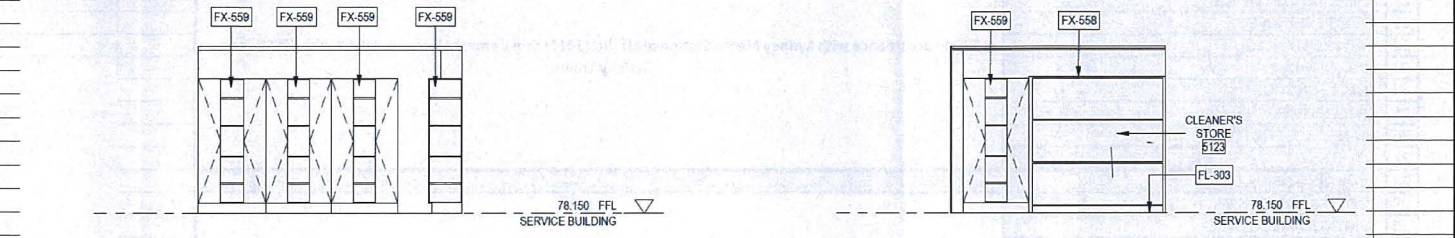
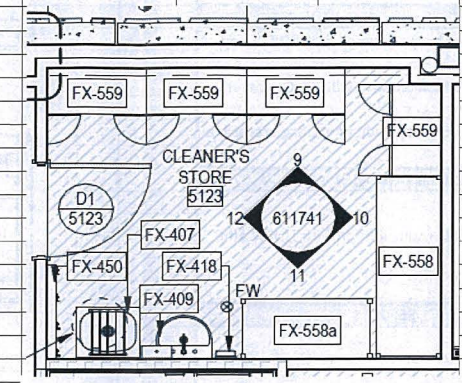
	A	B	C	D	E	F	G
1		Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule					
2							
3		ROOM DATA SHEET					
4		ROOM NAME	Chemical Store Room				
5		ROOM NUMBER	F1007				
6		FUNCTIONAL REQUIREMENTS					
7		FUNCTION	TBD in accordance with Sydney Metro Chemical Store Room (1007) requirements in consultation with TfNSW and Sydney Trains.				
8		SIZE / DIMENSION					
9		LOCATION	1 x adjacent to new Eastern Entrance, accessed from the paid concourse - grouped with other cleaning facilities including the Cleaners Store Room.				
10		CONNECTION					
11		MATERIALS & FINISHES				WATER TIGHTNESS*	
12		FLOOR					
13		SKIRTING	TBD in accordance with Sydney Metro Chemical Store Room (1007) requirements in consultation with TfNSW and Sydney Trains.				
14		WALL					
15		CEILING					
16		OTHERS					
17		DOORS & IRONMONGERY	SET 1		SET 2		
18		DOOR TYPE					
19		CLEAR OPENING REQUIRED					
20		DIRECTION OF SWING					
21		FIRE RESISTANCE					
22		AIR RESISTANCE	TBD in accordance with Sydney Metro Chemical Store Room (1007) requirements in consultation with TfNSW and Sydney Trains.				
23		STC RATING					
24		LOCK FUNCTION					
25		ACCESSORIES					
26		SAMS/SECURITY LEVEL					
27		OTHERS					
28		BUILDING SERVICES					
29		DELIVERY ROUTE SIZE					
30		RM. NOISE LEVEL					
31		COMMUNICATIONS FACILITIES					
32		ECS					
33		LIGHTING	TYPE				
34			DIFFUSER				
35			LUX	TBD in accordance with Sydney Metro Chemical Store Room (1007) requirements in consultation with TfNSW and Sydney Trains.			
36			IP				
37		FIRE PROTECTION	DETECTION				
38			SUPPRESSION				
39			EXTINGUISHER				
40			SEPARATION				
41			SMOKE EXTRACT				
42			OTHERS				
43		ELECTRICAL/POWER REQUIREMENTS	GENERAL SOCKET	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE
44			SPECIFIC EQUIPMENT	TBD in accordance with Sydney Metro Chemical Store Room (1007) requirements in consultation with TfNSW and Sydney Trains.			
45		PLUMBING & DRAINAGE					
46		Match Metro Male Public WC (1103) requirements					
47		TYPE & LOCATION	TBD in accordance with Sydney Metro Chemical Store Room (1007) requirements in consultation with TfNSW and Sydney Trains.				
48		OTHERS					
49		OTHERS					
50		OTHERS					
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52							
53		* Water Tightness Control Requirements					
54		Class	Description				
55		I	Free from all visible leakage, seepage, and damp patches				
56		II	Leakage shall be restricted to minor damp patches with no visible flow of water.				
57		III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.				
58		"damp" means wet with no visible film of water					
59							
60		F04 - Central Station - Room Data Sheets					

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																	
2																		
3	ROOM DATA SHEET																	
4	ROOM NAME		Platform Cleaning Machine Room															Example Layout (NTS) - ESB 003 Station Functional Spaces - Figure 3.4.15 - Cleaning Machine Room
5	ROOM NUMBER		F1008															
6	FUNCTIONAL REQUIREMENTS																	
7	FUNCTION																	
8	SIZE / DIMENSION																	
9	LOCATION																	
10	CONNECTION																	
11	MATERIALS & FINISHES																	
12	FLOOR																	
13	SKIRTING																	
14	WALL																	
15	CEILING																	
16	OTHERS																	
17	DOORS & IRONMONGERY																	
18	DOOR TYPE																	
19	CLEAR OPENING REQUIRED																	
20	DIRECTION OF SWING																	
21	FIRE RESISTANCE																	
22	AIR RESISTANCE																	
23	STC RATING																	
24	LOCK FUNCTION																	
25	ACCESSORIES																	
26	SAMS/SECURITY LEVEL																	
27	OTHERS																	
28	BUILDING SERVICES																	
29	DELIVERY ROUTE SIZE																	
30	RM NOISE LEVEL																	
31	COMMUNICATIONS FACILITIES																	
32	ECS																	
33	LIGHTING																	
34	TYPE																	
35	DIFFUSER																	
36	LUX																	
37	IP																	
38	FIRE PROTECTION																	
39	DETECTION																	
40	SUPPRESSION																	
41	EXTINGUISHER																	
42	SEPARATION																	
43	SMOKE EXTRACT																	
44	OTHERS																	
45	ELECTRICAL/POWER REQUIREMENTS																	
46	GENERAL SOCKET																	
47	SPECIFIC EQUIPMENT																	
48	NUMBER																	
49	LOCATION																	
50	SOCKET TYPE																	
51	CONDUIT TYPE																	
52	TBD in accordance with Sydney Metro Platform Cleaning Machine Room (1008) requirements in consultation with TfNSW and Sydney Trains.																	
53	* Water Tightness Control Requirements																	
54	Class																	
55	Description																	
56	I																	
57	Free from all visible leakage, seepage, and damp patches																	
58	II																	
59	Leakage shall be restricted to minor damp patches with no visible flow of water.																	
60	III																	
61	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls.																	
62	Jetting of water will not be acceptable.																	
63	The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.																	
64	"damp" means wet with no visible film of water																	
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ROOM DATA SHEET

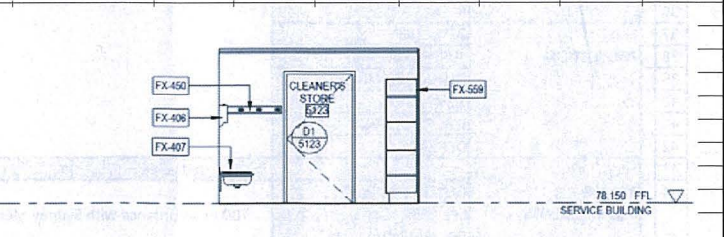
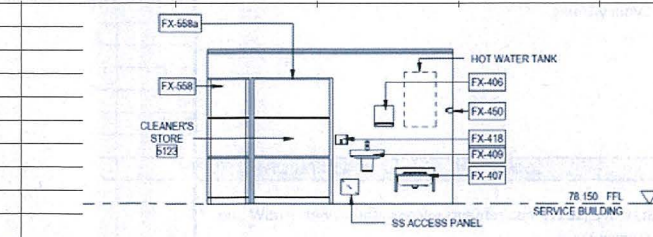
4	ROOM NAME	Cleaners Store Room			
5	ROOM NUMBER	F1009			
6	FUNCTIONAL REQUIREMENTS				
7	FUNCTION	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
8	SIZE / DIMENSION	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
9	LOCATION	1 x adjacent to new Eastern Entrance, accessed from the paid concourse - grouped with other cleaning facilities.			
10	CONNECTION	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
11	MATERIALS & FINISHES				
12	FLOOR	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
13	SKIRTING	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
14	WALL	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
15	CEILING	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
16	OTHERS	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
17	DOORS & IRONMONGERY				
18	DOOR TYPE	SET 1	SET 2		
19	CLEAR OPENING REQUIRED	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
20	DIRECTION OF SWING	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
21	FIRE RESISTANCE	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
22	AIR RESISTANCE	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
23	STC RATING	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
24	LOCK FUNCTION	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
25	ACCESSORIES	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
26	SAMS/SECURITY LEVEL	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
27	OTHERS	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
28	BUILDING SERVICES				
29	DELIVERY ROUTE SIZE	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
30	RM. NOISE LEVEL	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
31	COMMUNICATIONS FACILITIES	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
32	ECS	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
33	LIGHTING	TYPE	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.		
34		DIFFUSER	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.		
35		LUX	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.		
36		IP	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.		
37	FIRE PROTECTION	DETECTION	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.		
38		SUPPRESSION	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.		
39		EXTINGUISHER	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.		
40		SEPARATION	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.		
41		SMOKE EXTRACT	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.		
42		OTHERS	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.		
43	ELECTRICAL/POWER	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE
44	REQUIREMENTS	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
45	PLUMBING & DRAINAGE	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
46	Match Metro Male Public WC (1103) requirements				
47	TYPE & LOCATION	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
48	OTHERS	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
49	OTHERS	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			
50	OTHERS	TBD in accordance with Sydney Metro Cleaners Store Room (1009) requirements in consultation with TfNSW and Sydney Trains.			

Example Layout (NTS) - Metro Northwest - Bella Vista Station - NWRLOTS-NRT-BLV-AT-DWG-611736.H.01.REV & NWRLOTS-NRT-NRW-AD-DWG-612741_1.H.01.REV



9 CLEANERS STORE - WALL 9
1:50

10 CLEANERS STORE - WALL 10
1:50



11 CLEANERS STORE - WALL 11
1:50

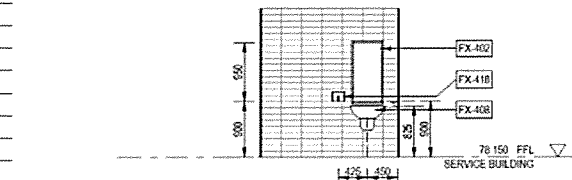
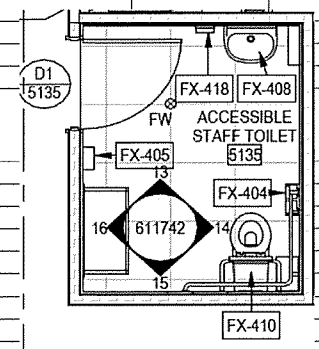
12 CLEANERS STORE - WALL 12
1:50

* Water Tightness Control Requirements	
Class	Description
I	Free from all visible leakage, seepage, and damp patches
II	Leakage shall be restricted to minor damp patches with no visible flow of water.
III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.

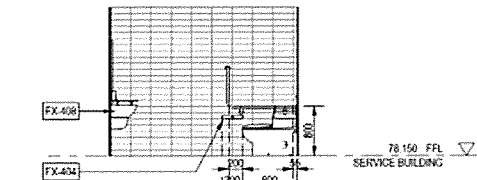
58 "damp" means wet with no visible film of water

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U											
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																															
2																																
3	ROOM DATA SHEET																															
4	ROOM NAME	Station Staff WC																														
5	ROOM NUMBER	F1011																														
6	FUNCTIONAL REQUIREMENTS																															
7	FUNCTION	TBD in accordance with Sydney Metro Station Staff WC (1011) requirements in consultation with TfNSW and Sydney Trains.																														
8	SIZE / DIMENSION																															
9	LOCATION	1 x adjacent to new Eastern Entrance with new staff facilities including the Maintenance Office – Customer Service Rep.																														
10	CONNECTION	Shower requirement TBD in consultation with TfNSW and Sydney Trains subject to an audit of existing accessible staff facilities provision.																														
11	MATERIALS & FINISHES										WATER TIGHTNESS*																					
12	FLOOR	TBD in accordance with Sydney Metro Station Staff WC (1011) requirements in consultation with TfNSW and Sydney Trains.																														
13	SKIRTING																															
14	WALL																															
15	CEILING																															
16	OTHERS																															
17	DOORS & IRONMONGERY										SET 1											SET 2										
18	DOOR TYPE																															
19	CLEAR OPENING REQUIRED																															
20	DIRECTION OF SWING																															
21	FIRE RESISTANCE																															
22	AIR RESISTANCE	TBD in accordance with Sydney Metro Station Staff WC (1011) requirements in consultation with TfNSW and Sydney Trains.																														
23	STC RATING																															
24	LOCK FUNCTION																															
25	ACCESSORIES																															
26	SAMS/SECURITY LEVEL																															
27	OTHERS																															
28	BUILDING SERVICES																															
29	DELIVERY ROUTE SIZE																															
30	RM. NOISE LEVEL																															
31	COMMUNICATIONS FACILITIES																															
32	ECS																															
33	LIGHTING	TYPE	TBD in accordance with Sydney Metro Station Staff WC (1011) requirements in consultation with TfNSW and Sydney Trains.																													
34		DIFFUSER																														
35		LUX																														
36		IP																														
37	FIRE PROTECTION	DETECTION																														
38		SUPPRESSION																														
39		EXTINGUISHER																														
40		SEPARATION																														
41		SMOKE EXTRACT																														
42		OTHERS																														
43	ELECTRICAL/POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE	TBD in accordance with Sydney Metro Station Staff WC (1011) requirements in consultation with TfNSW and Sydney Trains.																									
44	PLUMBING & DRAINAGE																															
45	Match Metro Male Public WC (1103) requirements																															
46	TYPE & LOCATION		TBD in accordance with Sydney Metro Station Staff WC (1011) requirements in consultation with TfNSW and Sydney Trains.																													
47	OTHERS																															
48	OTHERS																															
49	OTHERS																															
50	OTHERS																															
51	OTHERS																															
52	OTHERS																															
53	* Water Tightness Control Requirements																															
54	Class	Description																														
55	I	Free from all visible leakage, seepage, and damp patches																														
56	II	Leakage shall be restricted to minor damp patches with no visible flow of water.																														
57	III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.																														
58	"damp" means wet with no visible film of water																															
59																																
60																																

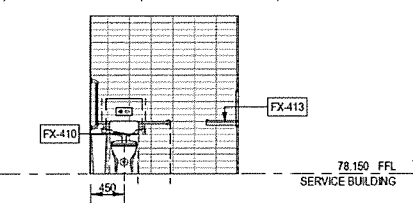
Example Layout (NTS) - Metro Northwest - Bella Vista Station - NWRLOTS-NRT-BLV-AT-DWG-611736.H.01.REV & NWRLOTS-NRT-BLV-AT-DWG-611742.E.01.REV



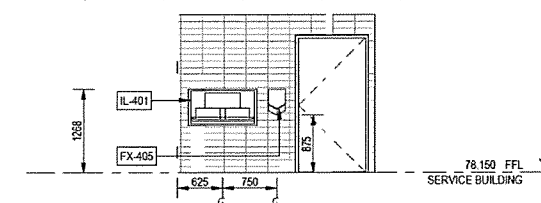
13 ACCESSIBLE STAFF TOILET ELEVATION A
1:50



14 ACCESSIBLE STAFF TOILET ELEVATION B
1:50



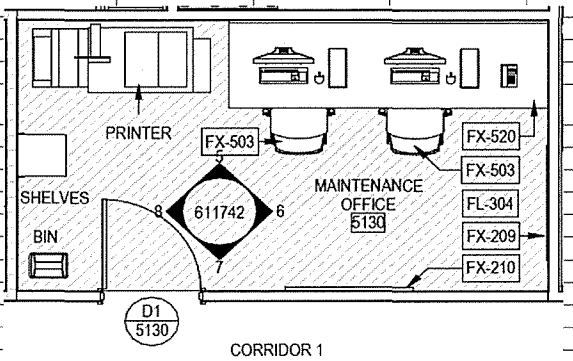
15 ACCESSIBLE STAFF TOILET ELEVATION C
1:50



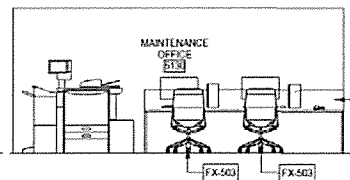
16 ACCESSIBLE STAFF TOILET ELEVATION D
1:50

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U										
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																													
2																														
3	ROOM DATA SHEET																													
4	ROOM NAME	Maintenance Office – Customer Service Rep.																												
5	ROOM NUMBER	F1015																												
6	FUNCTIONAL REQUIREMENTS																													
7	FUNCTION	TBD in accordance with Sydney Metro Maintenance Office – Customer Service Rep. (1015) requirements in consultation with TfNSW and Sydney Trains.																												
8	SIZE / DIMENSION	1 x adjacent to new Eastern Entrance with new staff facilities.																												
9	LOCATION	Size and equipment TBD in consultation with TfNSW and Sydney Trains.																												
10	CONNECTION																													
11	MATERIALS & FINISHES										WATER TIGHTNESS*																			
12	FLOOR	TBD in accordance with Sydney Metro Maintenance Office – Customer Service Rep. (1015) requirements in consultation with TfNSW and Sydney Trains.																												
13	SKIRTING																													
14	WALL																													
15	CEILING																													
16	OTHERS																													
17	DOORS & IRONMONGERY										SET 1										SET 2									
18	DOOR TYPE																													
19	CLEAR OPENING REQUIRED																													
20	DIRECTION OF SWING																													
21	FIRE RESISTANCE																													
22	AIR RESISTANCE	TBD in accordance with Sydney Metro Maintenance Office – Customer Service Rep. (1015) requirements in consultation with TfNSW and Sydney Trains.																												
23	STC RATING																													
24	LOCK FUNCTION																													
25	ACCESSORIES																													
26	SAMS/SECURITY LEVEL																													
27	OTHERS																													
28	BUILDING SERVICES																													
29	DELIVERY ROUTE SIZE																													
30	RM. NOISE LEVEL																													
31	COMMUNICATIONS FACILITIES																													
32	ECS																													
33	LIGHTING	TYPE	TBD in accordance with Sydney Metro Maintenance Office – Customer Service Rep. (1015) requirements in consultation with TfNSW and Sydney Trains.																											
34		DIFFUSER																												
35		LUX																												
36		IP																												
37	FIRE PROTECTION	DETECTION																												
38		SUPPRESSION																												
39		EXTINGUISHER																												
40		SEPARATION																												
41		SMOKE EXTRACT																												
42		OTHERS																												
43	ELECTRICAL/ POWER REQUIREMENTS	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE																									
44		GENERAL SOCKET	TBD in accordance with Sydney Metro Maintenance Office – Customer Service Rep. (1015) requirements in consultation with TfNSW and Sydney Trains.																											
45		SPECIFIC EQUIPMENT																												
46	PLUMBING & DRAINAGE																													
47	Match Metro Male Public WC (1103) requirements																													
48	TYPE & LOCATION	TBD in accordance with Sydney Metro Maintenance Office – Customer Service Rep. (1015) requirements in consultation with TfNSW and Sydney Trains.																												
49	OTHERS																													
50	OTHERS																													
51																														
52																														
53	* Water Tightness Control Requirements																													
54	Class	Description																												
55	I	Free from all visible leakage, seepage, and damp patches																												
56	II	Leakage shall be restricted to minor damp patches with no visible flow of water.																												
57	III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m2 per day overall and 0.24 l/day on any separate square metre.																												
58	"damp" means wet with no visible film of water																													
59																														

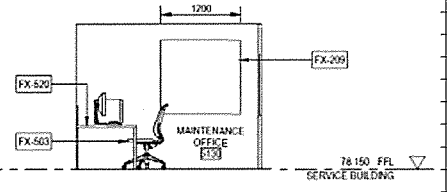
Example Layout
(NTS) - Metro
Northwest - Bella
Vista Station -
NWRLOTS-NRT-BLV-
AT-DWG-
611736.H.01.REV &
NWRLOTS-NRT-BLV-
AT-DWG-
611742.E.01.REV



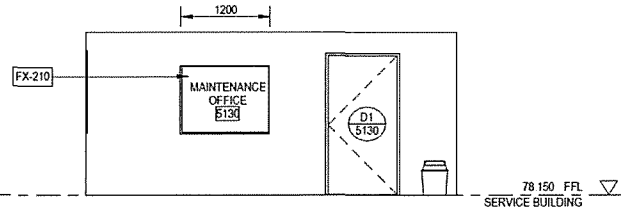
CORRIDOR 1



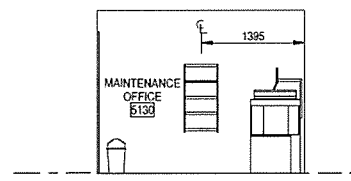
5 MAINTENANCE OFFICE ELEVATION A
1:50



6 MAINTENANCE OFFICE ELEVATION B
1:50



7 MAINTENANCE OFFICE ELEVATION C
1:50

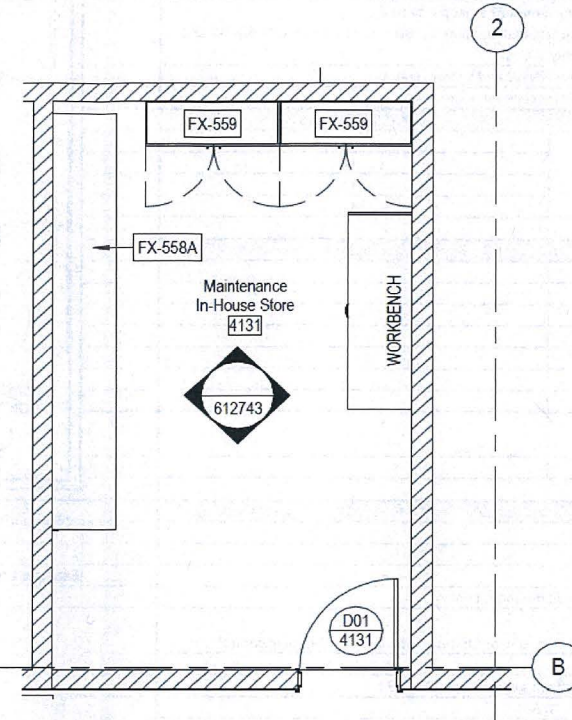


8 MAINTENANCE OFFICE ELEVATION D
1:50

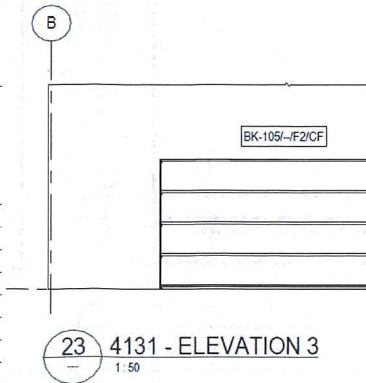
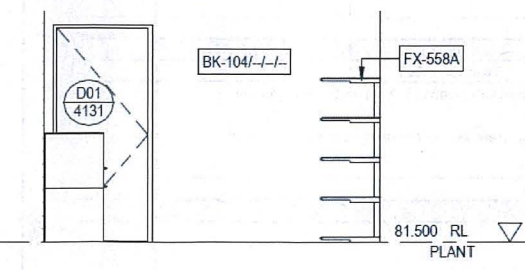


Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule	
ROOM DATA SHEET	
ROOM NAME	Maintenance Store Room
ROOM NUMBER	F1016
FUNCTIONAL REQUIREMENTS	
FUNCTION	TBD in accordance with Sydney Metro Maintenance Store Room (1016) requirements in consultation with TfNSW and Sydney Trains.
SIZE / DIMENSION	
LOCATION	1 x adjacent to new Eastern Entrance with new staff facilities.
CONNECTION	Size and equipment TBD in consultation with TfNSW and Sydney Trains.
MATERIALS & FINISHES	
FLOOR	
SKIRTING	
WALL	TBD in accordance with Sydney Metro Maintenance Store Room (1016) requirements in consultation with TfNSW and Sydney Trains.
CEILING	
OTHERS	
DOORS & IRONMONGERY	
DOOR TYPE	SET 1 SET 2
CLEAR OPENING REQUIRED	
DIRECTION OF SWING	
FIRE RESISTANCE	
AIR RESISTANCE	TBD in accordance with Sydney Metro Maintenance Store Room (1016) requirements in consultation with TfNSW and Sydney Trains.
STC RATING	
LOCK FUNCTION	
ACCESSORIES	
SAMS/SECURITY LEVEL	
OTHERS	
BUILDING SERVICES	
DELIVERY ROUTE SIZE	
RM. NOISE LEVEL	
COMMUNICATIONS FACILITIES	
ECS	
LIGHTING	
TYPE	
DIFFUSER	
LUX	
IP	
FIRE PROTECTION	
DETECTION	
SUPPRESSION	
EXTINGUISHER	
SEPARATION	
SMOKE EXTRACT	
OTHERS	
ELECTRICAL/ POWER REQUIREMENTS	
GENERAL SOCKET	
SPECIFIC EQUIPMENT	
PLUMBING & DRAINAGE	
Match Metro Male Public WC (1103) requirements	
TYPE & LOCATION	TBD in accordance with Sydney Metro Maintenance Store Room (1016) requirements in consultation with TfNSW and Sydney Trains.
OTHERS	
* Water Tightness Control Requirements	
Class	Description
I	Free from all visible leakage, seepage, and damp patches
II	Leakage shall be restricted to minor damp patches with no visible flow of water.
III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.
"damp" means wet with no visible film of water	

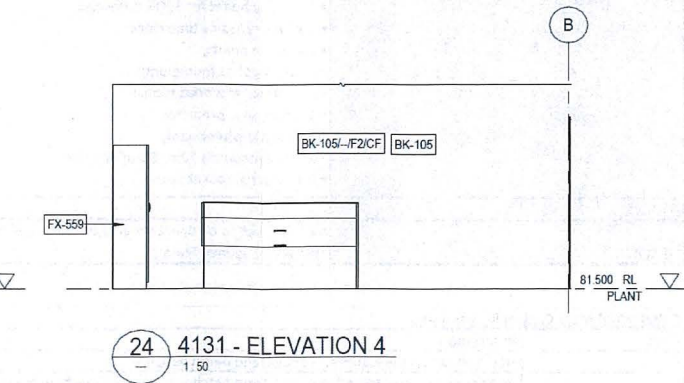
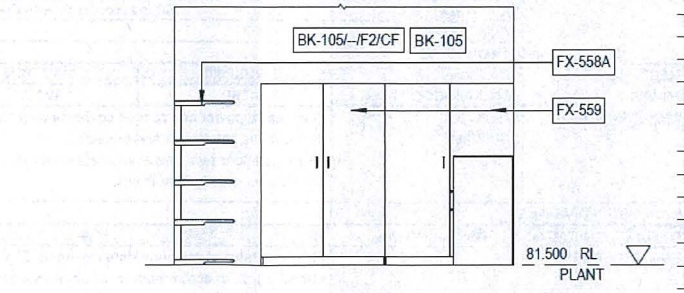
Example Layout (NTS) - Metro Northwest - Norwest Station - NWRL0TS-NRT-NRW-AD-DWG-612743_1.E.01.REV



20 1-50 4131 - PLAN
1:50

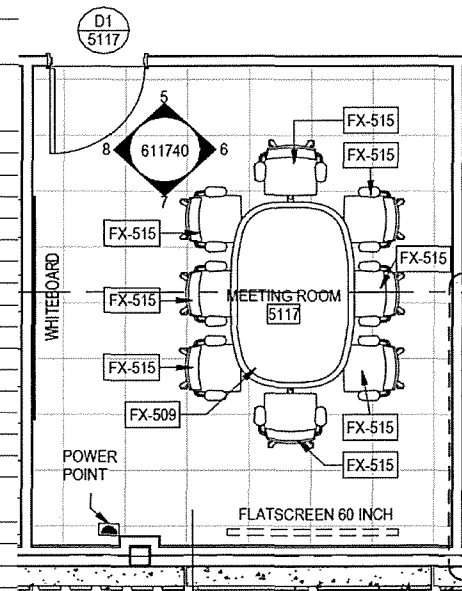


23 4131 - ELEVATION 3
1:50

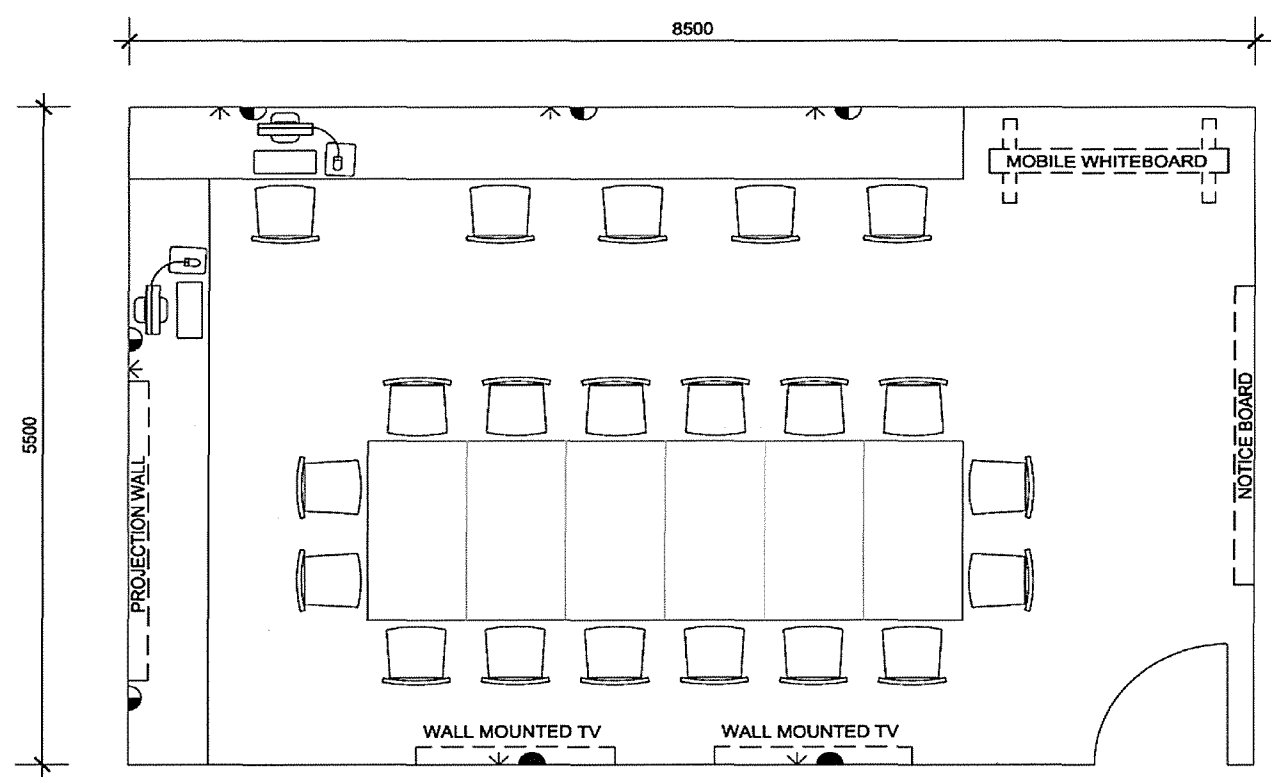


24 4131 - ELEVATION 4
1:50

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U										
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																													
2	ROOM DATA SHEET																													
3	Example Layout (NTS) - Metro Northwest - Bella Vista Station - NWRLOTS-NRT-BLV-AT-DWG-611736.H.01.REV																													
4	ROOM NAME	Multi-Purpose Meeting Room																												
5	ROOM NUMBER																													
6	FUNCTIONAL REQUIREMENTS																													
7	FUNCTION	To replace functionality of the 'Central Station Sydney Trains' Dwell / Conference Room' (ESR-27 + ESR-30)																												
8	SIZE / DIMENSION	Size to accommodate maximum 21 x people seated. Minimum dimensions 8.5m (L) x 5.5m (W) x 2.7m (H). Size and equipment TBD in consultation with TfNSW and Sydney Trains.																												
9	LOCATION	TBD in consultation with TfNSW and Sydney Trains.																												
10	CONNECTION	Accessed from secure corridor.																												
11	MATERIALS & FINISHES										WATER TIGHTNESS*																			
12	FLOOR																													
13	SKIRTING	TBD in accordance with SWTC Appendix B3.																												
14	WALL																													
15	CEILING																													
16	OTHERS																													
17	DOORS & IRONMONGERY										SET 1										SET 2									
18	DOOR TYPE	Single door																												
19	CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)																												
20	DIRECTION OF SWING	Swing in at 90 degrees																												
21	FIRE RESISTANCE	FRP to match enclosure.																												
22	AIR RESISTANCE																													
23	STC RATING																													
24	LOCK FUNCTION	EACS																												
25	ACCESSORIES	Door stop; kick plates; acoustic seal; door viewer.																												
26	SAMS/SECURITY LEVEL	Low																												
27	OTHERS																													
28	BUILDING SERVICES																													
29	DELIVERY ROUTE SIZE																													
30	RM: NOISE LEVEL																													
31	COMMUNICATIONS FACILITIES																													
32	ECS	* 1 x Reverse cycle air conditioning unit with internal wall mounted control.																												
33	LIGHTING	TYPE	Recessed LED downlights - number TBD. Occupancy sensor for automatic lighting. Dimming control.																											
34		DIFFUSER																												
35		LUX	Normal: 320 (AS1680); Emergency: As per AS 2293.																											
36		IP	N/A																											
37	FIRE PROTECTION	DETECTION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Smoke detectors, EWIS speakers, Strobe lights on ceiling.																											
38		SUPPRESSION	TBD in accordance with the Central Station Fire and Life Safety Strategy																											
39		EXTINGUISHER	YES																											
40		SEPARATION	TBD in accordance with the Central Station Fire and Life Safety Strategy																											
41		SMOKE EXTRACT	N/A																											
42	OTHERS																													
43	ELECTRICAL/ POWER REQUIREMENTS	GENERAL SOCKET	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE																								
44		SPECIFIC EQUIPMENT	TBD	WALL	Twin 13A, 230V	Concealed	<ul style="list-style-type: none"> Concealed power and conduit connections (HDMI or as agreed with Sydney Trains) between computer workstations, televisions and projector; Recessed floor twin power and data outlet for meeting table preferred, dependant on floor structure in consultation with Sydney Trains. 																							
45	PLUMBING & DRAINAGE																													
46	N / A																													
47	FIXTURES, EQUIPMENT & LOOSE FURNITURE																													
48	TYPE & LOCATION	<ul style="list-style-type: none"> Meeting table to accommodate maximum 16 x personnel Bench space to accommodate maximum 5 x personnel; Seating to accommodate maximum 21 x personnel; 1 x notice board for SEQR & Policies; 1 x Sydney Trains time clock; 2 x phone points; 2 x data points (minimum); 2 x computer workstations; 1 x computer projector; 1 x mobile whiteboard; 2 x wall mounted 70in LED televisions; 2 x TV aerial socket points. 																												
49	OTHERS	New facilities to be operational prior to the demolition of the existing Meeting Room (TBD in consultation with TfNSW and Sydney Trains).																												
50	OTHERS																													
51																														
52																														
53	* Water Tightness Control Requirements																													
54	Class	Description																												
55	I	Free from all visible leakage, seepage, and damp patches																												
56	II	Leakage shall be restricted to minor damp patches with no visible flow of water.																												
57	III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m2 per day overall and 0.24 l/day on any separate square metre.																												
58	"damp" means wet with no visible film of water																													
59																														
60																														

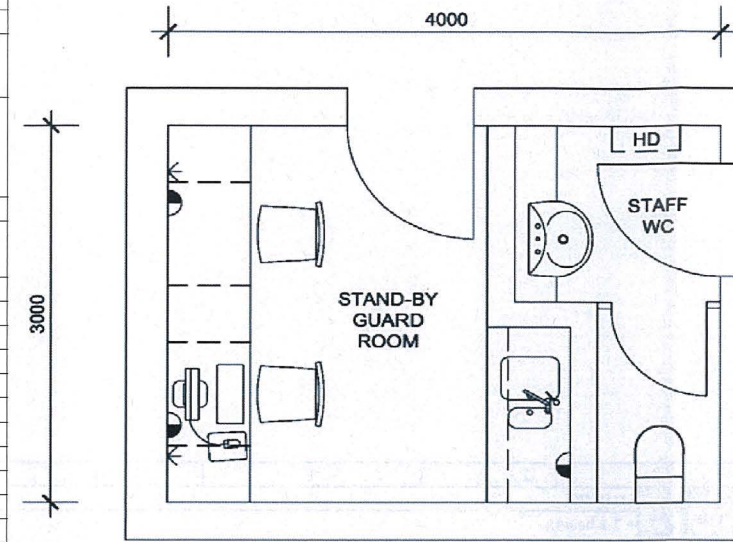


Example Layout (NTS) - TBD in consultation with Sydney Trains.

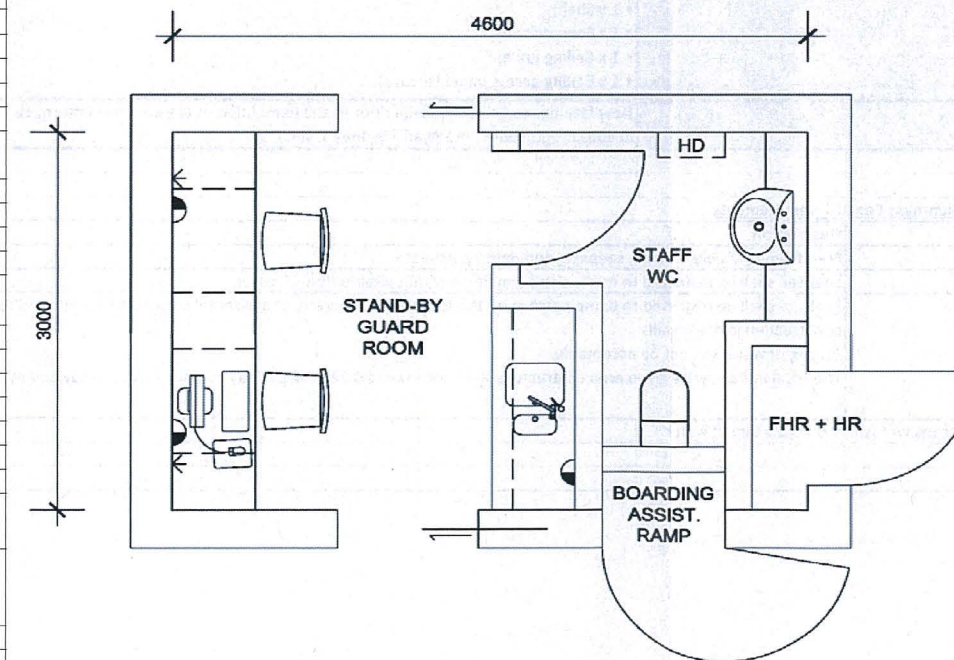


A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P						
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																				
2																					
3	ROOM DATA SHEET																				
4	ROOM NAME	Platform 16/17 Stand-by Guard Room																			
5	ROOM NUMBER																				
6	FUNCTIONAL REQUIREMENTS																				
7	FUNCTION	New facilities to replace the functionality of the existing Platform 16/17 Stand-by Guard Room to be demolished.																			
8	SIZE / DIMENSION	Size to accommodate maximum 2 x guards. Minimum dimensions 4m (L) x 3m (W) x 2.4m (H). Size dependant on access requirements and minimum clear track and platform edge offset requirements TBD in consultation with TfNSW and Sydney Trains.																			
9	LOCATION	Southern end of platform 16/17.																			
10	CONNECTION	Level access direct to platform 16/17. Access route and layout TBD for staff access in compliance with relevant standards.																			
11	MATERIALS & FINISHES										WATER TIGHTNESS*										
12	FLOOR																				
13	SKIRTING	TBD in accordance with SWTC Appendix B3.																			
14	WALL																				
15	CEILING																				
16	OTHERS																				
17	DOORS & IRONMONGERY										SET 1					SET 2					
18	DOOR TYPE	Single door										Single door (Staff WC)									
19	CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)										2100mm (H) x 900mm (W)									
20	DIRECTION OF SWING	Swing in at 90 degrees										Swing out at 90 degrees									
21	FIRE RESISTANCE	FRP to match enclosure.										FRP to match enclosure.									
22	AIR RESISTANCE																				
23	STC RATING																				
24	LOCK FUNCTION	ETCS										Internal Latch									
25	ACCESSORIES	Door closer; door stop; kick plates; acoustic seal; door viewer.										Air inlet grille; door stop; kick plates.									
26	SAMS/SECURITY LEVEL	Low										N / A									
27	OTHERS	Statutory signage in accordance with TfNSW guidelines.																			
28	BUILDING SERVICES																				
29	DELIVERY ROUTE SIZE	As per access route for staff access TBD in compliance with relevant standards.																			
30	RM. NOISE LEVEL																				
31	COMMUNICATIONS FACILITIES																				
32	ECS	• 1 x Reverse cycle air conditioning unit with internal wall mounted control; • 1 x exhaust air above toilet pan.																			
33	LIGHTING	TYPE	Recessed LED downlights - number TBD. Occupancy sensor for automatic lighting.																		
34		DIFFUSER																			
35		LUX	Normal: 320 (AS1680); Emergency: As per AS 2293.																		
36		IP																			
37	FIRE PROTECTION	DETECTION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Smoke detectors, EWIS speakers, Strobe lights on ceiling.																		
38		SUPPRESSION	TBD in accordance with the Central Station Fire and Life Safety Strategy																		
39		EXTINGUISHER	YES																		
40		SEPARATION	TBD in accordance with the Central Station Fire and Life Safety Strategy																		
41		SMOKE EXTRACT	N/A																		
42		OTHERS																			
43	ELECTRICAL/ POWER REQUIREMENTS	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE																
44		GENERAL SOCKET	TBD	WALL	Twin 13A, 230V	Concealed															
45		SPECIFIC EQUIPMENT	• 1 x Hand dryer (hardwire - Staff WC).																		
46	PLUMBING & DRAINAGE	• 2 x Domestic cold water and tempered hot water; • 1 x Floor waste (Staff WC); • 1 x Sewerage (Staff WC).																			
47	FIXTURES, EQUIPMENT & LOOSE FURNITURE																				
48	TYPE & LOCATION	Stand-by Guard Room																			
49		<ul style="list-style-type: none"> Bench space to accommodate maximum nominated personnel; Seating to accommodate maximum nominated personnel; 1 x notice board for SEQR & Policies; 1 x Sydney Trains time clock; 1 x phone points; 1 x data points (minimum); 1 x computer workstations; 1 x TLS panel unit. 																			
50		Kitchenette																			
51		<ul style="list-style-type: none"> 1 x zip hydrotap for chilled and boiling water; 1 x sink with hot & cold water flick mixer tap mounted to under sink storage cabinet; 1 x soap dispenser; 1 x hand sanitiser; 1 x Paper towel holder/dispenser; 1 x microwave (TBD in consultation with TfNSW and Sydney Trains); 1 x tea towel holder. 																			

Example Layout - External WC access - TBD in consultation with Sydney Trains.



Example Layout - Internal WC access - TBD in consultation with Sydney Trains.

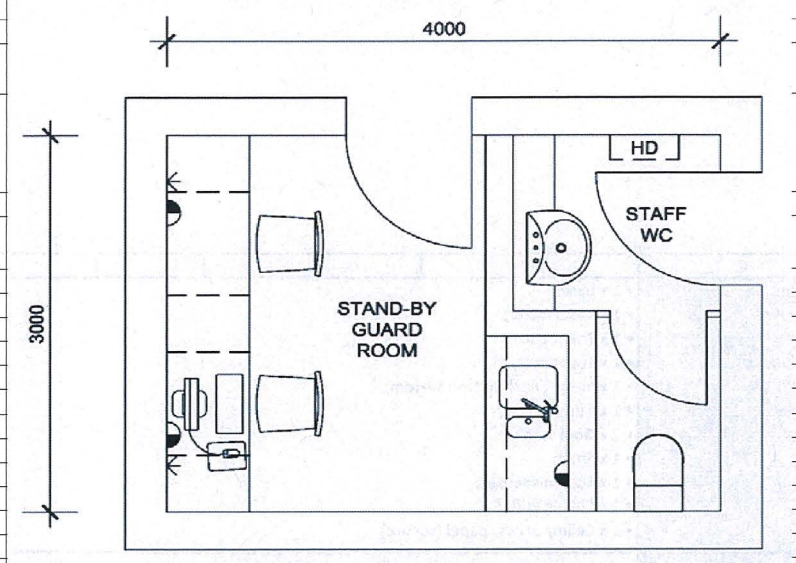


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
52			OTHERS	Staff WC <ul style="list-style-type: none"> • 1 x basin; • 1 x basin mixer; • 1 x Toilet pan; • 1 x Toilet seat; • 1 x In-wall flush button system; • 1 x Mirror; • 2 x Door hook; • 1 x Shelf; • 1 x Soap dispenser; • 1 x Ceiling grille; • 1 x Ceiling access panel (secure). 												
53			OTHERS	New facilities to be operational prior to the demolition of the existing Platform 16/17 Stand-by Guard Room (TBD in consultation with TfNSW and Sydney Trains).												
54																
55																
56																
57			* Water Tightness Control Requirements													
58			Class	Description												
59			I	Free from all visible leakage, seepage, and damp patches												
60			II	Leakage shall be restricted to minor damp patches with no visible flow of water.												
61			III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m2 per day overall and 0.24 l/day on any separate square metre.												
62			"damp" means wet with no visible film of water													
63																
64																

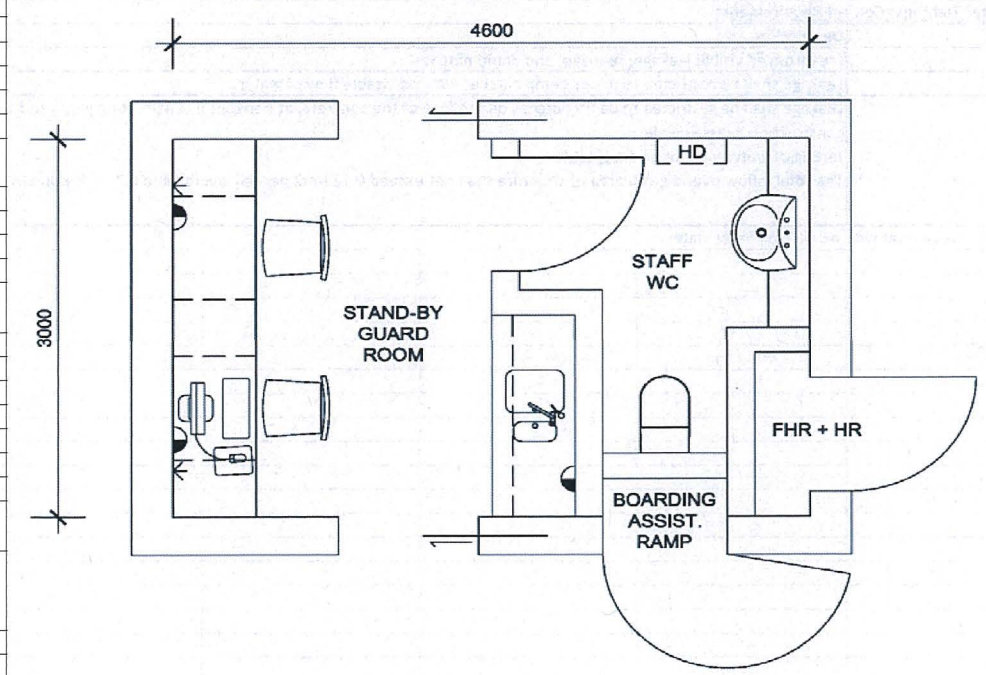
F04 - Central Station - Room Data Sheets

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule														
2															
3	ROOM DATA SHEET														
4	ROOM NAME	Platform 18/19 Stand-by Guard Room													
5	ROOM NUMBER														
6	FUNCTIONAL REQUIREMENTS														
7	FUNCTION	New facilities to replace the functionality of the existing Platform 18/19 Stand-by Guard Room to be demolished.													
8	SIZE / DIMENSION	Size to accommodate maximum 2 x guards. Minimum dimensions 4m (L) x 3m (W) x 2.4m (H). Size dependant on access requirements and minimum clear track and platform edge offset requirements TBD in consultation with TfNSW and Sydney Trains.													
9	LOCATION	Northern end of platform 18/19.													
10	CONNECTION	Level access direct to platform 18/19. Access route and layout TBD for staff access in compliance with relevant standards.													
11	MATERIALS & FINISHES			WATER TIGHTNESS*											
12	FLOOR														
13	SKIRTING	TBD in accordance with SWTC Appendix B3.													
14	WALL														
15	CEILING														
16	OTHERS														
17	DOORS & IRONMONGERY			SET 1						SET 2					
18	DOOR TYPE	Single door						Single door (Staff WC)							
19	CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)						2100mm (H) x 900mm (W)							
20	DIRECTION OF SWING	Swing in at 90 degrees						Swing out at 90 degrees							
21	FIRE RESISTANCE	FRP to match enclosure.						FRP to match enclosure.							
22	AIR RESISTANCE														
23	STC RATING														
24	LOCK FUNCTION	ETCS						Internal Latch							
25	ACCESSORIES	Door closer; door stop; kick plates; acoustic seal; door viewer.						Air inlet grille; door stop; kick plates.							
26	SAMS/SECURITY LEVEL	Low						N / A							
27	OTHERS	Statutory signage in accordance with TfNSW guidelines.													
28	BUILDING SERVICES														
29	DELIVERY ROUTE SIZE	As per access route for staff access TBD in compliance with relevant standards.													
30	RM. NOISE LEVEL														
31	COMMUNICATIONS FACILITIES														
32	ECS	<ul style="list-style-type: none"> 1 x Reverse cycle air conditioning unit with internal wall mounted control; 1 x exhaust air above toilet pan. 													
33	LIGHTING	TYPE	Recessed LED downlights - number TBD. Occupancy sensor for automatic lighting.												
34		DIFFUSER													
35		LUX	Normal: 320 (AS1680); Emergency: As per AS 2293.												
36		IP													
37	FIRE PROTECTION	DETECTION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Smoke detectors, EWIS speakers, Strobe lights on ceiling.												
38		SUPPRESSION	TBD in accordance with the Central Station Fire and Life Safety Strategy												
39		EXTINGUISHER	YES												
40		SEPARATION	TBD in accordance with the Central Station Fire and Life Safety Strategy												
41		SMOKE EXTRACT	N/A												
42	OTHERS														
43	ELECTRICAL/ POWER REQUIREMENTS	GENERAL SOCKET	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE									
44		SPECIFIC EQUIPMENT	1 x Hand dryer (hardwire - Staff WC).												
45	PLUMBING & DRAINAGE	<ul style="list-style-type: none"> 2 x Domestic cold water and tempered hot water; 1 x Floor waste (Staff WC); 1 x Sewerage (Staff WC). 													
46	FIXTURES, EQUIPMENT & LOOSE FURNITURE														
47	TYPE & LOCATION	Stand-by Guard Room													
48		<ul style="list-style-type: none"> Bench space to accommodate maximum nominated personnel; Seating to accommodate maximum nominated personnel; 1 x notice board for SEQR & Policies; 1 x Sydney Trains time clock; 1 x phone points; 1 x data points (minimum); 1 x computer workstations; 1 x TLS panel unit. 													
49															
50		Kitchenette <ul style="list-style-type: none"> 1 x zip hydrotap for chilled and boiling water; 1 x sink with hot & cold water flick mixer tap mounted to under sink storage cabinet; 1 x soap dispenser; 1 x hand sanitiser; 1 x Paper towel holder/dispenser; 1 x microwave (TBD in consultation with TfNSW and Sydney Trains); 1 x tea towel holder. 													
51															
52	OTHERS	Staff WC													

Example Layout - External WC access - TBD in consultation with Sydney Trains.



Example Layout - Internal WC access - TBD in consultation with Sydney Trains.

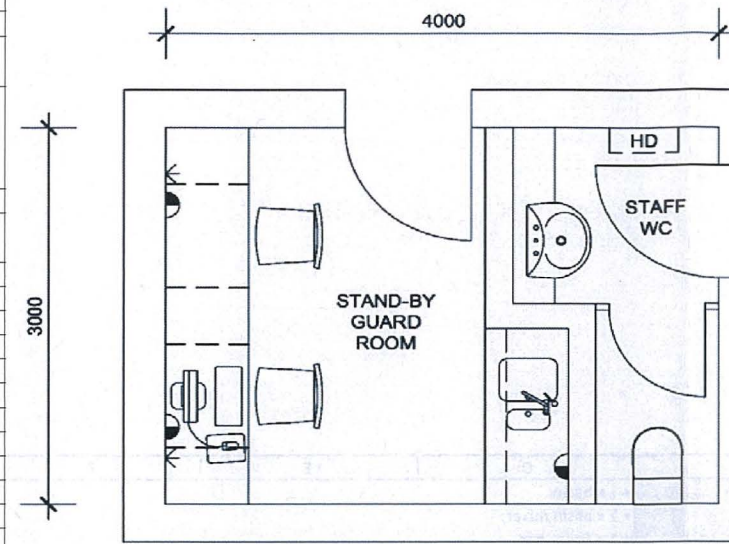


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
53				<ul style="list-style-type: none"> • 1 x basin; • 1 x basin mixer; • 1 x Toilet pan; • 1 x Toilet seat; • 1 x In-wall flush button system; • 1 x Mirror; • 2 x Door hook; • 1 x Shelf; • 1 x Soap dispenser; • 1 x Ceiling grille; • 1 x Ceiling access panel (secure). 												
54			OTHERS	New facilities to be operational prior to the demolition of the existing Platform 18/19 Stand-by Guard Room (TBD in consultation with TfNSW and Sydney Trains).												
55																
56																
57			* Water Tightness Control Requirements													
58			Class	Description												
59			I	Free from all visible leakage, seepage, and damp patches												
60			II	Leakage shall be restricted to minor damp patches with no visible flow of water.												
61			III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m2 per day overall and 0.24 l/day on any separate square metre.												
62			"damp" means wet with no visible film of water													
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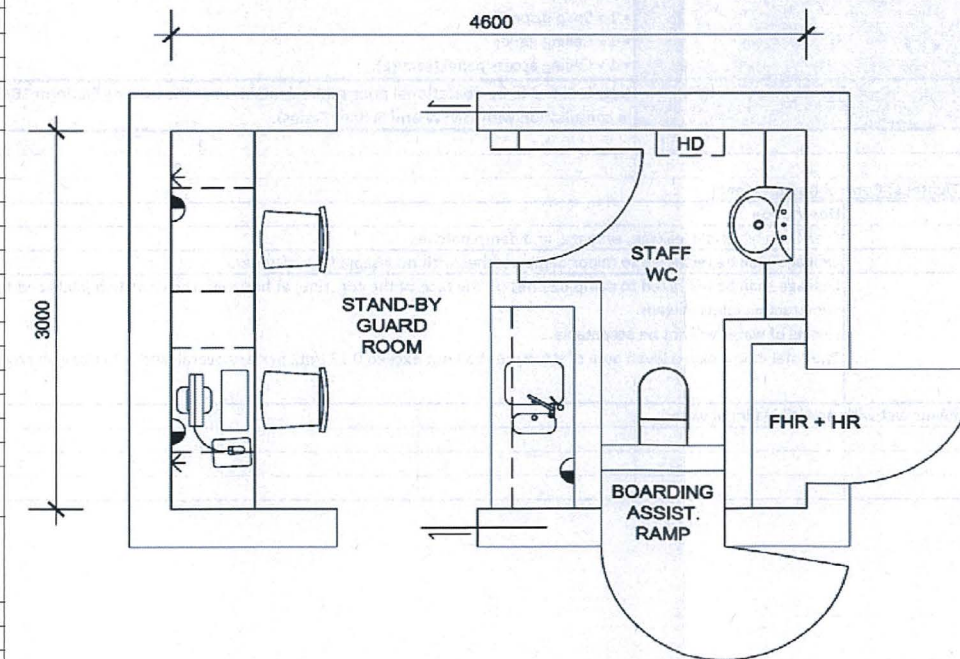
F04 - Central Station - Room Data Sheets

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P					
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																			
3	ROOM DATA SHEET																			
4	ROOM NAME	Platform 20/21 Stand-by Guard Room																		
5	ROOM NUMBER																			
6	FUNCTIONAL REQUIREMENTS																			
7	FUNCTION	New facilities to replace the functionality of the existing Platform 20/21 Stand-by Guard Room to be demolished.																		
8	SIZE / DIMENSION	Size to accommodate maximum 2 x guards. Minimum dimensions 4m (L) x 3m (W) x 2.4m (H). Size dependant on access requirements and minimum clear track and platform edge offset requirements TBD in consultation with TfNSW and Sydney Trains.																		
9	LOCATION	Southern end of platform 20/21.																		
10	CONNECTION	Level access direct to platform 20/21. Access route TBD for ambulant access in compliance with relevant standards.																		
11	MATERIALS & FINISHES										WATER TIGHTNESS*									
12	FLOOR	TBD in accordance with SWTC Appendix B3.																		
13	SKIRTING																			
14	WALL																			
15	CEILING																			
16	OTHERS																			
17	DOORS & IRONMONGERY										SET 1					SET 2				
18	DOOR TYPE	Single door										Single door (Staff WC)								
19	CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)										2100mm (H) x 900mm (W)								
20	DIRECTION OF SWING	Swing in at 90 degrees										Swing out at 90 degrees								
21	FIRE RESISTANCE	FRP to match enclosure.										FRP to match enclosure.								
22	AIR RESISTANCE																			
23	STC RATING																			
24	LOCK FUNCTION	ETCS										Internal Latch								
25	ACCESSORIES	Door closer; door stop; kick plates; acoustic seal; door viewer.										Air inlet grille; door stop; kick plates.								
26	SAMS/SECURITY LEVEL	Low										N / A								
27	OTHERS	Statutory signage in accordance with TfNSW guidelines.																		
28	BUILDING SERVICES																			
29	DELIVERY ROUTE SIZE	As per access route for staff access TBD in compliance with relevant standards.																		
30	RM. NOISE LEVEL																			
31	COMMUNICATIONS FACILITIES																			
32	ECS	<ul style="list-style-type: none"> 1 x Reverse cycle air conditioning unit with internal wall mounted control; 1 x exhaust air above toilet pan. 																		
33	LIGHTING	TYPE	Recessed LED downlights - number TBD. Occupancy sensor for automatic lighting.																	
34		DIFFUSER																		
35		LUX	Normal: 320 (AS1680); Emergency: As per AS 2293.																	
36		IP																		
37	FIRE PROTECTION	DETECTION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Smoke detectors, EWIS speakers, Strobe																	
38		SUPPRESSION	TBD in accordance with the Central Station Fire and Life Safety Strategy																	
39		EXTINGUISHER	YES																	
40		SEPARATION	TBD in accordance with the Central Station Fire and Life Safety Strategy																	
41		SMOKE EXTRACT	N/A																	
42		OTHERS																		
43	ELECTRICAL/POWER REQUIREMENTS	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE															
44		GENERAL SOCKET	TBD	WALL	Twin 13A, 230V	Concealed														
45		SPECIFIC EQUIPMENT	1 x Hand dryer (hardwire - Staff WC).																	
46	PLUMBING & DRAINAGE	<ul style="list-style-type: none"> 2 x Domestic cold water and tempered hot water; 1 x Floor waste (Staff WC); 1 x Sewerage (Staff WC). 																		
47	FIXTURES, EQUIPMENT & LOOSE FURNITURE																			
48	TYPE & LOCATION	Stand-by Guard Room <ul style="list-style-type: none"> Bench space to accommodate maximum nominated personnel; Seating to accommodate maximum nominated personnel; 1 x notice board for SEQR & Policies; 1 x Sydney Trains time clock; 1 x phone points; 1 x data points (minimum); 1 x computer workstations; 1 x TLS panel unit. Kitchenette <ul style="list-style-type: none"> 1 x zip hydrotap for chilled and boiling water; 1 x sink with hot & cold water flick mixer tap mounted to under sink storage cabinet; 1 x soap dispenser; 1 x hand sanitiser; 1 x Paper towel holder/dispenser; 1 x microwave (TBD in consultation with TfNSW and Sydney Trains); 1 x tea towel holder. 																		
49																				
50																				
51																				
52	OTHERS	Staff WC																		

Example Layout - External WC access - TBD in consultation with Sydney Trains.



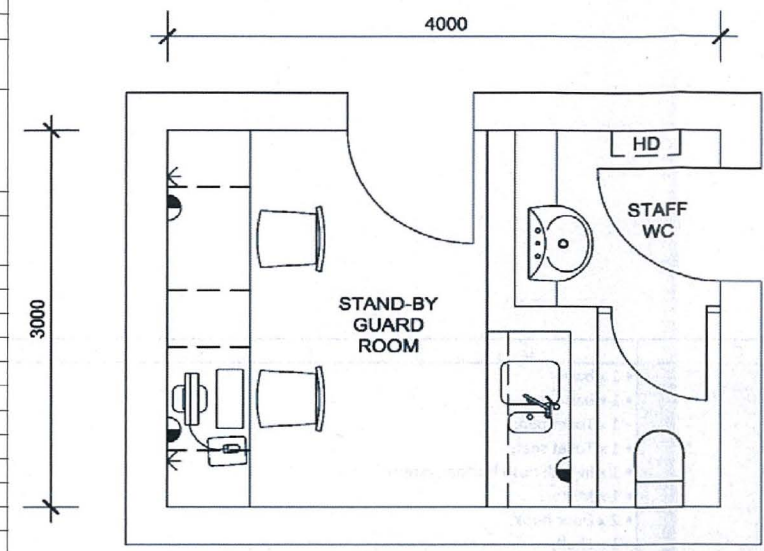
Example Layout - Internal WC access - TBD in consultation with Sydney Trains.



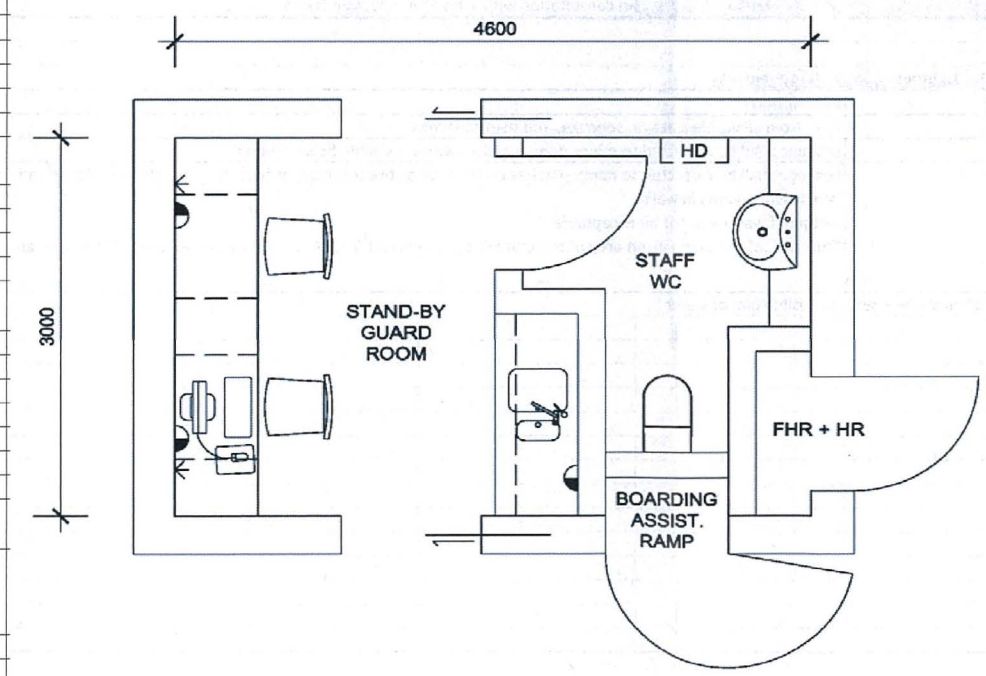
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
53				<ul style="list-style-type: none"> • 1 x basin; • 1 x basin mixer; • 1 x Toilet pan; • 1 x Toilet seat; • 1 x In-wall flush button system; • 1 x Mirror; • 2 x Door hook; • 1 x Shelf; • 1 x Soap dispenser; • 1 x Ceiling grille; • 1 x Ceiling access panel (secure). 												
54			OTHERS	New facilities to be operational prior to the demolition of the existing Platform 18/19 Stand-by Guard Room (TBD in consultation with TfNSW and Sydney Trains).												
55																
56																
57			* Water Tightness Control Requirements													
58			Class	Description												
59			I	Free from all visible leakage, seepage, and damp patches												
60			II	Leakage shall be restricted to minor damp patches with no visible flow of water.												
61			III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.												
62			"damp" means wet with no visible film of water													
63																
64																
65																

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P						
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																				
2																					
3	ROOM DATA SHEET																				
4	ROOM NAME	Platform 22/23 Stand-by Guard Room																			
5	ROOM NUMBER																				
6	FUNCTIONAL REQUIREMENTS																				
7	FUNCTION	New facilities to replace the functionality of the existing Platform 22/23 Stand-by Guard Room to be demolished.																			
8	SIZE / DIMENSION	Size to accommodate maximum 2 x guards. Minimum dimensions 4m (L) x 3m (W) x 2.4m (H). Size dependant on access requirements and minimum clear track and platform edge offset requirements TBD in consultation with TfNSW and Sydney Trains.																			
9	LOCATION	Northern end of platform 22/23.																			
10	CONNECTION	Level access direct to platform 22/23. Access route TBD for ambulant access in compliance with relevant standards.																			
11	MATERIALS & FINISHES										WATER TIGHTNESS*										
12	FLOOR																				
13	SKIRTING	TBD in accordance with SWTC Appendix B3.																			
14	WALL																				
15	CEILING																				
16	OTHERS																				
17	DOORS & IRONMONGERY										SET 1					SET 2					
18	DOOR TYPE	Single door										Single door (Staff WC)									
19	CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)										2100mm (H) x 900mm (W)									
20	DIRECTION OF SWING	Swing in at 90 degrees										Swing out at 90 degrees									
21	FIRE RESISTANCE	FRP to match enclosure.										FRP to match enclosure.									
22	AIR RESISTANCE																				
23	STC RATING																				
24	LOCK FUNCTION	ETCS										Internal Latch									
25	ACCESSORIES	Door closer; door stop; kick plates; acoustic seal; door viewer.										Air inlet grille; door stop; kick plates.									
26	SAMS/SECURITY LEVEL	Low										N / A									
27	OTHERS	Statutory signage in accordance with TfNSW guidelines.																			
28	BUILDING SERVICES																				
29	DELIVERY ROUTE SIZE	As per access route for staff access TBD in compliance with relevant standards.																			
30	RM. NOISE LEVEL																				
31	COMMUNICATIONS FACILITIES																				
32	ECS	• 1 x Reverse cycle air conditioning unit with internal wall mounted control; • 1 x exhaust air above toilet pan.																			
33	LIGHTING	TYPE	Recessed LED downlights - number TBD. Occupancy sensor for automatic lighting.																		
34		DIFFUSER																			
35		LUX	Normal: 320 (AS1680); Emergency: As per AS 2293.																		
36		IP																			
37	FIRE PROTECTION	DETECTION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Smoke detectors, EWIS speakers, Strobe lights on ceiling.																		
38		SUPPRESSION	TBD in accordance with the Central Station Fire and Life Safety Strategy																		
39		EXTINGUISHER	YES																		
40		SEPARATION	TBD in accordance with the Central Station Fire and Life Safety Strategy																		
41		SMOKE EXTRACT	N/A																		
42		OTHERS																			
43	ELECTRICAL/ POWER REQUIREMENTS	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE																
44		GENERAL SOCKET	TBD	WALL	Twin 13A, 230V	Concealed															
45		SPECIFIC EQUIPMENT	• 1 x Hand dryer (hardwire - Staff WC).																		
46	PLUMBING & DRAINAGE	• 2 x Domestic cold water and tempered hot water; • 1 x Floor waste (Staff WC); • 1 x Sewerage (Staff WC).																			
47	FIXTURES, EQUIPMENT & LOOSE FURNITURE																				
48	TYPE & LOCATION	Stand-by Guard Room • Bench space to accommodate maximum nominated personnel; • Seating to accommodate maximum nominated personnel; • 1 x notice board for SEQR & Policies; • 1 x Sydney Trains time clock; • 1 x phone points; • 1 x data points (minimum); • 1 x computer workstations; • 1 x TLS panel unit.																			
49																					
50		Kitchenette • 1 x zip hydrotap for chilled and boiling water; • 1 x sink with hot & cold water flick mixer tap mounted to under sink storage cabinet; • 1 x soap dispenser; • 1 x hand sanitiser; • 1 x Paper towel holder/dispenser; • 1 x microwave (TBD in consultation with TfNSW and Sydney Trains); • 1 x tea towel holder.																			
51																					
52	OTHERS	Staff WC																			

Example Layout - External WC access - TBD in consultation with Sydney Trains.



Example Layout - Internal WC access - TBD in consultation with Sydney Trains.



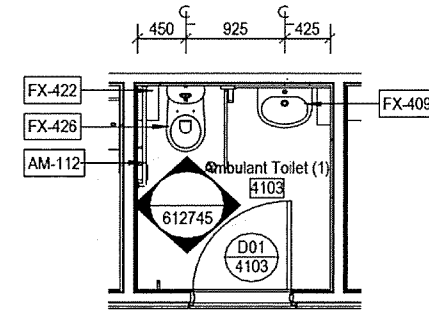
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
53			<ul style="list-style-type: none"> • 1 x basin; • 1 x basin mixer; • 1 x Toilet pan; • 1 x Toilet seat; • 1 x In-wall flush button system; • 1 x Mirror; • 2 x Door hook; • 1 x Shelf; • 1 x Soap dispenser; • 1 x Ceiling grille; • 1 x Ceiling access panel (secure). 												
54	OTHERS		New facilities to be operational prior to the demolition of the existing Platform 18/19 Stand-by Guard Room (TBD in consultation with TfNSW and Sydney Trains).												
55															
56															
57	* Water Tightness Control Requirements														
58	Class	Description													
59	I	Free from all visible leakage, seepage, and damp patches													
60	II	Leakage shall be restricted to minor damp patches with no visible flow of water.													
61	III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m2 per day overall and 0.24 l/day on any separate square metre.													
62	"damp" means wet with no visible film of water														
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F04 - Central Station - Room Data Sheets

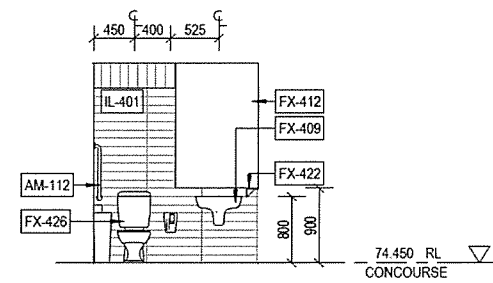
A	B	C	D	E	F	G
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule					
2						
3	ROOM DATA SHEET					
4	ROOM NAME	Remote Stand-by Guard Room				
5	ROOM NUMBER	-				
6	FUNCTIONAL REQUIREMENTS					
7	FUNCTION	New facilities to augment the new Suburban platform Stand-by Guard Rooms.				
8	SIZE / DIMENSION	Size to accommodate maximum 9 x guards. Size TBD in consultation with TfNSW and Sydney Trains.				
9	LOCATION	Within the paid zone at Intercity platform or concourse level within maximum 120 seconds walk (at 1.3m/s and VT speeds and capacities nominated in the SWTC) to all Suburban platform Stand-by Guard Rooms.				
10	CONNECTION	Access route TBD for ambulant access in compliance with relevant standards. Preference for access from secure corridor.				
11	MATERIALS & FINISHES				WATER TIGHTNESS*	
12	FLOOR	TBD in accordance with SWTC Appendix B3.				I
13	SKIRTING					I
14	WALL					I
15	CEILING					I
16	OTHERS					-
17	DOORS & IRONMONGERY		SET 1	SET 2		
18	DOOR TYPE	Single door		-		
19	CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)		-		
20	DIRECTION OF SWING	Swing out at 90 degrees		-		
21	FIRE RESISTANCE	FRP to match enclosure.		-		
22	AIR RESISTANCE			-		
23	STC RATING			-		
24	LOCK FUNCTION	ETCS		-		
25	ACCESSORIES	Door closer; door stop; kick plates; acoustic seal; door viewer.		-		
26	SAMS/SECURITY LEVEL	Low		-		
27	OTHERS	Statutory signage in accordance with TfNSW guidelines.				
28	BUILDING SERVICES					
29	DELIVERY ROUTE SIZE	As per access route for ambulant access TBD in compliance with relevant standards.				
30	RM. NOISE LEVEL					
31	COMMUNICATIONS FACILITIES					
32	ECS	• 1 x Reverse cycle air conditioning unit with internal wall mounted control.				
33	LIGHTING	TYPE	Recessed LED downlights - number TBD. Occupancy sensor for automatic lighting.			
34		DIFFUSER				
35		LUX	Normal: 320 (AS1680); Emergency: As per AS 2293.			
36		IP				
37	FIRE PROTECTION	DETECTION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Smoke detectors, EWIS speakers, Strobe lights on ceiling.			
38		SUPPRESSION	TBD in accordance with the Central Station Fire and Life Safety Strategy			
39		EXTINGUISHER	YES			
40		SEPARATION	TBD in accordance with the Central Station Fire and Life Safety Strategy			
41		SMOKE EXTRACT	N/A			
42	OTHERS					
43	ELECTRICAL/ POWER REQUIREMENTS		NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE
44		GENERAL SOCKET	TBD	WALL	Twin 13A, 230V	Concealed
45		SPECIFIC EQUIPMENT				
46	PLUMBING & DRAINAGE	• 1 x Domestic cold water and tempered hot water;				
47	FIXTURES, EQUIPMENT & LOOSE FURNITURE					
48	TYPE & LOCATION	Stand-by Guard Room				
49		<ul style="list-style-type: none"> • Bench space to accommodate maximum nominated personnel; • Seating to accommodate maximum nominated personnel; • 1 x notice board for SEQR & Policies; • 1 x Sydney Trains time clock; • 1 x phone points; • 1 x data points (minimum); • 1 x computer workstations; • 1 x TLS panel unit. 				
50		Kitchenette <ul style="list-style-type: none"> • 1 x zip hydrotap for chilled and boiling water; • 1 x sink with hot & cold water flick mixer tap mounted to under sink storage cabinet; • 1 x soap dispenser; • 1 x hand sanitiser; • 1 x Paper towel holder/dispenser; • 1 x microwave; • 1 x tea towel holder. 				
51						
52	OTHERS					
53						
54	OTHERS	New facilities to be operational prior to the demolition of the existing Suburban platform Stand-by Guard Rooms (TBD in consultation with TfNSW and Sydney Trains).				
55						
56						
57	* Water Tightness Control Requirements					
58	Class	Description				
59	I	Free from all visible leakage, seepage, and damp patches				
60	II	Leakage shall be restricted to minor damp patches with no visible flow of water.				
61	III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.				
62	"damp" means wet with no visible film of water					
63						
64		F04 - Central Station - Room Data Sheets				

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																				
2																					
3	ROOM DATA SHEET																				
4	ROOM NAME	Male Public WC																			
5	ROOM NUMBER	1103, F1103																			
6	FUNCTIONAL REQUIREMENTS																				
7	FUNCTION	Public toilet facilities.																			
8	SIZE / DIMENSION	Minimum dimensions 1.5 m (L) x 2 m (W) x 2.4 m (H). Size TBD in consultation with TfNSW, MTR and Sydney Trains.																			
9	LOCATION	<ul style="list-style-type: none"> • 1103 - 2 x in Metro North South Concourse - grouped by sex with other public toilet facilities (1104, 1105, 1106). • F1103 - 2 x adjacent to new Eastern Entrance, in the paid concourse - grouped by sex with other public toilet facilities. 																			
10	CONNECTION	Access route TBD for ambulant access in compliance with relevant standards. Direct access from public concourse.																			
11	MATERIALS & FINISHES										WATER TIGHTNESS*										
12	FLOOR	TBD in accordance with SWTC Appendix B3.																			
13	SKIRTING																				
14	WALL																				
15	CEILING																				
16	OTHERS																				
17	DOORS & IRONMONGERY										SET 1					SET 2					
18	DOOR TYPE	Single solid door to comply with relevant standards for ambulant access. Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains.																			
19	CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)																			
20	DIRECTION OF SWING	Swing out at 90 degrees																			
21	FIRE RESISTANCE	FRP to match enclosure.																			
22	AIR RESISTANCE																				
23	STC RATING																				
24	LOCK FUNCTION	EACS. Remote control from SMO. Opal enabled TBD in consultation with TfNSW, MTR and Sydney Trains.																			
25	ACCESSORIES	Door closer, door stop, kick plates.																			
26	SAMS/SECURITY LEVEL	Low																			
27	OTHERS	Statutory signage in accordance with TfNSW guidelines.																			
28	BUILDING SERVICES																				
29	DELIVERY ROUTE SIZE	As per access route for ambulant access TBD in compliance with relevant standards.																			
30	RM. NOISE LEVEL																				
31	COMMUNICATIONS FACILITIES																				
32	ECS	Exhaust air above toilet pan, supply air under basin with external variable speed control.																			
33	LIGHTING	TYPE	1 x recessed LED downlight (vandal proof). Occupancy sensor for automatic lighting. LED strip lighting at mirror.																		
34		DIFFUSER																			
35		LUX	Normal: 320 (AS1680); Emergency: As per AS 2293.																		
36		IP																			
37	FIRE PROTECTION	DETECTION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Smoke detectors, EWIS speakers, Strobe lights on ceiling.																		
38		SUPPRESSION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Sprinkler protection.																		
39		EXTINGUISHER	N/A																		
40		SEPARATION	TBD in accordance with the Central Station Fire and Life Safety Strategy.																		
41		SMOKE EXTRACT																			
42	OTHERS																				
43	ELECTRICAL/ POWER REQUIREMENTS	GENERAL SOCKET	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE															
44		SPECIFIC EQUIPMENT	TBD in consultation with TfNSW, MTR and Sydney Trains. <ul style="list-style-type: none"> • 1 x Hand dryer (hardwire); • 1 x LED screen. (External from room indicating room occupancy and relevant information i.e. maintenance and cleaning schedule. Provision TBD in consultation with TfNSW, MTR and Sydney Trains). 																		
45																					

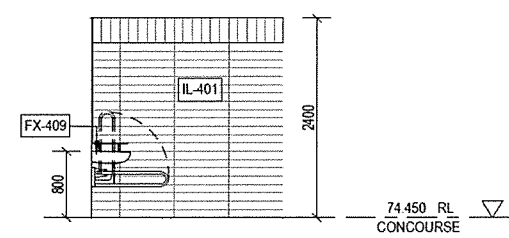
Example Layout (NTS) - Metro Northwest - Norwest Station - NWRLOTS-NRT-NRW-AD-DWG-612745_1.H.01.REV



6 1/50 - AMBULANT TOILET
1:50



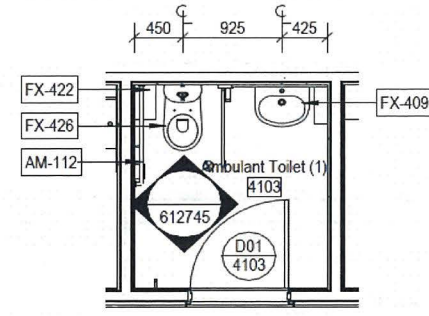
7 WC (AMBULANT) - ELEVATION 1
612590 1:50



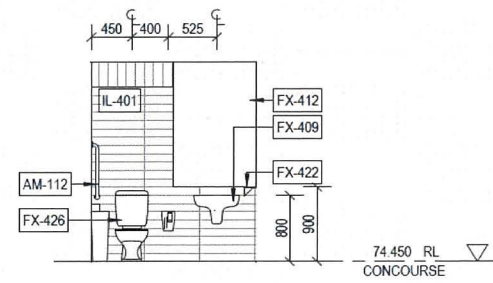
8 WC (AMBULANT) - ELEVATION 2
612590 1:50

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
46	PLUMBING & DRAINAGE			TBD in consultation with TfNSW, MTR and Sydney Trains. <ul style="list-style-type: none"> 1 x Domestic cold water and tempered hot water; 1 x Floor waste; 1 x Sewerage. 																	
47	FIXTURES, EQUIPMENT & LOOSE FURNITURE																				
48	TYPE & LOCATION			TBD in consultation with TfNSW, MTR and Sydney Trains. <ul style="list-style-type: none"> 1 x basin; 1 x basin mixer (Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x Toilet pan; 1 x Toilet seat (Touch-free changing of seat covers TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x In-wall hands-free flush button system (Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x Mirror; 2 x Door hook; 1 x Shelf; 1 x Soap dispenser (automatic - recessed or integrated); 1 x Ceiling grille; 1 x Ceiling access panel (secure); 1 x Toilet roll holder (Recessed provision TBD in consultation with TfNSW, MTR and Sydney Trains); 2 x Grab rails (Ambulant); 1 x Sharps disposal unit (recessed provision TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x Garbage bin (recessed - TBD in consultation with TfNSW and Sydney Trains subject to security assessment). 																	
49																					
50	OTHERS																				
51																					
52																					
53	* Water Tightness Control Requirements																				
54	Class		Description																		
55	I		Free from all visible leakage, seepage, and damp patches																		
56	II		Leakage shall be restricted to minor damp patches with no visible flow of water.																		
57	III		Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.																		
58	"damp" means wet with no visible film of water																				
59																					
60																					

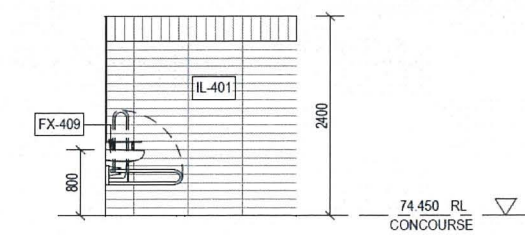
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U										
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																													
2																														
3	ROOM DATA SHEET										Example Layout (NTS) - Metro Northwest - Norwest Station - NWRLOTS-NRT-NRW-AD-DWG-612745_1.H.01.REV																			
4	ROOM NAME	Female Public WC																												
5	ROOM NUMBER	1104, F1104																												
6	FUNCTIONAL REQUIREMENTS																													
7	FUNCTION	Public toilet facilities.																												
8	SIZE / DIMENSION	Minimum dimensions 1.5 m (L) x 2 m (W) x 2.4 m (H). Size TBD in consultation with TfNSW, MTR and Sydney Trains.																												
9	LOCATION	<ul style="list-style-type: none"> • 1104 - 2 x in Metro North South Concourse - grouped by sex with other public toilet facilities (1103, 1105, 1106). • F1104 - 2 x adjacent to new Eastern Entrance, in the paid concourse - grouped by sex with other public toilet facilities. (F1103, F1105, F1106). 																												
10	CONNECTION	Access route TBD for ambulant access in compliance with relevant standards. Direct access from public concourse.																												
11	MATERIALS & FINISHES										WATER TIGHTNESS*																			
12	FLOOR	TBD in accordance with SWTC Appendix B3.																												
13	SKIRTING																													
14	WALL																													
15	CEILING																													
16	OTHERS																													
17	DOORS & IRONMONGERY										SET 1										SET 2									
18	DOOR TYPE	Single solid door to comply with relevant standards for ambulant access. Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains.																												
19	CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)																												
20	DIRECTION OF SWING	Swing out at 90 degrees																												
21	FIRE RESISTANCE	FRP to match enclosure.																												
22	AIR RESISTANCE																													
23	STC RATING																													
24	LOCK FUNCTION	EACS. Remote control from SMO. Opal enabled TBD in consultation with TfNSW, MTR and Sydney Trains.																												
25	ACCESSORIES	Door closer, door stop, kick plates.																												
26	SAMS/SECURITY LEVEL	Low																												
27	OTHERS	Statutory signage in accordance with TfNSW guidelines.																												
28	BUILDING SERVICES																													
29	DELIVERY ROUTE SIZE	As per access route for ambulant access TBD in compliance with relevant standards.																												
30	RM. NOISE LEVEL																													
31	COMMUNICATIONS FACILITIES																													
32	ECS	Exhaust air above toilet pan, supply air under basin with external variable speed control.																												
33	LIGHTING	TYPE	1 x recessed LED downlight (vandal proof). Occupancy sensor for automatic lighting. LED strip lighting at mirror.																											
34		DIFFUSER																												
35		LUX	Normal: 320 (AS1680); Emergency: As per AS 2293.																											
36		IP																												
37	FIRE PROTECTION	DETECTION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Smoke detectors, EWIS speakers, Strobe lights on ceiling.																											
38		SUPPRESSION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Sprinkler protection.																											
39		EXTINGUISHER	N/A																											
40		SEPARATION	TBD in accordance with the Central Station Fire and Life Safety Strategy.																											
41		SMOKE EXTRACT																												
42		OTHERS																												
43	ELECTRICAL/ POWER REQUIREMENTS	GENERAL SOCKET	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE																								
44		SPECIFIC EQUIPMENT	TBD in consultation with TfNSW, MTR and Sydney Trains. <ul style="list-style-type: none"> • 1 x Hand dryer (hardwire); • 1 x LED screen. (External from room indicating room occupancy and relevant information i.e. maintenance and cleaning schedule. Provision TBD in consultation with TfNSW, MTR and Sydney Trains). 																											
45																														



6 1/50 - AMBULANT TOILET
1:50

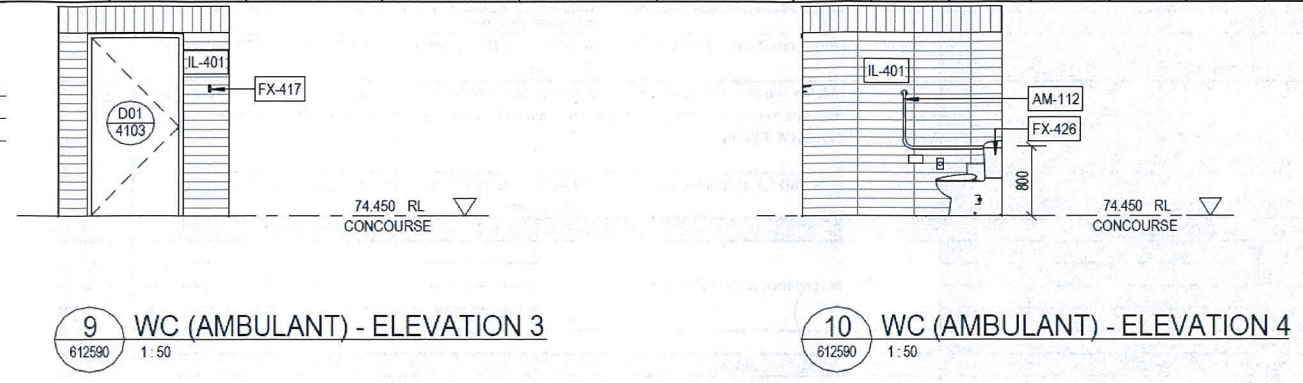


7 WC (AMBULANT) - ELEVATION 1
612590 1:50



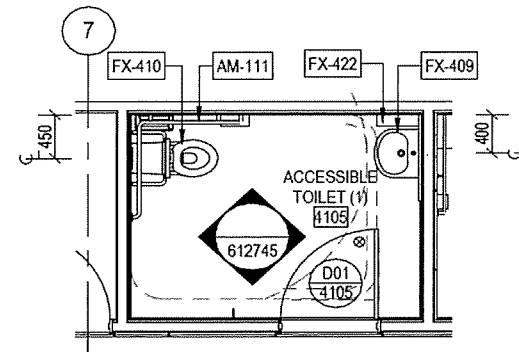
8 WC (AMBULANT) - ELEVATION 2
612590 1:50

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
46	PLUMBING & DRAINAGE			TBD in consultation with TfNSW, MTR and Sydney Trains.																	
				<ul style="list-style-type: none"> • 1 x Domestic cold water and tempered hot water; • 1 x Floor waste; • 1 x Sewerage. 																	
47	FIXTURES, EQUIPMENT & LOOSE FURNITURE																				
48	TYPE & LOCATION			TBD in consultation with TfNSW, MTR and Sydney Trains.																	
				<ul style="list-style-type: none"> • 1 x basin; • 1 x basin mixer (Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains); • 1 x Toilet pan; • 1 x Toilet seat (Touch-free changing of seat covers TBD in consultation with TfNSW, MTR and Sydney Trains); • 1 x In-wall hands-free flush button system (Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains); • 1 x Mirror; • 2 x Door hook; • 1 x Shelf; • 1 x Soap dispenser (automatic - recessed or integrated); • 1 x Ceiling grille; • 1 x Ceiling access panel (secure); • 1 x Toilet roll holder (Recessed provision TBD in consultation with TfNSW, MTR and Sydney Trains); • 2 x Grab rails (Ambulant); • 1 x Sharps disposal unit (recessed provision TBD in consultation with TfNSW, MTR and Sydney Trains); • 1 x Sanitary waste bin; • 1 x Garbage bin (recessed - TBD in consultation with TfNSW, MTR and Sydney Trains subject to security assessment). 																	
49																					
50	OTHERS																				
51																					
52																					
53	* Water Tightness Control Requirements																				
54	Class		Description																		
55	I		Free from all visible leakage, seepage, and damp patches																		
56	II		Leakage shall be restricted to minor damp patches with no visible flow of water.																		
	III		Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.																		
57																					
58	"damp" means wet with no visible film of water																				
59																					
60																					

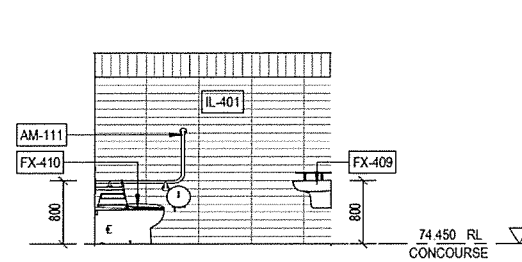


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																				
2																					
3	ROOM DATA SHEET																				
4	ROOM NAME	Accessible Public WC																			
5	ROOM NUMBER	1105, F1105																			
6	FUNCTIONAL REQUIREMENTS																				
7	FUNCTION	Public toilet facilities.																			
8	SIZE / DIMENSION	Minimum dimensions 2.8 m (L) x 2.1 m (W) x 2.4 m (H). Size TBD in consultation with TfNSW, MTR and Sydney Trains.																			
9	LOCATION	<ul style="list-style-type: none"> • 1105 - 2 x in Metro North South Concourse - grouped by sex with other public toilet facilities (1103, 1104, 1106). • F1105 - 2 x adjacent to new Eastern Entrance, in the paid concourse - grouped by sex with other public toilet facilities (F1103, F1104, F1106). 																			
10	CONNECTION	Access route TBD for accessible access in compliance with relevant standards. Direct access from public concourse.																			
11	MATERIALS & FINISHES										WATER TIGHTNESS*										
12	FLOOR																				
13	SKIRTING	TBD in accordance with SWTC Appendix B3.																			
14	WALL																				
15	CEILING																				
16	OTHERS																				
17	DOORS & IRONMONGERY										SET 1					SET 2					
18	DOOR TYPE	Single solid door to comply with relevant standards for accessible access. Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains.																			
19	CLEAR OPENING REQUIRED	2100mm (H) x 900mm (W)																			
20	DIRECTION OF SWING	Swing out at 90 degrees																			
21	FIRE RESISTANCE	FRP to match enclosure.																			
22	AIR RESISTANCE																				
23	STC RATING																				
24	LOCK FUNCTION	EACS. Remote control from SMO. Opal enabled TBD in consultation with TfNSW, MTR and Sydney Trains.																			
25	ACCESSORIES	Door closer, door stop, kick plates.																			
26	SAMS/SECURITY LEVEL	Low																			
27	OTHERS	Statutory signage in accordance with TfNSW guidelines.																			
28	BUILDING SERVICES																				
29	DELIVERY ROUTE SIZE	As per access route for accessible access TBD in compliance with relevant standards.																			
30	RM: NOISE LEVEL																				
31	COMMUNICATIONS FACILITIES	Emergency call button.																			
32	ECS	Exhaust air above toilet pan, supply air under basin with external variable speed control.																			
33	LIGHTING	TYPE	2 x recessed LED downlight (vandal proof). Occupancy sensor for automatic lighting. LED strip lighting at mirror.																		
34		DIFFUSER																			
35		LUX	Normal: 320 (AS1680); Emergency: As per AS 2293.																		
36		IP																			
37	FIRE PROTECTION	DETECTION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Smoke detectors, EWIS speakers, Strobe lights on ceiling.																		
38		SUPPRESSION	TBD in accordance with the Central Station Fire and Life Safety Strategy. Sprinkler protection.																		
39		EXTINGUISHER	N/A																		
40		SEPARATION	TBD in accordance with the Central Station Fire and Life Safety Strategy.																		
41		SMOKE EXTRACT																			
42	OTHERS																				

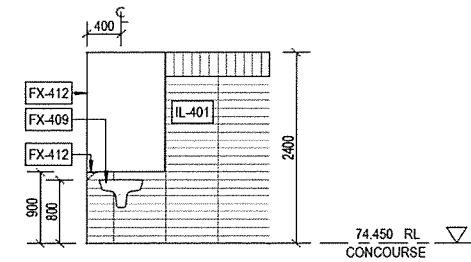
Example Layout (NTS) - Metro Northwest - Norwest Station - NWRLOTS-NRT-NRW-AD-DWG-612745_1.H.01.REV



1 1/50 - ACCESSIBLE WC - PLAN
1:50

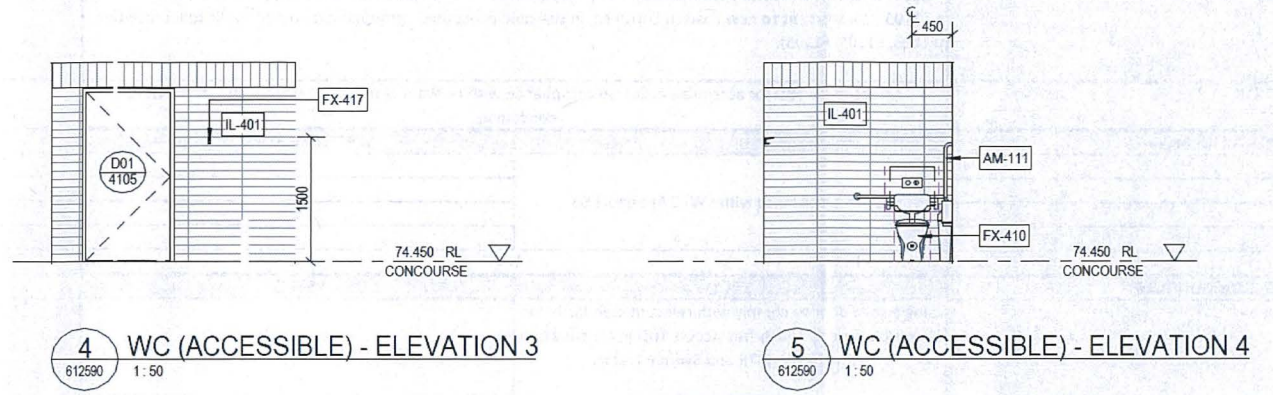


2 WC (ACCESSIBLE) - ELEVATION 1
612590 1:50



3 WC (ACCESSIBLE) - ELEVATION 2
612590 1:50

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
43	ELECTRICAL/POWER	GENERAL SOCKET	NUMBER	LOCATION	SOCKET TYPE	CONDUIT TYPE														
44	REQUIREMENTS	SPECIFIC EQUIPMENT				Concealed														
45			TBD in consultation with TfNSW, MTR and Sydney Trains.																	
46	PLUMBING & DRAINAGE		TBD in consultation with TfNSW, MTR and Sydney Trains.																	
47	FIXTURES, EQUIPMENT & LOOSE FURNITURE		TBD in consultation with TfNSW, MTR and Sydney Trains.																	
48	TYPE & LOCATION		<ul style="list-style-type: none"> 1 x basin; 1 x basin mixer (Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x Accessible toilet pan with backrest; 1 x Accessible toilet seat (Touch-free changing of seat covers TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x In-wall hands-free flush button system (Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x Mirror; 2 x Door hook; 1 x Shelf; 1 x Soap dispenser (automatic - recessed or integrated); 1 x Ceiling grille; 1 x Ceiling access panel (secure); 1 x Toilet roll holder (Recessed provision TBD in consultation with TfNSW, MTR and Sydney Trains); 2 x Grab rails (Accessible); 1 x Sharps disposal unit (recessed provision TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x Sanitary waste bin (Female); 1 x Garbage bin (recessed - TBD in consultation with TfNSW, MTR and Sydney Trains subject to security assessment). 																	
49	OTHERS																			
50																				
51																				
52																				
53	* Water Tightness Control Requirements																			
54	Class	Description																		
55	I	Free from all visible leakage, seepage, and damp patches																		
56	II	Leakage shall be restricted to minor damp patches with no visible flow of water.																		
57	III	Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre.																		
58	"damp" means wet with no visible film of water																			
59																				
60																				

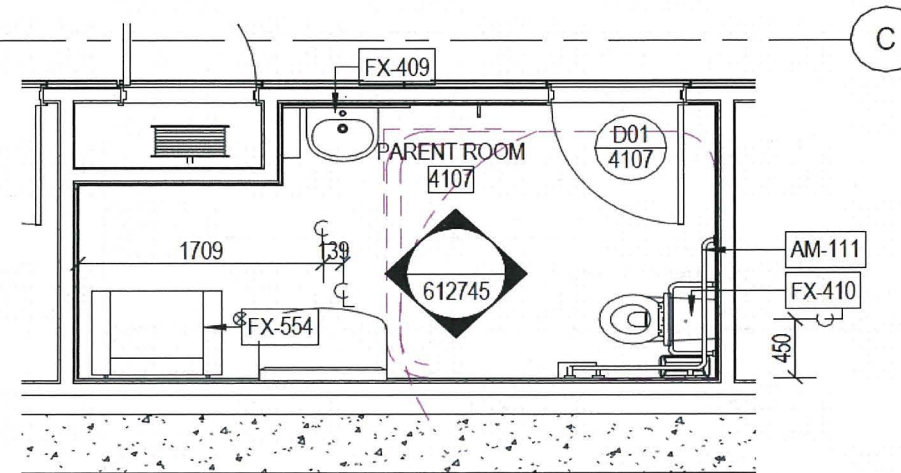


4 WC (ACCESSIBLE) - ELEVATION 3
612590 1:50

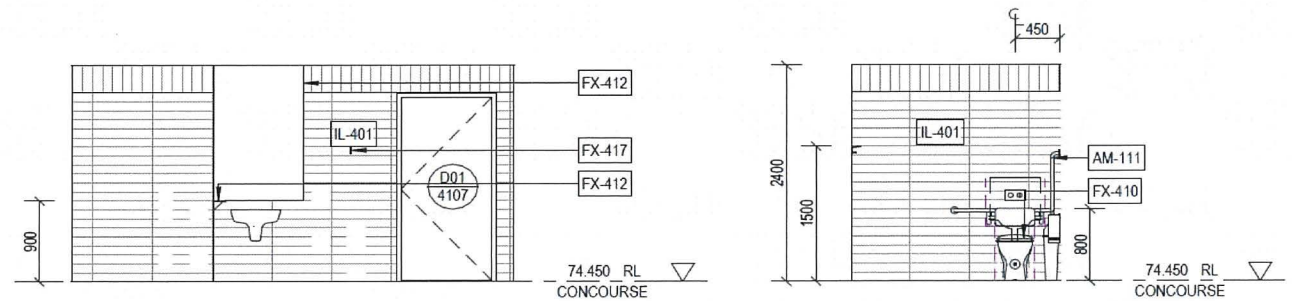
5 WC (ACCESSIBLE) - ELEVATION 4
612590 1:50

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T										
2	Central Station Main Works: SWTC Appendix F4 - Metro Station Works - Room Schedule																													
3	ROOM DATA SHEET																													
4	ROOM NAME		Parenting Room																											
5	ROOM NUMBER		1106, F1106																											
6	FUNCTIONAL REQUIREMENTS																													
7	FUNCTION		Public toilet facilities.																											
8	SIZE / DIMENSION		Minimum dimensions 2.5 m (L) x 3 m (W) x 2.7 m (H). Size TBD in consultation with TfNSW, MTR and Sydney Trains.																											
9	LOCATION		<ul style="list-style-type: none"> • 1105 - 1 x in Metro North South Concourse - grouped with other public toilet facilities (1103, 1104, 1105). • F1105 - 1 x adjacent to new Eastern Entrance, in the paid concourse - grouped with other public toilet facilities (F1103, F1104, F1105). 																											
10	CONNECTION		Access route TBD for accessible access in compliance with relevant standards. Direct access from public concourse.																											
11	MATERIALS & FINISHES										WATER TIGHTNESS*																			
12	FLOOR		-																											
13	SKIRTING		-																											
14	WALL		TBD in accordance with SWTC Appendix B3.																											
15	CEILING		-																											
16	OTHERS		-																											
17	DOORS & IRONMONGERY										SET 1										SET 2									
18	DOOR TYPE		Single solid door to comply with relevant standards for accessible access. Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains.																											
19	CLEAR OPENING REQUIRED		2100mm (H) x 900mm (W)																											
20	DIRECTION OF SWING		Swing out at 90 degrees																											
21	FIRE RESISTANCE		FRP to match enclosure.																											
22	AIR RESISTANCE		-																											
23	STC RATING		-																											
24	LOCK FUNCTION		EACS. Remote control from SMO. Opal enabled TBD in consultation with TfNSW, MTR and Sydney Trains.																											
25	ACCESSORIES		Door closer, door stop, kick plates.																											
26	SAMS/SECURITY LEVEL		Low																											
27	OTHERS		Statutory signage in accordance with TfNSW guidelines.																											
28	BUILDING SERVICES																													
29	DELIVERY ROUTE SIZE		As per access route for accessible access TBD in compliance with relevant standards.																											
30	RM. NOISE LEVEL		-																											
31	COMMUNICATIONS FACILITIES		Emergency call button.																											
32	ECS		Exhaust air above toilet pan, supply air under basin with external variable speed control.																											
33	LIGHTING		TYPE		2 x recessed LED downlight (vandal proof). Occupancy sensor for automatic lighting. LED strip lighting at mirror.																									
34			DIFFUSER		-																									
35			LUX		Normal: 320 (AS1680); Emergency: As per AS 2293.																									
36			IP		-																									
37	FIRE PROTECTION		DETECTION		TBD in accordance with the Central Station Fire and Life Safety Strategy. Smoke detectors, EWIS speakers, Strobe																									
38			SUPPRESSION		TBD in accordance with the Central Station Fire and Life Safety Strategy. Sprinkler protection.																									
39			EXTINGUISHER		N/A																									
40			SEPARATION		TBD in accordance with the Central Station Fire and Life Safety Strategy.																									
41			SMOKE EXTRACT		-																									
42			OTHERS		-																									
43	ELECTRICAL/POWER REQUIREMENTS		GENERAL SOCKET		NUMBER		LOCATION		SOCKET TYPE		CONDUIT TYPE		-																	
44			SPECIFIC EQUIPMENT		TBD in consultation with TfNSW, MTR and Sydney Trains.																									
45					<ul style="list-style-type: none"> • 1 x Hand dryer (hardwire); • 1 x LED screen. (External from room indicating room occupancy and relevant information i.e. maintenance and cleaning schedule. Provision TBD in consultation with TfNSW, MTR and Sydney Trains). 																									

Example Layout (NTS) - Metro Northwest - Norwest Station - NWRLOTS-NRT-NRW-AD-DWG-612745_1.H.01.REV



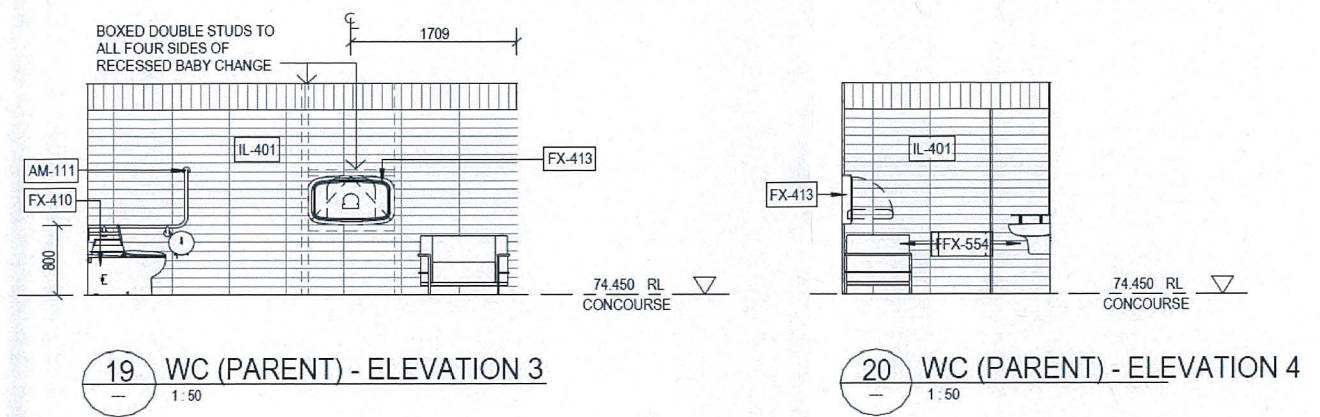
16 1/50 - PARENT ROOM
--- 1:50



17 WC (PARENT) - ELEVATION 1
--- 1:50

18 WC (PARENT) - ELEVATION 2
--- 1:50

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
46	PLUMBING & DRAINAGE		TBD in consultation with TfNSW, MTR and Sydney Trains. <ul style="list-style-type: none"> 1 x Domestic cold water and tempered hot water; 1 x Floor waste; 1 x Sewerage. 																
47	FIXTURES, EQUIPMENT & LOOSE FURNITURE																		
48	TYPE & LOCATION		TBD in consultation with TfNSW, MTR and Sydney Trains.																
49	OTHERS		<ul style="list-style-type: none"> 1 x basin; 1 x basin mixer (Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x Accessible toilet pan with backrest; 1 x Accessible toilet seat (Touch-free changing of seat covers TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x In-wall hands-free flush button system (Touch-free access TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x Mirror; 2 x Door hook; 1 x Shelf; 1 x Soap dispenser (automatic - recessed or integrated); 1 x Ceiling grille; 1 x Ceiling access panel (secure); 1 x Toilet roll holder (Recessed provision TBD in consultation with TfNSW, MTR and Sydney Trains); 2 x Grab rails (Accessible); 1 x Sharps disposal unit (recessed provision TBD in consultation with TfNSW, MTR and Sydney Trains); 1 x Sanitary waste bin; 1 x Seat; 1 x Baby change table; 1 x Garbage bin (recessed - TBD in consultation with TfNSW, MTR and Sydney Trains subject to security assessment). 																
50	OTHERS																		
51																			
52																			
53	* Water Tightness Control Requirements																		
54	Class		Description																
55	I		Free from all visible leakage, seepage, and damp patches																
56	II		Leakage shall be restricted to minor damp patches with no visible flow of water.																
57	III		Leakage shall be restricted to damp patches on the face of the concrete, at horizontal construction joints and to minor weeping of vertical construction joints in walls. Jetting of water will not be acceptable. The total inflow over a given area of structure shall not exceed 0.12 l/m ² per day overall and 0.24 l/day on any separate square metre																
58	"damp" means wet with no visible film of water																		
59																			
60																			



Central Station Main Works: SWTC Appendix F5 - Metro Station Works - Room Schedule
Metro Station Room Data Sheets - Interface Contractor's Equipment - Size and Weight

Room Number	Room Name	Equipment	Size (mm) (per item)	Weight (per item)
100A	Signalling Equipment Room	ATS Cubicle	600 (W) x 1100 (D) x 2350 (H)	550kg
		MSS Cubicle	600 (W) x 1000 (D) x 2190 (H)	450kg
		CCTV DRCS	800 (W) x 1000 (D) x 2000 (H)	215kg
		CCTV ISM	800 (W) x 1000 (D) x 2000 (H)	215kg
		BTN - Network cubicle, type 1	600 (W) x 800 (D) x 2080 (H)	162.8kg
		BTN - Network cubicle, type 2	800 (W) x 1000 (D) x 2080 (H)	175.6kg
		INCMR	1200 (W) x 800 (D) x 2200 (H)	350kg
		UPS	600 (W) x 800 (D) x 2200 (H)	400kg
		Battery Cabinet	800 (W) x 800 (D) x 2200 (H)	1050kg
		PDC1	900 (W) x 800 (D) x 2200 (H)	650kg
		PDC2	900 (W) x 800 (D) x 2200 (H)	400kg
		PDC3	600 (W) x 800 (D) x 2200 (H)	300kg
		BFB	400 (W) x 250 (D) x 600 (H)	50kg
		SDM WS	1200 (W) x 800 (D) x 2200 (H)	150kg
		NMS WS	1200 (W) x 800 (D) x 2200 (H)	150kg
		CLC	565 (W) x 800 (D) x 2013 (H)	200kg
		ZC	600 (W) x 845 (D) x 2000 (H)	200kg
		LC	600 (W) x 845 (D) x 2000 (H)	200kg
		MET	50 (W) x 50 (D) x 8 (H)	10kg
		100B	PSD Equipment Room	Voltage Limiting Device
PSD Central Interface Panel	800 (W) x 800 (D) x 2200 (H)			600kg
PSD Power Distribution Panel	1000 (W) x 800 (D) x 2200 (H)			1000kg
PSD Battery Rack	1000 (W) x 800 (D) x 2200 (H)			1000kg
PCS Cubicle	800 (W) x 800 (D)			400 kg
200, 201	Telecom Equipment Room	COMS equipment cabinet	600 (W) x 800 (D) x 2200 (H)	400kg
		CCS equipment cabinet	800 (W) x 800 (D) x 2200 (H)	500kg
		PCS Cubicle	600 (W) x 800 (D)	400 kg
203	Common Telecom Equipment Room	COMS equipment cabinet	600 (W) x 800 (D) x 2200 (H)	400kg
205	Station Computer Room	COMS equipment cabinet	600 (W) x 800 (D) x 2200 (H)	400kg
		CCS equipment cabinet	800 (W) x 800 (D) x 2200 (H)	500kg
		PCS Cubicle	600 (W) x 800 (D)	400 kg
306A, 306B	DC Isolating Links Room (1500V)	DC Isolator (per panel)	1000 (W) x 1400 (D)	1000 kg
		PCS Cubicle	600 (W) x 800 (D)	400 kg
400A, 400B, 400C, 400D	11kV Switchboard & Transformer Room	11kV/400V Transformer (Dry Type with	3000 (W) x 2500 (D)	8000 kg
		11kV Switchgear (per panel)	600 (W) x 1300 (D) (per panel)	1000 kg (per panel)
		125V DC Battery Charger	1100 (W) x 800 (D)	600 kg
		125V DC Batteries	2000 (W) x 800 (D)	5500 kg
		PCS Cubicle	600 (W) x 800 (D)	400 kg
509A, 509B	MCC and Control Equipment Room	MCC/Control	Delivery route: 2000(L) x 2500 (W) x 2500 (H)	2000 kg
602A, 602B, 602C, 602D	Tunnel Ventilation Fan Room	TVF	Delivery route: 3000(L) x 3000 (W) x 3000 (H)	10000 kg
605A	Trackway Exhaust Fan Room	TEF/TSF	Delivery route: 3000(L) x 3000 (W) x 3000 (H)	8000 kg
613A, 613B	TVS Air Compressor and Receiver Room	Air receiver	Delivery route: 2000(L) x 2000 (W) x 2100 (H)	3000 kg
704	Fire Control Room	Fire Indication Panel	600 (W) x 600 (D) x 1800 (H)	250kg
1009	Station Control Room	Console+PCs+mosaic IBP	Area of SCR console set: 11m ²	1000kg
1030, 1031	Cable Termination Room	Cable Distribution Box	1500 (W) x 500 (D)	200 kg

F05 - Metro Station Works - Interface Contractors Equipment

Sydney Metro City and Southwest - Central Station Main Works
Appendix F06: Metro Station - Cable Containment Schedule

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Item	Containment Discipline	Cable Containment Type	Cable Containment Dimensions	Quantity	Accommodated Cable Type	Point-to-Point Connection				Minimum Bending Radius (m)	Minimum Separation from High Voltage Cables (m)	Other Special Requirements	Notes
						From		To					
						Room Name	Room ID	Room Name	Room ID				
A1	CCS	Cable trunking (power and data)	For data: 400mm(w) x 100mm (h) or 300mm(w) x 150mm (h) For LV power: 100mm(w) x 100mm (h)	1	Control	Station Computer Room (SCpR)	205	Station Control Room (SCR)	1009	0.7	0.55	Through wall opening under raised floor between SCR and SCpR	a) 300mm x 100mm + 200mm x 100mm or other combination b) 400mm x 150mm (2-compartment)
A2	CCS	Cable tray	200mm (w)	1	Control	CCS main cable containment along concourse				0.7	0.55		CCS main cable containment (connected to CCS main cable containment at BOH)
A3	CCS	Cable tray	200mm (w)	1	Control	CCS main cable containment along platform				0.7	0.55		CCS main cable containment (connected to CCS main cable containment at BOH)
A4	CCS	Cable tray	a) 300mm (w) (at the end/level where SCpR is located) b) 200mm (w) (other locations)	1	Control	CCS main cable containment along BOH				0.7	0.55		CCS main cable containment (CCS main cable containment at BOH at concourse level and platform level (at the same end) should be interconnected)
A5	CCS	Cable tray	100mm (w)	1	Control	CCS main cable containment		Fire Control Room	704	0.7	0.55		
A6	CCS	Cable tray	50mm (w)	1	Control	CCS main cable containment		PSD Equipment Room	100B	0.7	0.55		
A7	CCS	Cable tray	100mm (w)	1	Control	CCS main cable containment		each 11kV Switchboard & Transformer Room	400A, 400B, 400C, 400D	0.7	0.55		
A8	CCS	Cable tray	200mm (w)	1	Control	CCS main cable containment		each Telecom Equipment Room	200, 201	0.7	0.55		
A9	CCS	Under raised floor (power and data) cable trunking systems (to be confirmed if raised floor will be provided)	For data: 400mm(w) x 100mm(h) or 300mm(w) x 150mm(h) For LV power: 100mm(w) x 100mm(h)	1	Control / communications / signalling	Station Computer Room	205	Station Computer Room	205	0.7	0.55	To be shared with other E&M disciplines	a) 300mm x 100mm + 200mm x 100mm or other combination b) 400mm x 150mm (2-compartment)
A10	CCS	Under raised floor (power and data) cable trunking systems (to be confirmed if raised floor will be provided)	For data: 400mm(w) x 100mm(h) or 300mm(w) x 150mm(h) For LV power: 100mm(w) x 100mm(h)	1	Control	Station Control Room	1009	Station Control Room	1009	0.7	0.55	To be shared with other E&M disciplines	a) 300mm x 100mm + 200mm x 100mm or other combination b) 400mm x 150mm (2-compartment)
A11	CCS	Cable tray	50mm (w)	1	Control	CCS main cable containment		Maintenance Office	1017(a)	0.7	0.55		
A12	CCS	Cable tray	50mm (w)	1	Control	CCS main cable containment		Multipurpose Room	1003	0.7	0.55		
A13	CCS	Cable tray	300mm (w)	1	Control	CCS main cable containment		Station Computer Room	205	0.7	0.55		
A14	CCS	Cable tray	100mm (w)	1	Control	CCS main cable containment		each Trackside LV Switch Room	614A, 614B	0.7	0.55		
B1	EACS	Trunking	50mm (w) x 50mm (h)	1	Control / data	Station Computer Room	205	EACS Local Controller		0.7	0.9		
B2	EACS	Conduit/trunking	20mm dia / 50mm x 50mm	1	Control / data	EACS door		EACS local controller		0.7	0.9		
C1	Signalling	Cable tray	600mm (w) x 50mm (h)	2 (one for up track, one for down track)	Signalling	Signalling Equipment Room	100A	Up / Down track cable basket/hanger		0.7	0.55		Main cable routes
C2	Signalling	Cable duct	100 mm diameter	16	Signalling	Signalling Equipment Room	100A	Up / Down track cable hanger		0.7	0.55	8 cable ducts connected to Up track cable basket/hangers; 8 cable ducts connected to Down track cable basket/hangers	
C3	Signalling	Cross track cable duct	100 mm diameter (1 no. near headwall of each track, 1 no. near tailwall of each track, and 1 no. at approximately 100m interval)	>= 4 (two per platform)	Signalling	left tunnel wall / tunnel wall		right tunnel wall / central partition		0.7	0.9	The ducts shall be connect to the main cable routes from SER	Headwall/tailwall ducts are for axle counter and point position indicator cables
C4	Signalling	Cable tray	150mm (w) x 50mm (h)	1	Signalling	Signalling Equipment Room	100A	all PEKS/SPKS in platform		0.7	0.55		
C5	Signalling	Cable tray	150mm (w) x 50mm (h)	1	Signalling	Signalling Equipment Room	100A	each Telecom Equipment Room	200, 201	0.7	0.55		
C6	Signalling	Cable tray	150mm (w) x 50mm (h)	1	Signalling	Signalling Equipment Room	100A	Station Computer Room	205	0.7	0.55		
C7	Signalling	Cable tray	150mm (w) x 50mm (h)	1	Signalling	Signalling Equipment Room	100A	Station Control Room	1009	0.7	0.55		

Sydney Metro City and Southwest - Central Station Main Works
Appendix F06: Metro Station - Cable Containment Schedule

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Item	Containment Discipline	Cable Containment Type	Cable Containment Dimensions	Quantity	Accommodated Cable Type	Point-to-Point Connection				Minimum Bending Radius (m)	Minimum Separation from High Voltage Cables (m)	Other Special Requirements	Notes
						From		To					
						Room Name	Room ID	Room Name	Room ID				
C8	Signalling	Cable tray	100mm (w) x 50mm (h)	1	Signalling	Signalling Equipment Room	100A	headwall + tailwall units		0.7	0.55		
C9	Signalling	Concealed cable conduit	2 x 32mm diameter	12 (4 PEKS per platform, 2 SPKS per platform at head/tailwall unit)	Signalling	cable tray for PEKS/SPKS		PEKS/SPKS		0.7	0.55	150mm(L) x 150mm(w) x 100mm(d) concealed adapter box shall be provided for each PEKS & each SPKS; 6 for up platform; 6 for down platform. Two conduits for each PEKS. Two conduits for each SPKS	For PEKS and SPKS The 4th PEKS is reserved for 8-car provision.
C10	Signalling	Cable basket	300mm x 100 mm	2 (one along Up track and one along Down track)	Signalling	Along trackside		Along trackside		0.7	0.9	The cable basket must be connected to the cable containment leading to the SER	This is the main cable routes along trackside.
D1	Communications and radio	Cable tray	450mm (width)	1 per platform	Audio / data / RF / optical	each Telecom Equipment Room Common Telecom Equipment Room Station Computer Room	200, 201, 203, 205	Platform (communications main cable containment along platform)		0.4	0.55	Cable tray end should be extended to room inner wall by no less than 300mm	Communications main cable containment at platform to be from headwall to tailwall
D2	Communications and radio	Cable tray	450mm (width)	1	Audio / data / RF / optical	each Telecom Equipment Room Common Telecom Equipment Room Station Computer Room	200, 201, 203, 205	North South Concourse (Communications main cable containment along concourse)		0.4	0.55	Cable tray end should be extended to room inner wall by no less than 300mm	Communications main cable containment at North South Concourse to be formed as a circular ring throughout the whole area
D3	Communications and radio	Cable tray	450mm (width)	1	Audio / data / RF / optical	each Telecom Equipment Room Common Telecom Equipment Room Station Computer Room	200, 201, 203, 205	BOH (Communications main cable containment along BOH, including vertical cable containments to connect communications main cable containment along platform and concourse)		0.4	0.55	Cable tray end should be extended to room inner wall by no less than 300mm	
D4	Communications and radio	Cable tray	200mm (width)	1	Audio / data / RF / optical	each Telecom Equipment Room Common Telecom Equipment Room Station Computer Room	200, 201, 203, 205	each Cable Termination Room (Room for communications cable transition from station to trackside to be identified)	1030, 1031	0.4	0.55	Cable tray end should be extended to room inner wall by no less than 300mm	
D5	Communications and radio	Cable tray or Cable trunking	300mm (width) or 200mm x 200mm	1	Audio / data / optical	Communications main cable containment		Station Control Room	1009	0.4	0.55	Cable tray end should be extended to room inner wall by no less than 300mm	
D6	Communications and radio	Cable tray or Cable trunking	150mm (width) or 100mm x 100mm	1	Audio / data / optical	Communications main cable containment		Each station entrance (including entrance shutters, night entrance, emergency services entrance)		0.4	0.55		
D7	Communications and radio	Conceal conduit (with outlet box)	1 x 32mm diameter	1	Audio / data / RF / optical	Communications main cable containment (at entrance)		Night entrance Help Point		0.4	0.55		
D8	Communications and radio	Conceal conduit (with outlet box)	2 x 32mm diameter	1	Audio / data / RF	Communications main cable containment		HWU/ TWU/ auxiliary communication unit		0.2	0.55		
D9	Communications and radio	Cable tray	200mm (width)	1	Audio / data / RF / optical	Communications main cable containment		BOH (Communications main cable containment along BOH)		0.4	0.55		Communications main cable containment at BOH to be throughout all corridors
D10	Communications and radio	Cable tray or Cable trunking	150mm (width) or 100mm x 100mm	1	Audio / data / optical	Communications main cable containment		Help Points		0.4	0.55		
D11	Communications and radio	Cable tray	100mm (width)	1	Audio / data	Communications main cable containment		All BOH equipment rooms / plant rooms		0.2	0.55	Cable tray end should be extended to room inner wall by no less than 300mm	
D12	Communications and radio	Cable tray	50mm (width)	1	Audio / data	Communications main cable containment		All staff rooms / maintenance offices		0.2	0.55	Cable tray end should be extended to room inner wall by no less than 300mm	

Sydney Metro City and Southwest - Central Station Main Works
Appendix F06: Metro Station - Cable Containment Schedule

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Item	Containment Discipline	Cable Containment Type	Cable Containment Dimensions	Quantity	Accommodated Cable Type	Point-to-Point Connection				Minimum Bending Radius (m)	Minimum Separation from High Voltage Cables (m)	Other Special Requirements	Notes
						From		To					
						Room Name	Room ID	Room Name	Room ID				
D13	Communications and radio	Cable tray	300mm (width)	1	Audio / data / RF / optical	Common Telecom Equipment Room	203	Station telecom lead-in drawpit		0.7	0.55	Cable tray end should be extended to room inner wall by no less than 300mm	
D14	Communications and radio	Cable tray	150mm (width)	1	Audio / data / RF / optical	each Cable Termination Room	1030, 1031	Communications main/BOH cable containment		0.4	0.55	Cable tray end should be extended to room inner wall by no less than 300mm	
D15	Communications and radio	Cable tray	300mm (width)	1 per track	Audio / data / RF / optical	each Cable Termination Room	1030, 1031	Trackside (Communications cable containment)		0.7	0.55	Cable tray end should be extended to room inner wall by no less than 300mm	
D16	Communications and radio	Cable duct	100 mm diameter	8	Audio / data / RF / optical	each Cable Termination Room	1030, 1031	Up / Down track cable hanger		0.7	0.55	4 cable ducts connected to Up track cable hangers; 4 cable ducts connected to Down track cable hangers	
D17	Communications and radio	Cable hanger	200mm (width)	1	Audio / data / RF / optical	Trackside (Communications cable containment)				0.7	0.9		Tunnel wall along low voltage/extra low voltage side at 1 metre intervals
D18	Communications and radio	Cable tray	150mm (width)	1	Audio / data / RF / optical	Communications main cable containment		Lift control panel at top of lift landing		0.4	0.55	Cable tray end to be extended to inner wall of the lift control panel from inside of lift shaft	
D19	Communications and radio	Cable tray	100mm (width)	1	Audio / data / RF / optical	Communications main cable containment		Retail and commercial opportunities		0.4	0.55		
D20	Communications and radio	Conceal conduit (with outlet box)	32mm diameter	1	Audio / data / RF / optical	Communications main cable containment		Digital panel controller		0.4	0.55		
D21	Communications and radio	Conceal conduit (with outlet box)	32mm diameter	1	Audio / data / RF / optical	Digital panel controller		Digital wayfinding screens		0.4	0.55		
D22	Communications and radio	Conceal conduit (with outlet box)	25mm diameter	1	Audio / data / RF / optical	Station Control Room	1009	SCR intercom		0.4	0.55	Cable tray end should be extended to room inner wall by no less than 300mm	
D23	Communications and radio	Cable tray	200mm (width)	1	Optical	Communications main cable containment		Distributed equipment cabinet (DEC)		0.4	0.55		
D24	Communications and radio	Cable tray	100mm (width)	1	Audio / data	Communications main cable containment		Intermediate distribution frame (IDF) / termination box (TB)		0.4	0.55		
D25	Communications and radio	Cable tray	300mm (width)	1	Audio / data / RF / optical	Each of the following locations: - Sydney Trains rail system communications room - Sydney Metro communications cupboards at North South Concourse level - Sydney Trains communications cupboards		North South Concourse (Communications main cable containment along North South Concourse)		0.4	0.55		
D26	Communications and radio	Cable tray	200mm (width)	1	Audio / data / RF / optical	each Telecom Equipment Room	200, 201	Signalling Equipment Room	100A	0.4	0.55	cable tray end should be extended to room inner wall by no less than 300mm	
D27	Communications and radio	Cable tray	100mm (width)	1	Audio / data / RF / optical	Each EACS controller		Communications main cable containment along platform, concourse and BOH		0.4	0.9	cable tray end should be extended to room inner wall by no less than 300mm	
D28	Communications and radio	Concealed conduit	100mm (width)	1	Audio / data / RF / optical	outside of each equipment room requiring access control through EACS		Communications main cable containment along platform, concourse and BOH		0.4	0.55		
D29	Communications and radio	Cable tray	100mm (width)	1	Audio / data / optical	Telecom Equipment Room #1	200	Station telecom lead-in drawpit		0.7	0.55 / 0.9 (see notes)	cable tray end should be extended to room inner wall by no less than 300mm	0.9 for cable containment along platform and trackside 0.55 for concourse and BOH
D30	Communications and radio	Cable tray	100mm (width)	1	Audio / data / optical	Common Telecom Equipment Room	203	Station roof top		0.7	0.55 / 0.9 (see notes)	cable tray end should be extended to room inner wall by no less than 300mm	0.9 for cable containment along platform and trackside 0.55 for concourse and BOH Cable route length from room 203 to roof top need to be less than 150 metres to ensure signal strength of global positioning system is sufficient
D31	Communications and radio	Cable tray	100mm (width)	1	Audio / data / optical	Telecom Equipment Room #1	200	Station roof top		0.7	0.55 / 0.9 (see notes)	cable tray end should be extended to room inner wall by no less than 300mm	0.9 for cable containment along platform and trackside 0.55 for concourse and BOH
E1	Tunnel ventilation	Cable tray	600mm (w)	1	Power cable	MCC and Control Equipment Room (Chatswood end)	509B	TVF room serving Chatswood end	602C/D	0.7	0.55		

Sydney Metro City and Southwest - Central Station Main Works
Appendix F06: Metro Station - Cable Containment Schedule

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Item	Containment Discipline	Cable Containment Type	Cable Containment Dimensions	Quantity	Accommodated Cable Type	Point-to-Point Connection				Minimum Bending Radius (m)	Minimum Separation from High Voltage Cables (m)	Other Special Requirements	Notes
						From		To					
						Room Name	Room ID	Room Name	Room ID				
E2	Tunnel ventilation	Cable tray	150mm (w)	1	Control cables	MCC and Control Equipment Rm (Chatswood end)	509B	TVF room serving Chatswood end	602C/D	0.7	0.55		
E3	Tunnel ventilation	Cable tray	400mm (w)	1	for pneumatic pipe	Nearest TVS Air Compressor/Receiver Room	613B	TVF room serving Chatswood end	602C/D	0.7	0.55		
E4	Tunnel ventilation	Cable tray	300mm (w)	1	Power cable	MCC and Control Equipment Rm (Chatswood end)	509B	TVS Air Compressor/Receiver Room serving Chatswood end	613B	0.7	0.55		
E5	Tunnel ventilation	Cable tray	300mm (w)	1	Control cables	MCC and Control Equipment Rm (Chatswood end)	509B	TVS Air Compressor/Receiver Room serving Chatswood end	613B	0.7	0.55		
E6	Tunnel ventilation	Cable tray	200mm (w)	2	Control and interface cables	MCC and Control Equipment Rm (Chatswood end)	509B	Fire control room	704	0.7	0.55		
E7	Tunnel ventilation	Cable tray	400mm (w)	2	Control and interface cables	MCC and Control Equipment Rm (Chatswood end)	509B	Station Communications Room (renamed as Station Computer Room)	205	0.7	0.55		The two cable containment must run in separate route
E8	Tunnel ventilation	Cable tray	600mm (w)	2	Control and interface cables	MCC and Control Equipment Rm (Chatswood end)	509B	Station control room	1009	0.7	0.55		
E9	Tunnel ventilation	Cable tray	400mm (w)	2	fibre cable	MCC and Control Equipment Rm (Chatswood end)	509B	Telecom Equipment Room 1	200	0.7	0.55		
E10	Tunnel ventilation	Cable tray	400mm (w)	1	Power cable	11KV Switchboard & Transformer Rm 1	400A	MCC and Control Equipment Rm (Chatswood end)	509B	0.7	0.55		Assume 400A is at north end and 400D is at south end after space proofing exercise
E11	Tunnel ventilation	Cable tray	600mm (w)	1	Power cable	MCC and Control Equipment Rm (Bankstown end)	509A	TVF room serving Bankstown end	602A/B	0.7	0.55		
E12	Tunnel ventilation	Cable tray	150mm (w)	1	Control cables	MCC and Control Equipment Rm (Bankstown end)	509A	TVF room serving Bankstown end	602A/B	0.7	0.55		
E13	Tunnel ventilation	Cable tray	400mm (w)	1	for pneumatic pipe	Nearest TVS Air Compressor/Receiver Room	613A	TVF room serving Bankstown end	602A/B	0.7	0.55		
E14	Tunnel ventilation	Cable tray	300mm (w)	1	Power cable	MCC and Control Equipment Rm (Bankstown end)	509A	TVS Air Compressor/Receiver Room serving Bankstown end	613A	0.7	0.55		
E15	Tunnel ventilation	Cable tray	300mm (w)	1	Control cables	MCC and Control Equipment Rm (Bankstown end)	509A	TVS Air Compressor/Receiver Room serving Bankstown end	613A	0.7	0.55		
E16	Tunnel ventilation	Cable tray	600mm (w)	2	Power cable	MCC and Control Equipment Rm (Bankstown end)	509A	TEF Room	605A	0.7	0.55		Assume the TEF Room (605A) was provided at the south end after spaceproofing exercise.
E17	Tunnel ventilation	Cable tray	200mm (w)	2	Control cables	MCC and Control Equipment Rm (Bankstown end)	509A	TEF Room	605A	0.7	0.55		Assume the TEF Room (605A) was provided at the south end after spaceproofing exercise.
E18	Tunnel ventilation	Cable tray	400mm (w)	2	for pneumatic pipe	Nearest TVS Air Compressor/Receiver Room	613A	TEF Room	605A	0.7	0.55		Assume the TEF Room (605A) was provided at the south end after spaceproofing exercise.
E19	Tunnel ventilation	Cable tray	200mm (w)	2	Control and interface cables	MCC and Control Equipment Rm (Bankstown end)	509A	Fire control room	704	0.7	0.55		
E20	Tunnel ventilation	Cable tray	400mm (w)	2	Control and interface cables	MCC and Control Equipment Rm (Bankstown end)	509A	Station Computer Room	205	0.7	0.55		The two cable containment should run in separate route
E21	Tunnel ventilation	Cable tray	600mm (w)	2	Control and interface cables	MCC and Control Equipment Rm (Bankstown end)	509A	Station control room	1009	0.7	0.55		
E22	Tunnel ventilation	Cable tray	400mm (w)	1	Power cable	11KV Switchboard & Transformer Room 4	400D	MCC and Control Equipment Rm (Bankstown end)	509A	0.7	0.55		Assume 400A is at north end and 400D is at south end after space proofing exercise

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Item	Containment Discipline	Cable Containment Type	Cable Containment Dimensions	Quantity	Accommodated Cable Type	Point-to-Point Connection				Minimum Bending Radius (m)	Minimum Separation from High Voltage Cables (m)	Other Special Requirements	Notes
						From		To					
						Room Name	Room ID	Room Name	Room ID				
E23	Tunnel ventilation	Cable Bracket	120mm (w) x 150mm (s)	2 (one along up track and one along down track)	Control / battery cables			Along trackside		0.7	0.9		(1) For TVS control cables (2) "(s)" refers to vertical spacing
E24	Tunnel ventilation	Cable Bracket	120mm (w) x 150mm (s)	2 (one along up track and one along down track)	Control / battery cables			Along trackside		0.7	0.9		(1) For tunnel temperature monitoring system (The mounting level shall be at the level over the train roof) (2) "(s)" refers to vertical spacing
F1	Tunnel services	Cable tray	600mm (w)	4	Earthing	Trackside LV Switch Rooms at each end	614A, 614B	Platform end at each side					Trackside auxiliary
F2	Tunnel services	Cable tray			UPS supply (120 mins)						Tunnel lighting / radio amplifier		
F3	Tunnel services	Cable tray			ESS supply						Tunnel socket outlets		
F4	Tunnel services	Cable tray									Task lighting		
F5	Tunnel services	Cable tray			Non-ESS supply						Trackside advertising panels		
F6	Tunnel services	Cable tray			ESS supply						Trackside equipment (OHV isolator, niche and sump pit lighting, tunnel sump pump)		
F7	Tunnel services	Cable tray			UPS supply (30 mins)						CCTV		
G1	PSD	Cable tray	200mm (w)	1	Control and monitor	PSD Equipment Room	100B	One end of each platform		0.7	0.55	To the nearest platform ends at high level and same route as for the power cables	
G2	PSD	Cable tray	300mm (w)	1	Power	PSD Equipment Room	100B	One end of each platform		0.7	0.55	To the nearest platform ends at high level and same route as for the control & monitoring cables	
G3	PSD	Cable tray	150mm (w)	1	Control and monitor	PSD Equipment Room	100B	Signalling Equipment Room	100A	0.4	0.55		
H1	HV	Cable ladder	400mm (w)	1	11KV cable	11KV Switchboard & Transformer Room 1	400(a)	11KV Switchboard & Transformer Room 3	400(c)	1.1	n/a		
H2	HV	Cable tray	150mm (w)	1	Control cables	11KV Switchboard & Transformer Room 1	400(a)	11KV Switchboard & Transformer Room 3	400(c)	0.21	0.55		
H3	HV	Cable ladder	400mm (w)	1	11KV cable	11KV Switchboard & Transformer Room 2	400(b)	11KV Switchboard & Transformer Room 4	400(d)	1.1	n/a		
H4	HV	Cable tray	150mm (w)	1	Control cables	11KV Switchboard & Transformer Room 2	400(b)	11KV Switchboard & Transformer Room 4	400(d)	0.21	0.55		
H5	HV	Cable tray	150mm (w)	1	Control / battery cables	11KV Switchboard & Transformer Room 1	400(a)	11KV Switchboard & Transformer Room 2	400(b)	0.21	0.55		
H6	HV	Cable tray	150mm (w)	1	Control / battery cables	11KV Switchboard & Transformer Room 3	400(c)	11KV Switchboard & Transformer Room 4	400(d)	0.21	0.55		
H7	HV	Cable ladder	400mm (w)	1	11KV cable	11KV Switchboard & Transformer Room 1	400(a)	Down track (MSW)		1.1	n/a	Segregate from 11KV Switchboard & Transformer Room 2 cable route	
H8	HV	Cable ladder	400mm (w)	1	11KV cable	11KV Switchboard & Transformer Room 2	400(b)	Up track (MSW)		1.1	n/a	Segregate from 11KV Switchboard & Transformer Room 1 cable route	
H9	HV	Cable tray	150mm (w)	1	Pilot cable	11KV Switchboard & Transformer Room 1	400(a)	Down track (MSW)		0.21	0.55	Segregate from 11KV Switchboard & Transformer Room 2 cable route	
H10	HV	Cable tray	150mm (w)	1	Pilot cable	11KV Switchboard & Transformer Room 2	400(b)	Up track (MSW)		0.21	0.55	Segregate from 11KV Switchboard & Transformer Room 1 cable route	
H11	HV	Cable ladder	400mm (w)	1	11KV cable	11KV Switchboard & Transformer Room 3	400(c)	Down track (MSW)		1.1	n/a	Segregate from 11KV Switchboard & Transformer Room 4 cable route	
H12	HV	Cable ladder	400mm (w)	1	11KV cable	11KV Switchboard & Transformer Room 4	400(d)	Up track (MSW)		1.1	n/a	Segregate from 11KV Switchboard & Transformer Room 3 cable route	
H13	HV	Cable tray	150mm (w)	1	Pilot cable	11KV Switchboard & Transformer Room 3	400(c)	Down track (MSW)		0.21	0.55	Segregate from 11KV Switchboard & Transformer Room 4 cable route	
H14	HV	Cable tray	150mm (w)	1	Pilot cable	11KV Switchboard & Transformer Room 4	400(d)	Up track (MSW)		0.21	0.55	Segregate from 11KV Switchboard & Transformer Room 3 cable route	
H15	HV	Cable tray	100mm (w)	1	Control cables for PCS	PCS main cable containment among 11KV Switchboard & Transformer Room, DC Isolating Links Room, and PSD Equipment Room (Room ID 306A and 206B, 400A, 400B, 400C and 400D, 100B)				0.7	0.55		For PCS communication cables
H16	HV	Cable tray	100mm (w)	1	Control cables for PCS	PCS main cable containment		each Telecom Equipment Room	200, 201	0.7	0.55		For PCS communication cables
H17	HV	Cable tray	100mm (w)	1	Control cables for PCS	PCS main cable containment		Station Computer Room	205	0.7	0.55		For PCS communication cables

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Item	Containment Discipline	Cable Containment Type	Cable Containment Dimensions	Quantity	Accommodated Cable Type	Point-to-Point Connection				Minimum Bending Radius (m)	Minimum Separation from High Voltage Cables (m)	Other Special Requirements	Notes
						From		To					
						Room Name	Room ID	Room Name	Room ID				
I1	OHW and traction power supply	Cable ladder	300mm (w)	2	3.8/6.6kV Cables (DC Positive)	DC Isolator Links Room 1	306A	Up track (MSW) (Station end towards Chatswood)		0.75	n/a		It is assumed that the DC Isolating Links Room 1 (306A) is located at platform near the station end towards Chatswood
I2	OHW and traction power supply	Cable tray	300mm (w)	1	3.8/6.6kV cables (DC negative)	DC Isolator Links Room 1	306A	Up track (MSW) (Station end towards Chatswood)		0.75	n/a		
I3	OHW and traction power supply	Cable ladder	300mm (w)	2	3.8/6.6kV Cables (DC Positive)	DC Isolator Links Room 2	306B	Down track (MSW) (Station end towards Bankstown)		0.75	n/a		It is assumed that the DC Isolating Links Room 2 (306B) is located at platform near the station end towards Bankstown
I4	OHW and traction power supply	Cable tray	300mm (w)	1	3.8/6.6kV cables (DC negative)	DC Isolator Links Room 2	306B	Down track (MSW) (Station end towards Bankstown)		0.75	n/a		
I5	OHW and traction power supply	Cable tray	150mm (w)	1	Battery supply cable	11KV Switchboard & Transformer Room 1	400A	PSD Equipment Room	100B	0.21	n/a		For the DC supply to the voltage limiting device installed in the PSD Equipment Room
I6	OHW and traction power supply	Cable tray	300mm (w)	1	Voltage limiting device cables	PSD Equipment Room	100B	Up track (MSW) (Station end towards Chatswood)		0.7	n/a		It is assumed that the PSD Equipment Room is located at platform end near the station end towards Chatswood
I7	OHW and traction power supply	Cable tray	300mm (w)	1	Cross track bonding cables	Up track (MSW) (Station end towards Chatswood)		Down track (MSW) (Station end towards Chatswood)		0.7	n/a		