Transport Asset Standards Authority

For queries regarding this document
standards@transport.nsw.gov.au
www.transport.nsw.gov.au

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Issue date: 28 June 2018

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Subject: Update to T MU AM 02001 ST *Asset Information and Register Requirements,* version 3.0

This technical note is issued by the Asset Standards Authority (ASA) to notify an update to T MU AM 02001 ST *Asset Information and Register Requirements,* version 3.0.

ASA has published T MU AM 02006 TI *Asset Register and Data Dictionary,* version 1.0 that contains detailed definition of a minimum set of asset attributes and metadata for Transport for NSW (TfNSW) owned assets. This document supplements the requirements of T MU AM 02001 ST.

In this context, the following updates are made to T MU AM 02001 ST:

1. Section 7 Asset register requirements

Add the following contents after Figure 3 in section 7:

T MU AM 02006 TI *Asset Register and Data Dictionary* provides detailed definition of asset attributes and metadata for TfNSW owned assets.

Refer to T MU AM 02006 TI for capturing and formatting asset attributes and metadata.

2. Section 10.1 Asset data

Add the following contents at the end of section 10.1.

Refer to T MU AM 02006 TI for capturing and formatting asset attributes and metadata.

Authorisation:

	Technical content prepared by	Checked and approved by	Interdisciplinary coordination checked by	Authorised for release
Signature				
Date				
Name	Ivan Catabay	Angelo Koutsoukos	Andrew Cooper	Jagath Peiris
Position	Asset Information Specialist	Manager Asset Information	A/Director Network and Asset Strategy	Director Network Standards and Services

T MU AM 02001 ST

Standard

Asset Information and Register Requirements

Version 3.0

Issued date: 28 April 2016

Standard governance

Owner: Manager Asset Stewardship, Asset Standards Authority

Authoriser: Principal Manager, Network and Asset Strategy, Asset Standards Authority

Approver: Executive Director, Asset Standards Authority on behalf of the ASA Configuration Control Board

Document history

Version	Summary of changes
1.0	First issue.
2.0	Second issue. Minor changes to correct wording, improve clarity and alignment with asset classification.
3.0	Third issue. Minor changes to contents to align with the TfNSW EAM service delivery requirements and change of document title from *Asset Information Management* to *Asset Information and Register Requirements*.

For queries regarding this document,
please email the ASA at
standards@transport.nsw.gov.au
or visit www.asa.transport.nsw.gov.au

Transport Asset Standards Authority

Preface

The Asset Standards Authority (ASA) is an independent unit within Transport for NSW (TfNSW) and is the network design and standards authority for defined NSW transport assets.

The ASA is responsible for developing engineering governance frameworks to support industry delivery in the assurance of design, safety, integrity, construction, and commissioning of transport assets for the whole asset life cycle. In order to achieve this, the ASA effectively discharges obligations as the authority for various technical, process, and planning matters across the asset life cycle.

The ASA collaborates with industry using stakeholder engagement activities to assist in achieving its mission. These activities help align the ASA to broader government expectations of making it clearer, simpler, and more attractive to do business within the NSW transport industry, allowing the supply chain to deliver safe, efficient, and competent transport services.

The ASA develops, maintains, controls, and publishes a suite of standards and other documentation for transport assets of TfNSW. Further, the ASA ensures that these standards are performance-based to create opportunities for innovation and improve access to a broader competitive supply chain.

This standard provides information regarding the requirements for the asset register, associated asset data and documents for assets owned by TfNSW over the asset life cycle.

This document is part of an integrated set of asset management standards. The ASA expects to develop a series of related standards on specific asset coding, asset data requirements and data standards relevant to each transport mode and asset class for use by Authorised Engineering Organisations (AEOs) and service providers.

This standard has been approved by the ASA Configuration Control Board and is the third issue.

This document has been retitled from *Asset Information Management*, Version 2.0 to *Asset Information and Register Requirements,* Version 3.0 to accurately reflect the document content and includes minor content changes to better align with the TfNSW Enterprise Asset Management (EAM) service delivery requirements.

Changes to this version include updates to reference documents, transport modes, asset containers within the asset portfolio, asset structuring and the hierarchy, and asset key configuration data libraries.

Table of contents

1. Introduction

The Asset Standards Authority (ASA) is committed to effective and efficient management of Transport Assets. The ASA is collaborating with other government and non-government organisations to continuously improve the capability, performance and condition of the assets over the full life cycle.

This standard defines the asset information and asset register requirements for Transport for NSW (TfNSW) owned assets over their life cycle or portion thereof. The requirements ensure consistency, accuracy and completeness of asset information. These requirements also support and enable the transition to digital engineering.

Asset managers and maintainers are required to demonstrate that assets and related asset information is managed accurately and efficiently in accordance with the requirements of this standard.

2. Purpose

The objective of this document is to describe the requirements of the TfNSW asset register and the creation and management of the asset information related to all assets owned and managed by and on behalf of TfNSW across the asset life cycle. It sets high-level requirements for the asset register, associated asset data and documents over the life cycle, and the asset information system. It also provides clarity of ownership of the asset information system, data and documents.

2.1. Scope

This standard establishes the requirements of an asset register and associated asset information including the asset information system. This standard defines an asset classification framework and structure required to be used in the development and maintenance of the asset register.

The document also specifies an asset classification system and standard asset reference coding libraries to support a common structure, terminology and naming for the assets. This enables ease of identification, collaboration, collection, exchange, access and reporting of the assets and associated asset information.

This standard also defines when assets should be created and how they are classified and grouped.

Asset information requirements presented in this standard cover the whole-of-life management of assets required to support and substantiate decisions made over the life cycle that includes but are not limited to the following:

- finance management requirements including asset capitalisation and whole-of-life costs
- asset handover requirements including asset acceptance information
- asset configuration change requirements including asset type approvals or sub-component type approvals, new assets, configuration and operational changes including changes in asset strategy and concessions to standards

2.2. Application

This standard applies to TfNSW divisions, transport cluster agencies, Authorised Engineering Organisations (AEOs) and other service providers involved in the planning, delivery, operation, maintenance and disposal of assets across the transport portfolio. The requirements in this standard apply to all phases of the asset life cycle.

This standard also applies to organisations, service providers or project developers that perform asset management-related services to TfNSW, including AEOs, non AEOs and their suppliers who are involved in defining, designing, implementing, commissioning or integrating into the operating network any new or altered assets or systems. This standard also applies to the decommissioning and disposal of assets.

The standard applies to the asset register, associated asset information and the asset information system containing and managing assets owned by TfNSW and operated and maintained by TfNSW agencies and service providers.

3. Reference documents

The following documents are cited in the text. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document applies.

Transport for NSW standards

T MU AM 01004 ST Maintenance Service Schedule Classification and Compliance

T MU AM 01005 ST Asset Handover Requirements

T MU AM 01006 ST Asset Reference Codes

T MU AM 01007 TI Asset Reference Codes Register

T MU AM 01008 ST Technical Maintenance Plans and Coding System

T MU AM 01009 TI Technical Maintenance Coding Register

T MU AM 02001 GU Developing Configuration Information Delivery Plans

T MU AM 02002 TI Asset Classification System

T MU AM 02003 TI Register of Asset Information Systems and Repositories

T MU MD 00006 ST Engineering Drawings and CAD Requirements

Legislation

Disability Discrimination Act 1992

Other reference documents

Building Code of Australia

4. Terms and definitions

The following terms and definitions apply in this document:

AEO Authorised Engineering Organisation; a legal entity (which may include a Transport Agency as applicable) to whom the ASA has issued an ASA Authorisation

ASA Asset Standards Authority

asset an item, thing or entity that has potential or actual value to an organisation. Physical assets usually refer to equipment, inventory and properties owned by the organisation. Physical assets are the opposite of intangible assets, which are non-physical assets such as leases, brands, digital assets, use rights, licences, intellectual property rights, reputation or agreements

asset class used to define and group assets having a similar nature in the operations of an entity and comprised of a number of related asset functions

asset discipline represents a top level grouping of related asset classes

asset function used to define and group assets having a similar function in the operations of an entity and comprised of a number of asset types that perform the same or similar function within an asset class

asset information the combined set of data (graphical and non-graphical) and documents (drawings, manuals, plans and certificates) required to support the management of assets over the life cycle

asset information management the discipline of managing the asset-related data and documents to a sufficient quality to support organisational objectives and outcomes

asset information repository a recognised physical or electronic location for the storage and management of asset information

asset information repository custodian a person responsible for managing an asset information repository and the processes related to the creation and maintenance of the information and provision of access to the information in the repository

asset information system a set of interrelated repositories of structured asset information and related processes required to manage the asset portfolio over the life cycle

asset life the period from conception to end-of-life

asset portfolio assets that are within the scope of the asset management system

asset register record of asset inventory considered worthy of separate identification including associated historical, condition, construction, technical and financial information about each asset

asset specification used to define and group assets having common characteristics that distinguish them separately (different make and model or a different build) and associated with an asset type or function

asset type used to define and group assets that perform the same or similar asset function and which may serve the same purpose within an asset function. An asset type will have characteristics that distinguish them separately from other asset types within an asset function (different technical specification or different construction). The difference in specification within an asset type including variations in make and model is identified by the asset specification also known as the technical maintenance code (TMC)

attribute piece of data forming a partial description of an object or entity

availability the measure of the percentage of time that an item or system is available to perform its designated function

CCTV closed circuit television; a system for displaying, monitoring, recording and retrieving video information

component parts of an asset (defined by its specification or build) having independent physical or functional identity and having specific attributes such as different life expectancy, maintenance regimes, risk or criticality. Also identifies the defective part or part causing failure that requires repair or replacement

conditional failure a defect is a conditional failure when it has the potential to become a functional failure and occurs when the asset condition is outside a maintenance threshold but it is still able to perform its function and does not yet have operational consequences (may need to be monitored as part of condition assessment or repaired)

configuration interrelated functional and physical characteristics of an asset defined in asset information

configuration change a change in functional or physical configuration of an asset

corridor a linear zonal area (within a boundary and defined by a start and end node) that contains heavy rail, light rail, road or maritime infrastructure assets to support the operation of transport services

data information collected and stored but not yet interpreted or analysed (graphical and non-graphical)

document any record of information and includes -

a) anything on which there is writing,

b) anything on which there are marks, figures symbols or perforations having a meaning for the person qualified to interpret them, or

c) anything from which sounds, images or writings can be reproduced with or without the aid of anything else, or

d) a map, plan, drawing or photograph

drawing static, printed or geographical representation of part or all of a project or asset

dynamic data data collected over time about how the asset is operating, performing, its condition, work done and measurements which change through its operation and maintenance

facility a zonal area (within a precinct boundary) that contains buildings, systems, plant and associated infrastructure assets to support the operation and maintenance of transport services

FMECA failure modes, effect and criticality analysis

functional failure a defect is a functional failure when the equipment cannot fully perform its design function and causes immediate operational consequences such as train delays or loss of power (subject to the level of available redundancy)

graphical data data conveyed using shape and arrangement in space

HV high voltage

HVAC heating, ventilation and air conditioning

interchange a location where it is possible to change within a transport mode or between transport modes

life cycle the scope of the system or product evolution beginning with the identification of a perceived customer need, addressing development, test, manufacturing, operation, support and training activities, continuing through various upgrades or evolutions, until the product and its related processes are disposed of

LV low voltage

maintainability a characteristic of design and installation, expressed as the probability that an item will be restored to operating condition, within a given period of time, using prescribed procedures and resources

maintenance in the context of this document has two components:

- routine maintenance, also referred to as recurrent maintenance, is a collective of all preventive and repair activities excluding renewals. Includes visual inspections, preventive maintenance, corrective maintenance and breakdown maintenance
- renewals maintenance, also referred to as capital maintenance or major periodic maintenance, includes the cyclic renewal and upgrading of assets to avoid deterioration in their condition to ensure long term asset performance and financial sustainability

MTBF mean time between failures is the predicted elapsed time between inherent failures of a system during operation

MTTR mean time to repair; basic measure of the maintainability of repairable items

non-graphical data data conveyed using alphanumeric characters

RAMS reliability, availability, maintainability and safety

reliability the probability that a specified item will perform a specified function within a defined environment, for a specified length of time

RTU remote terminal unit

static data data about an asset that does not change after being recorded and which is usually related to its design and configuration

TfNSW Transport for NSW

TMC technical maintenance code; identifies the variation of unique technical specifications for an asset type. Assets are assigned a TMC to reflect their configuration based on the asset type and specification and to define the applicable technical maintenance plan (TMP)

TMP technical maintenance plan; defines the maintenance plan applicable for an asset (assets are associated with their required maintenance plan by the TMC). The TMP defines what maintenance tasks are to be performed (packaged as service schedules), when (frequency, conditional or statistical trigger) and where the maintenance tasks are to be performed

Transport Assets means those assets which are vested in or owned, managed, controlled, commissioned or funded by the NSW Government, a NSW Government agency or a Transport Agency

transport form type of vehicle or method used to facilitate the movement of people and freight. For example train, bus, ferry, light rail vehicle, car, motorbike, bicycle or walking

transport infrastructure [1]means infrastructure used for or in connection with or to facilitate the movement of persons and freight by road, rail, sea, air or other transport mode[2], and includes:

a) railways and railway infrastructure, and

b) roads and road infrastructure, and

c) maritime infrastructure and ports, and

d) transport safety infrastructure, and

e) systems, works, structures, buildings, plant, machinery and equipment that are associated with or incidental to transport infrastructure

(Emphasis added. See notes below)

Note 1: includes associated vehicles, vessels and rolling stock

Note 2: includes active transport such as walking and cycling

transport mode means by which people and freight achieve mobility. They fall into one of three basic types land (road, rail and active), sea and air

transport network transport system owned and operated by TfNSW or its operating agencies which TfNSW has power to exercise its functions as conferred by the Transport Administration Act or any other Act

transport services includes railway services (heavy rail, metro rail, light rail services), bus services and ferry services

transport system the transport services and transport infrastructure of the state for all modes of transport

yard a linear zonal area (within a boundary and defined limits) that contains heavy rail, light rail, road or maritime infrastructure assets and facilities to support the stabling, servicing and presentation of the transport fleet. This is an area that contains one or more rail sidings, roads or a ship yard identified for a business purpose

5. Asset register and asset information ownership

The asset register and associated asset information including data and documents are owned by TfNSW. The ASA represents TfNSW in this capacity.

A range of asset information is in existence and is continually developed by TfNSW and parties working directly or indirectly with TfNSW. The ASA is the delegated owner of the asset register and associated asset information. Asset information is generally restricted to that defined in Section 10 of this document and is necessary for the effective management and sustainability of the assets that form the TfNSW asset portfolio.

6. Asset register and asset information overview

The TfNSW transport system comprises infrastructure covering two primary portfolio groups, namely, fixed infrastructure and mobile fleet assets. These fixed infrastructure and mobile fleet assets are used in connection with or to facilitate the movement of persons and freight by road, rail, sea, air or other modes of transport.

The TfNSW asset portfolio is defined in Section 8.

The three primary areas, key to establishing and defining assets in an asset register are as follows:

- define what the asset is (unique identification, asset classification and specification) - physical and functional requirements
- define the purpose of the asset (demand, usage and service obligation) – operational requirements
- define where the asset is (physical location and spatial reference)

Figure 1 shows a diagrammatic representation of the three key areas.

Figure 1 - Asset core requirements

The asset register requirements in relation to defining the asset are explained in Section 7. The asset classification system and technical specification requirements are explained in Section 9 and the asset information requirements are explained in Section 10 of this document.

The asset location requirements in relation to the physical and spatial reference of the assets are explained in Section 8.5 of this document.

Asset information is the combined set of data (graphical and non-graphical) and documents (drawings, manuals, plans and certificates) required to support the management of assets over the life cycle. Figure 2 shows how asset information is linked to the asset register.

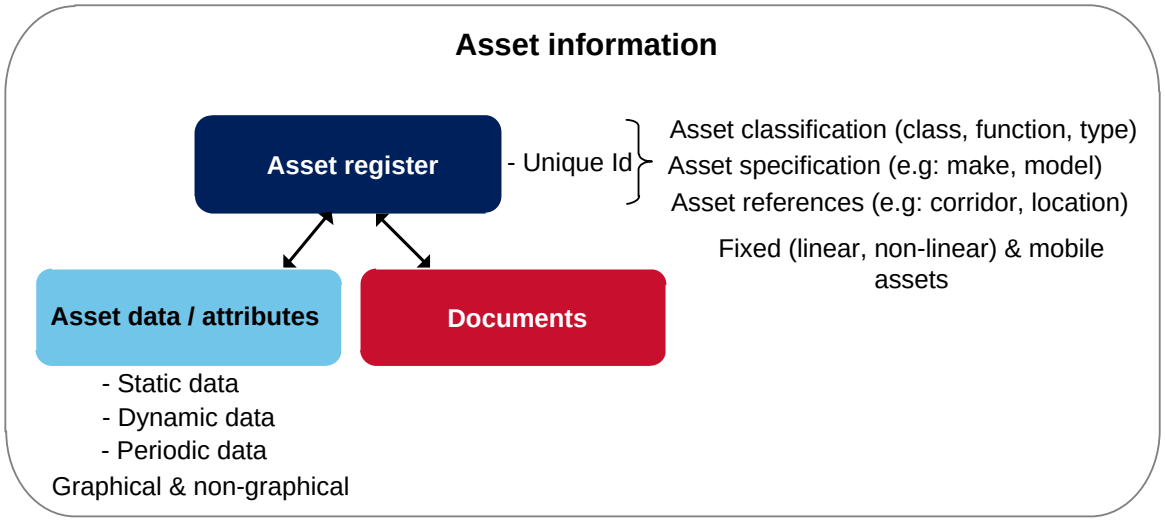


Figure 2 - Asset register link to asset data and documents

Accurate and complete asset information shall support and substantiate key decisions made on the existing asset portfolio to ensure the following:

- maintaining the condition and long term value to ensure delivery of required services by achieving the following:
    - improving effectiveness on investment decisions based on total life cycle costs and taking into consideration the enterprise risk management impact areas such as safety, security and environment
    - improving effectiveness of repair and replace decisions through greater knowledge of asset condition and utilisation
    - enhancing the life of the assets through the optimisation of maintenance plans
- improving the efficiency and sustainability of services and operations by achieving the following:
    - reducing downtime by reducing mean time to repair (MTTR)
    - improving reliability by increasing mean time between failures (MTBF)

Decisions may be based on the asset location, asset condition including age and remaining life of the asset, failure probability and consequence, resource constraints, spares availability, regulatory compliance, business priorities and whole-of-life costs.

Accurate and complete asset information shall also support and substantiate key decisions when analysing and addressing gaps between performance of the existing asset portfolio and the assets that are required to support future service needs. The key areas to be analysed includes the following:

- asset dependability – can service delivery be made less asset dependent?
- asset utilisation – are the assets fully utilised in the delivery of identified services?

- asset location – are the assets properly located to optimise service delivery?
- asset capacity – are the assets able to support a change in service demand?
- asset functionality – are the assets functionally suitable to support optimal service delivery?

The asset information shall also be used to support the following activities:

- plan (design, construct and procure), deliver (test, commission, handover) and maintain (maintain, refurbish, renew) and dispose asset
- comply with relevant asset management standards and legislative requirements
- monitor performance, condition and reliability
- manage asset management accountability
- manage risk

7. Asset register requirements

The asset register integrates associated asset information and provides a historical record of both financial and non-financial information over each asset's life cycle.

The asset register provides a defined and structured inventory of the assets owned, operated and maintained by an entity and shall be used to determine and report on the following:

- the condition and integrity of the assets
- the configuration of the assets
- the location of the assets
- the history of work performed and future planned and forecasted work
- the age, expected life and remaining life of the assets
- when the assets are required to be repaired, replaced or disposed
- maintenance compliance
- maintenance effectiveness including work arising and repeat failures
- the asset maintenance plan and annual works plan including backlog
- the operational consequence (delays) resulting from asset failures
- the reliability and performance of the assets
- the life cycle costs including initial asset capital cost, accumulated maintenance costs, depreciation and disposal costs
- the utilisation (capacity) of the assets
- the operational criticality

Figure 3 illustrates the integration of the asset register and the related asset information required to support and manage the asset management activities over all phases of the life cycle.

Figure 3 - Integrated asset information framework model

7.1. Creation of assets in the asset register

Assets shall be created in the asset register under any of the following conditions:

- to enable scheduling of work, capture of costs and maintenance to be recorded and analysed using work orders associated with an asset
- the asset has a defined maintenance plan
- the asset is operationally critical and to assess condition and performance over the service life
- the asset is of a major value and is also required for financial capitalisation and depreciation requirements
- the asset is required for parent hierarchy grouping purposes
- the asset is rotable, individually serialised and for which service life installation and maintenance history is required
- the asset is required for safety or statutory purposes
- the asset is required for recording statistical and measurement details for operational or maintenance purposes
- the asset is required for configuration control purposes including the management of type approved assets and assets under trial

- the asset requires warranty details to be recorded and managed
- to identify total cost of ownership or life cycle costs of the asset

If an asset does not satisfy any of the above conditions, it does not require an entry in the asset register.

7.2. Unique identification of assets in the asset register

The assets in the asset register shall have a unique identification.

The requirements for an asset identifier are to ensure the information system stores a unique identifier that enables allocation of data and documents against a particular asset located or fitted to a fixed functional 'hole' at a geographic point in the system, against a linear asset or mobile asset. The unique identifier shall contain the following:

- A unique number, usually system generated, that is allocated to the asset for the whole-of-life; this unique number enables searching for and tracking of assets and serves as the primary key to link related asset data, attributes and documents.
- A structured code that provides the primary means to identify the asset uniquely in the operating environment and for maintenance purposes. This may contain references to its location, asset function, kilometrage, site label or serial number to ensure uniqueness.

8. Asset portfolio

Assets owned by TfNSW are grouped into asset classes as defined in Section 8.2 of this document. These asset classes are further subdivided as defined in the asset classification system in Section 9.1 of this document. The asset classes shall be applied within the asset information system to enable unique identification, searching and reporting and shall be coded in accordance with T MU AM 02002 TI *Asset Classification System*.

The TfNSW asset portfolio includes the following assets:

- interchanges
  - stations, stops and wharves
- facilities
  - electrical facilities including substations, sectioning huts, distribution substation and external low voltage supplies
  - rail signalling facilities including signal complexes and enclosures
  - road traffic facilities
  - telecommunications facilities including communications rooms and enclosures
  - technology facilities

  - maintenance facilities
  - logistics facilities
  - service facilities
  - operations facilities including drivers and training facilities
  - rest areas
- corridors
  - heavy rail, light rail, road and waterway
- fleet (including on-board systems)
  - passenger trains
  - light rail vehicles
  - ferries
  - buses
  - vessels
  - track vehicles and machines including recording vehicles
  - locomotives
  - wagons
  - rail cars and vans
  - road vehicles and trailers
- feeders
  - electrical high voltage cable feeders, aerial line feeders and pole equipment
  - telecommunications backbone cables
- plant including mobile plant, fixed plant and minor plant and equipment
- bridges including overbridges, underbridges, footbridges and subways
- drainage and culverts
- tunnels
- earthworks and geotechnology
- buildings
- level crossings
- fencing and barriers
- car parking and taxi ranks

- station, stop and wharf structures including access ramps, stairs, concourses, platforms, canopies/shelters, plinths, jetties, moorings, piers and pontoons
- overhead and support structures including overhead traction supports, gantries and towers
- retaining structures including retaining walls, sea walls and basins
- miscellaneous structures including slipways, dry docks, inspection pits, airspace developments, walkways and cycleways
- track including mainline track, crossovers and sidings, turnouts, buffer stops, trackslabs, lubricators and insulated joints
- roads including access roads
- electrical substations including traction, non-traction substation and distribution equipment
- electrical low voltage distribution
- overhead traction including overhead wiring and equipment
- rail signalling systems including trackside signalling equipment, level crossing protection, automatic train protection (ATP), interlockings, workstations, telemetry, power supply and cables
- road traffic control systems
- rail control systems
- technology and telecommunications systems including road traffic information systems, passenger information systems, road traffic warning systems, passenger security systems, ticketing systems and information technology systems
- technology and telecommunications equipment
    - customer information indicators and clocks, audio and public address
    - security help points and closed circuit television (CCTV)
    - wireless, network and terminal equipment
    - telecommunication licences
    - condition monitoring equipment
    - ticketing equipment
    - hardware
    - software applications and licences
- services including building management, vertical transport (lifts and escalators), fire management, heating, ventilation and air conditioning (HVAC), low voltage electrical and lighting, gas, air, fuel and hydraulic (water, sewer and drainage) systems

- furniture and fixtures including bike lockers, bike racks, seat, bins, boards, screens and amenities
- service routes, underline crossings and pits
- wayfinding and facility signage
- guidance, delineation and corridor signage
- electrolysis and bonding
- land
- landscaping
- aids to navigation
- heritage items

8.1. Asset containers

Asset containers shall be used to create a hierarchical structured representation in the asset register for all assets in the TfNSW asset portfolio.

Fixed infrastructure assets and associated fixed systems shall be contained within the following four major zonal asset classes:

- corridors
- interchanges
- facilities
- feeders

Mobile assets and their associated on-board systems shall be contained within the following fleet asset classes:

- trains
- light rail vehicles
- ferries
- buses
- vessels
- road vehicles and trailers
- locomotives
- wagons
- track vehicles and machines

- rail cars and vans
- mobile plant

These asset container classes shown in Figure 4 enable a structured approach to navigation within an asset register hierarchy. Refer to Section 8.6 for further details on asset structuring and Section 8.7 for examples of how these details are applied on the asset structuring.

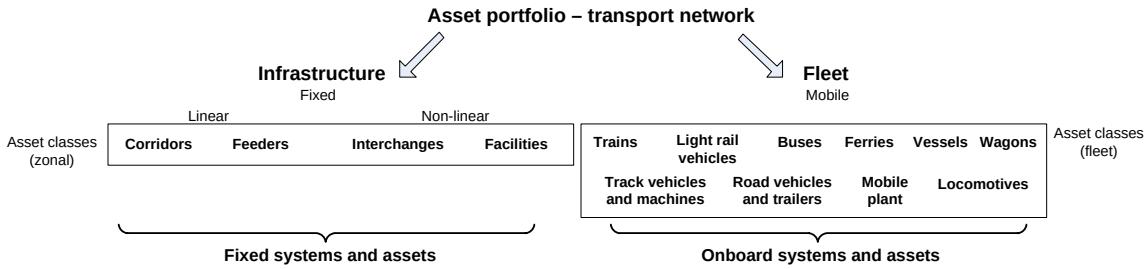


Figure 4 - Asset container classes

8.2. Asset classes

Asset classes exist for fixed infrastructure zonal containers, mobile fleet containers and their associated assets and asset systems, (fixed and on-board) both physical and non-physical.

Asset classes are defined as part of the asset classification system detailed in Section 9.1 and shall be used as a primary means of grouping assets having a similar nature.

Asset classes shall be related to a discipline in accordance with the coding requirements in T MU AM 02002 TI *Asset Classification System*. The asset class shall be recorded for each asset in the asset register.

Fixed infrastructure assets exist within the interchanges, facilities, corridors and feeders. Facilities can exist within a corridor; for example, train station, signal box or electrical substation, or can stand alone; for example, an operations centre, warehouse or training centre. Facilities can also exist within a larger facility. For example, a communications room or building services room can exist within a train station.

Figure 5 illustrates how the asset classes are defined and their relationship with the fixed infrastructure zonal containers and mobile fleet containers.

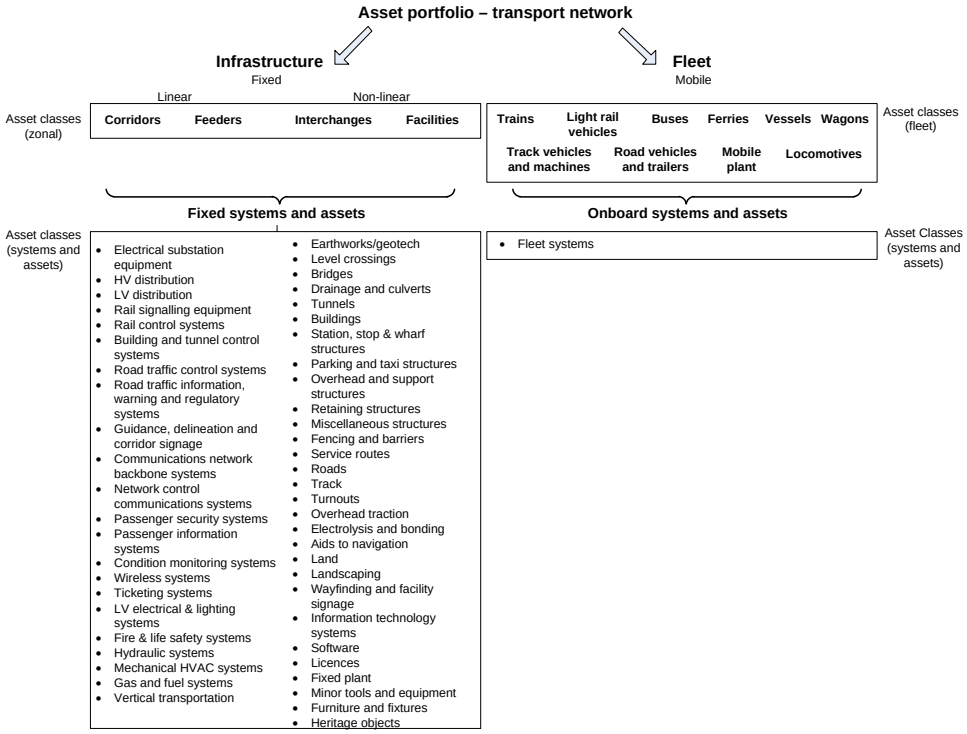


Figure 5 - Asset class relationship with asset containers

8.3. Asset category

The TfNSW transport system comprises infrastructure covering fixed infrastructure and mobile fleet assets. All infrastructure assets in the asset portfolio shall be categorised within the asset register as linear, non-linear or mobile.

Asset categories across the portfolio shall be defined as follows:

- fixed (linear or non-linear) – for infrastructure assets and associated fixed systems contained within a corridor, interchange, feeder or facility
- mobile – for fleet assets and associated on-board systems (including plant and equipment)

8.4. Transport mode and transport form

Transport modes are the means by which people and freight achieve mobility. They fall into three basic types: land (road, rail and active), sea or air.

In TfNSW the following six transport modes apply:

- road
- rail
  - heavy rail
  - light rail
- maritime

- air
- active

All fixed infrastructure and fleet assets shall be associated with one of the transport modes listed. Fleet defines the type of vehicle used to facilitate the movement of people and freight which interact with the fixed network infrastructure to enable the provision of transport services. Fleet operating on the TfNSW network (defined as a transport form) includes trains (including locomotives and wagons), light rail vehicles, ferries, buses, road vehicles and vessels.

Each transport mode shall be identified by a two character code in accordance with T MU AM 01007 TI *Asset Reference Codes Register*.

Each transport form shall be identified by a two character code in accordance with T MU AM 01007 TI *Asset Reference Codes Register*.

8.5. Asset location references

Asset reference codes are used to identify the general geographic and physical location of all assets within the asset register and associated information repositories; for example, document management systems, operational and timetable systems and incident management systems.

Asset reference codes include but are not limited to the following:

- corridor codes (general)
- location codes (general)
- site codes (facility specific)
- base codes (track specific)

To define the location of assets within each asset container, general geographic and physical location references have been defined and shall be used as the primary means of asset location referencing aside from geospatial referencing. Assets may have more than one asset reference allocated to assist in determining the location. For example, non-linear assets within a corridor shall have both a corridor and location reference. Asset reference codes shall be recorded in the asset register and applied in accordance with the requirements defined in T MU AM 01006 ST *Asset Reference Codes* and as listed in T MU AM 01007 TI *Asset Reference Codes Register*.

8.6. Asset register structuring

Asset register structuring provides the framework and a means to logically navigate within an asset register hierarchy. From a TfNSW perspective, all asset register structuring shall be aligned with the asset containers defined in Section 8.1 for both fixed infrastructure and mobile fleet assets.

Detailed asset hierarchy examples for each of the asset containers classes are provided in Section 8.7.

Level 1		Level 2	Level 3-4	Level 5-6	Level 7-8	Level 9-10
Portfolio		**Infrastructure class**	**Infrastructure type and no.**	**Infrastructure asset system and no.**	**Infrastructure asset sub-system and no.**	**Infrastructure asset assembly and no.**
TfNSW	**F**	Corridor	Corridor type/id	Corridor asset/system and id	Corridor sub asset/id	Corridor assembly/id
	F	Interchange	Interchange type/id	Interchange asset/system and id	Interchange sub asset/id	Interchange assembly/id
	F	Facility	Facility type/id	Facility asset/system and id	Facility sub asset/id	Facility assembly/id
	F	Feeder	Feeder type/id	Feeder asset/system and id	Feeder sub asset/id	Feeder assembly/id
		Fleet class	**Fleet type and set no.**	**Fleet sub-type and no.**	**Fleet asset/system and no.**	**Fleet sub asset and no.**
	M	Train	Train set type/id	Train car type/id	Train asset/system and id	Train sub asset/id
	M	Light rail vehicle	Light rail vehicle set type/id	Light rail vechicle car type/id	Light rail vehicle asset/system and id	Light rail vehicle sub asset/id

Key: F Fixed infrastructure container
M Mobile fleet container

Figure 6 - Asset register structuring using asset containers

The examples given in Figure 7 relate to the structuring as defined in Figure 6. The examples provide a guide to the identification, logical navigation and unique structuring at all levels within the asset register hierarchy and cover the following five asset functions:

- rail corridor (right of way)
- train station
- electrical traction substation
- electrical high voltage (HV) feeder
- Tangara train set

Corridor	RWAY-M00	RWAY-M00-TRAK-01	RWAY-M00-TRAK-01-TOUT-01	RWAY-M00-TRAK-01-TOUT-01-PTSM-1
Interchange	STAT-ASH-01	STAT-ASH-01-PLAT-01	STAT-ASH-01-PLAT-01-BINS-01	
Facility	TSUB-ASH-01	TSUB-ASH-01-TRAN-01		
Feeder	FEDR-721	FEDR-721-AERL-01	FEDR-721-AERL-01-POLE-01	FEDR-721-AERL-01-POLE-01-SWIT-1
Train	TSET-T01	TSET-T01-TCAR-1	TSET-T01-TCAR-1-BOGI-1	TSET-T01-TCAR-1-BOGI-1-MOTR-1

Figure 7 - Asset register structuring examples

All maintainable levels within the hierarchy shall contain references to the applicable asset classification and asset specification as follows:

- asset classification (class, function and type) as defined in Section 9.1 and in accordance with the coding requirements in T MU AM 02002 TI
- asset specification as defined in Section 9.1.5 and in accordance with the coding requirements in T MU AM 01008 ST *Technical Maintenance Plans and Coding System* and T MU AM 01009 TI *Technical Maintenance Coding Register*

8.7. Asset hierarchy

An asset hierarchy provides a logical representation of the asset relationship within the asset register. Assets shall be defined at a number of different levels within the hierarchy. The asset hierarchy ensures the following:

- assets can be viewed in a logical way in reference to how they physically relate with other assets
- assets can be grouped in a way that they are managed and maintained
- all assets are covered
- asset specific, parent or zonal examinations are possible
- reporting at different levels

Assets from one asset class may form part of a hierarchy with assets from another asset class.

8.7.1. Corridors

A corridor is a linear zonal area containing heavy rail, light rail, road or maritime infrastructure assets to support the operation of fleet services. A corridor includes the heavy rail corridor, light rail corridor, road or transitway corridor, ferry corridor and includes rail stabling yards.

Figure 8 shows examples of corridors across various transport modes.

Corridors contain fixed infrastructure assets and systems. The types of corridors include the following:

- rail (heavy rail and light rail)
- road (major state, federal and regional roads)
- maritime waterways

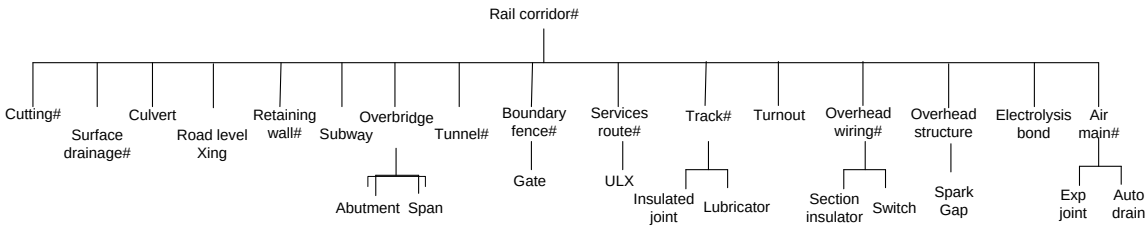
Figure 8 – Examples of corridors and stabling yard across various transport modes

The following infrastructure assets are generally included in the transport corridors and stabling yards:

- bridges including overbridges, underbridges, footbridges and subways
- drainage and culverts
- tunnels

- earthworks and geotechnology
- level crossings
- fencing and barriers
- overhead and support structures including overhead traction supports, gantries and towers
- retaining structures including retaining walls, sea walls and basins
- miscellaneous structures including slipways, dry docks, inspection pits, airspace developments, walkways and cycleways
- track including mainline track, crossovers and sidings, turnouts, buffer stops, trackslabs, lubricators and insulated joints
- roads including access roads
- overhead traction including overhead wiring and equipment
- rail signalling systems equipment including trackside signalling equipment, level crossing protection, ATP, interlockings, workstations, telemetry, power supply and cables
- road traffic control systems
- service routes, underline crossings and pits
- guidance, delineation and corridor signage
- electrolysis and bonding
- property
- landscaping
- aids to navigation

Figure 9 shows an example of a rail corridor asset hierarchy.



Asset structuring:

- Asset hierarchy (zonal area – corridor) – parent (corridor) and related child assets (various asset systems and asset classes)
- Asset classifications at all levels of the hierarchy – asset class, asset function, asset type
- Asset specification – defines build (make and model)
- Asset reference – corridor, location (both physical and spatial), track base code
- Asset category – linear or non-linear together with linear reference – (#) linear start & end km along the corridor
- Transport mode – heavy rail (primary mode)

Note: Electrical substation facilities, signalling and control facilities and communications facilities and associated infrastructure and systems in the corridor/yard are not shown here but can be managed under their own hierarchy. They shall still contain the same asset and linear references to the corridor/yard and Location where applicable.

Figure 9 - Example of a rail corridor asset hierarchy

8.7.2. Interchanges

An interchange is a zonal area containing stations, stops, wharves, taxi ranks and car, bus or cycle parking infrastructure assets to allow the customer to join or transfer between transport modes. An interchange includes at least one of the following:

- train station
- light rail stop
- bus stop
- ferry wharf

An interchange may contain a taxi rank and car, bus or cycle parking facilities.

Figure 10 shows examples of interchanges.

Interchanges contain fixed infrastructure assets and systems. The types of interchanges include the following:

- stations
- stops
- wharves

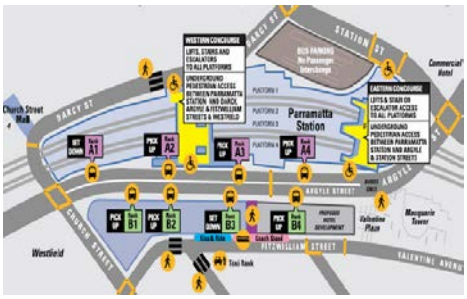


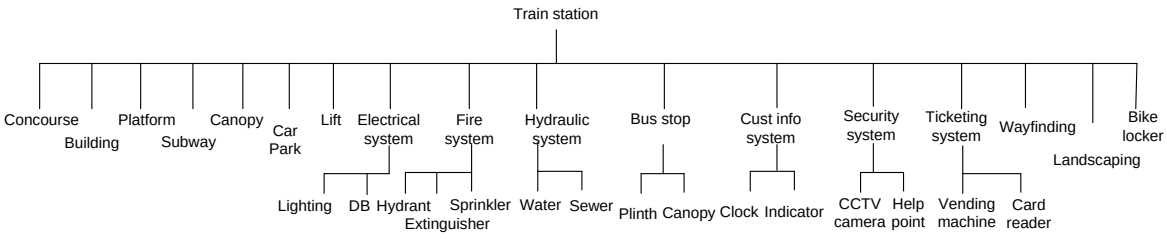
Figure 10 – Examples of various transport interchanges

The following infrastructure assets and systems are generally included in transport interchanges:

- bridges including footbridges and subways
- buildings
- fencing and barriers
- car parking and taxi ranks
- station, stop and wharf structures including access ramps, stairs, concourses, platforms, canopies or shelters, plinths, jetties, moorings, piers and pontoons
- overhead and support structures including towers
- retaining structures including retaining walls

- miscellaneous structures including walkways
- technology and telecommunications systems including passenger information systems, passenger security systems and ticketing systems
- technology and telecommunications equipment
  - customer information indicators and clocks, audio and public address
  - security help points and CCTV
  - wireless, network and terminal equipment
  - telecommunication licences
  - condition monitoring equipment
  - ticketing equipment
  - hardware
  - software applications and licences
- services including building management, vertical transport (lifts and escalators), fire management, HVAC, low voltage electrical and lighting, gas, air, fuel and hydraulic (water, sewer and drainage) systems
- furniture and fixtures including bike lockers, bike racks, seat, bins, boards, screens and amenities
- wayfinding and facility signage
- landscaping
- heritage items

Figure 11 shows an example of a train station interchange asset hierarchy.



Asset structuring:

- Asset hierarchy (zonal area – interchange) – parent (interchange) and related child assets (various asset systems and asset classes)
- Asset classifications at all levels of the hierarchy – asset class, asset function, asset type
- Asset specification – defines build (make and model)
- Asset reference – corridor, location (both physical and spatial)
- Asset category – linear or non-linear together with linear reference – (#) linear start and end km along the corridor
- Transport mode – heavy rail (primary mode) for train station including the bus stop that services the train station

Note: Additional transport interchange assets may exist within the same precinct as the primary interchange such as taxi tank, bike locker. These assets shall be associated with the primary modal interchange.

Figure 11 - Example of a train station asset hierarchy

8.7.3. Facilities

A facility is a zonal area (within a precinct boundary) that contains buildings, systems, plant and associated infrastructure assets to support the operation and maintenance of transport services including the home depots of mobile fleet assets. The types of facilities include the following:

- rest area facilities
    - rest area locations
    - load checking area locations
- electrical facilities
    - substations (traction, non-traction and distribution)
    - sectioning huts
    - electrical backup supply locations
- signalling, control and traffic facilities
    - rail signal complexes and signal locations
    - rail control system locations
    - road traffic control locations
- telecommunications facilities
    - communications, passenger security and passenger information locations
    - road traffic information, warning, compliance and regulatory locations
    - condition monitoring locations
- service facilities
    - services control locations – buildings and tunnels
    - services plant locations - water and sewerage treatment plants
- maintenance facilities
    - maintenance depots (fleet) – servicing and presentation
    - maintenance depots (infrastructure)
    - workshops
- logistics facilities
    - warehouses
    - fabrication centres
    - quarries

- operations facilities
    - operations control centres
    - drivers and guards facilities
    - training centres
    - office complexes

Figure 12 shows examples of service facilities (electrical, signalling and communications), maintenance facilities and operations facilities.

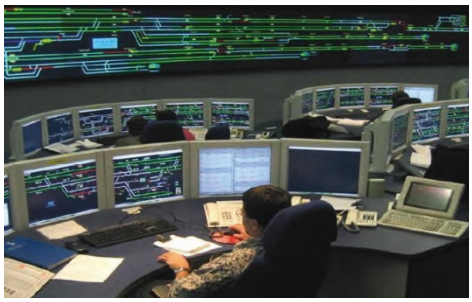


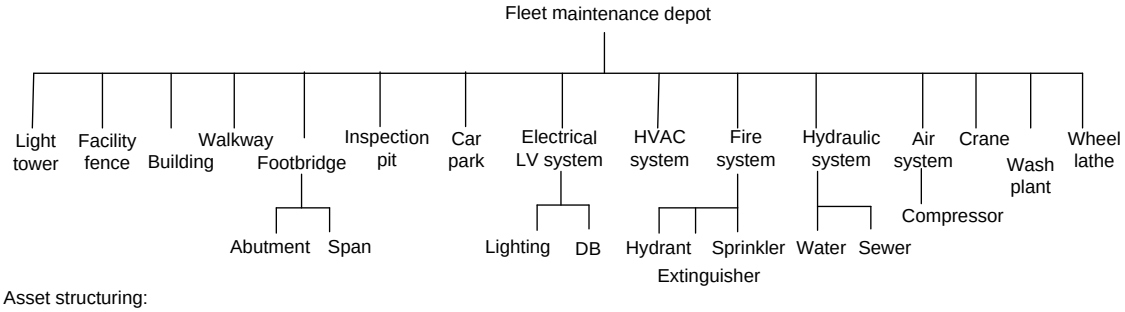
Figure 12 – Examples of facilities

The following infrastructure assets and systems are generally included in transport facilities:

- plant including mobile plant, fixed plant and minor plant and equipment
- buildings
- fencing and barriers
- car parking and taxi ranks
- retaining structures including retaining walls, sea walls and basins
- miscellaneous structures including slipways, dry docks, inspection pits, walkways and cycleways
- roads including access roads
- electrical substations including traction, non-traction substation and distribution equipment
- electrical low voltage distribution
- rail signalling and control equipment including trackside signalling equipment, level crossing protection, ATP, interlockings, workstations, telemetry, power supply and cables
- road traffic control systems
- rail control systems

- technology and telecommunications systems including road traffic information systems, passenger information systems, road traffic warning systems, passenger security systems and ticketing systems
- technology and telecommunications equipment
    - customer information indicators and clocks, audio and public address
    - security help points and CCTV
    - wireless, network and terminal equipment
    - telecommunication licences
    - condition monitoring equipment
    - ticketing equipment
    - hardware
    - software applications and licences
- services including building management, vertical transport (lifts and escalators), fire management, HVAC, low voltage electrical and lighting, gas, air, fuel and hydraulic (water, sewer and drainage) systems
- furniture and fixtures including bike lockers, bike racks, seats, bins, boards, screens and amenities
- landscaping
- heritage items

Figure 13 shows an example of a fleet maintenance depot facility asset hierarchy.



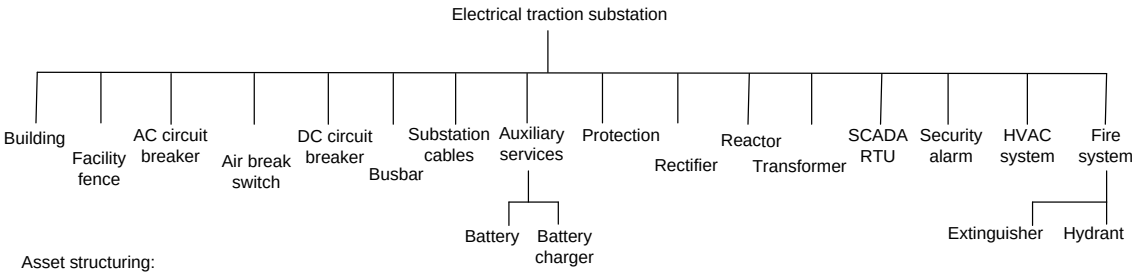
Asset structuring:

- Asset hierarchy (zonal area – facility) – parent (facility) and related child assets (various asset systems and asset classes)
- Asset classifications at all levels of the hierarchy – asset class, asset function, asset type
- Asset specification – defines build (make and model)
- Asset reference – corridor, location (both physical and spatial), track base code
- Asset category – linear or non-linear together with linear reference – (#) linear start and end km along the corridor
- Transport mode – heavy rail (primary mode)

Note: Track, electrical substation facilities, overhead traction, HV & LV feeders, signalling and control facilities and communications facilities and associated infrastructure and systems in the corridor/yard that services the fleet maintenance depot are not shown as they shall be managed under their own hierarchy. They shall still contain the same asset and linear references to the corridor/yard and location where applicable.

Figure 13 - Example of a fleet maintenance depot facility asset hierarchy

Figure 14 shows an example of an electrical traction substation facility asset hierarchy.



Asset structuring:

- Asset hierarchy (zonal area – facility) – parent (facility) and related child assets (various asset systems and asset classes)
- Asset classifications at all levels of the hierarchy – asset class, asset function, asset type
- Asset specification – defines build (make and model)
- Asset reference – corridor, location (both physical and spatial), track base code
- Asset category – linear or non-linear together with linear reference – (#) linear start and end km along the corridor
- Transport mode – heavy rail (primary mode)

Note: Electrical distribution substations exist off aerial or cable feeders. Feeders are not shown here but shall be defined under the feeder container. Each electrical distribution substation shall be defined as its own facility.

Figure 14 - Example of an electrical traction substation facility asset hierarchy

8.7.4. Feeders

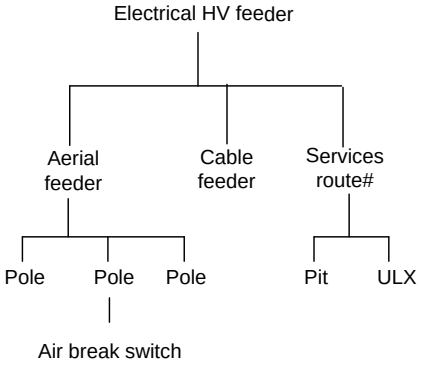
Feeders contain fixed infrastructure assets. The types of feeders include the following:

- high voltage feeders (heavy rail)
- communication feeders

Each feeder shall include the following infrastructure assets where applicable:

- cable feeders, aerial line feeders and pole equipment
- service routes, underline crossings and pits

Figure 15 shows an example of an electrical HV feeder asset hierarchy.



Asset structuring:

- Asset hierarchy (zonal area – facility) – parent (facility) and related child assets (various asset systems and asset classes)
- Asset classifications at all levels of the hierarchy – asset class, asset function, asset type
- Asset specification – defines build (make and model)
- Asset reference – corridor, location (both physical and spatial)
- Asset category – linear or non-linear together with linear reference – (#) linear start and end km along the corridor
- Transport mode – heavy rail (primary mode)

Figure 15 - Example of an electrical HV feeder asset hierarchy

8.7.5. Fleet

Fleet assets includes passenger trains, light rail vehicles, ferries, vessels, buses, track vehicles and machines, locomotives, wagons, recording vehicles, mobile plant, road vehicles and trailers.

Each fleet asset contains on-board fleet systems. Figure 16 shows examples of fleet types including mobile plant.

Figure 16 - Examples of fleet

Plant assets cover the following three classes:

- mobile plant
- fixed plant
- minor tools and equipment

Mobile plant is covered under fleet whereas fixed plant and minor tools and equipment are associated with assets contained within a facility as explained in Section 8.7.3.

Fleet includes but is not limited to the following on-board systems, subsystems and assemblies:

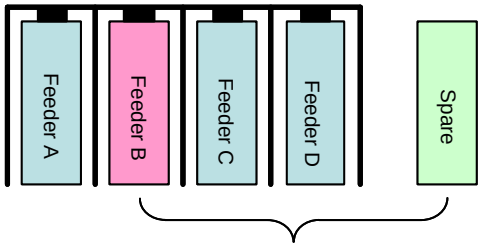
- body and hull system
- chassis system
- bogie system
- door system
- traction system
- main and auxiliary power system
- transmission system
- navigation system
- steering system
- engine and drive system
- electrical system
- lighting system

- pneumatic system
- air conditioning system
- braking system
- communications system
- customer information system
- control and monitoring system
- ticketing system
- catering equipment system

8.8. Rotable assets and tracking

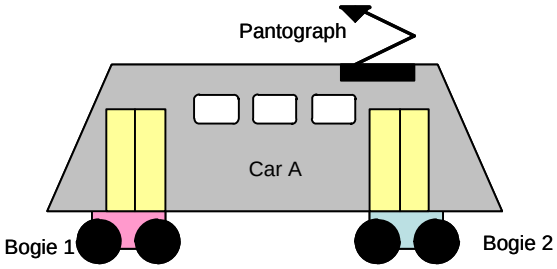
Rotable assets are assets or assemblies that are fitted or removed from an asset and refitted to the same or other similar asset such as a train bogie, traction motor and high voltage withdrawable circuit breaker. Rotable assets shall be managed by tracking their serial numbers in the asset register.

Figure 17 shows an example of a rotable asset and its tracking.



The HV circuit breaker servicing feeder B shall be rotated with the spare for maintenance, failure repair of operational requirements.

HV Circuit Breakers have unique serial numbers and need to be tracked over their useful life.



The bogie servicing position 1 on rollingstock car A shall be rotated with a spare for failure repair or refurbishment requirements.

Bogies have unique serial numbers and need to be tracked over their useful life.

Note: In this example the bogie itself is an assembly comprised of wheels, axles and traction motors. These sub assemblies may also be fitted / removed separately to the bogie itself and shall also be tracked.

Figure 17 - Example of rotable assets and tracking

Assets or assemblies may be moved throughout their useful life due to the following reasons:

- maintenance examination – rotate interchangeable asset or assembly with a spare for temporary maintenance purposes and to keep system operational (maintained asset or assembly shall be moved back into operation while spare is placed back into the spares location)
- failure repair – rotate interchangeable failed asset or assembly with a spare to replace the failed item (failed asset or assembly shall be sent for repairs if it is a repairable item or disposed if it is not economically viable)
- refurbishment – rotate interchangeable degraded asset or assembly (based on condition or age) with a spare to replace the degraded item (degraded item shall then be sent for refurbishment if it has a remaining useful life or disposed if it is not economically viable)
- operational duty – rotate interchangeable asset or assembly with a spare to support operational requirements and to ensure even usage distribution

The asset register shall reflect the current configuration and status of all fitted assets and assemblies and the location and status of removed assets and assemblies.

8.9. Asset capitalisation and the fixed asset register

NSW Treasury requires TfNSW to value its assets at 'fair value'.

In the context of this document 'fair value' for new assets is based on the cost of construction of the completed asset and will applies to any expense with a value greater than $5000 (excluding land and network assets which have no capitalisation threshold), with an economic benefit exceeding 12 months and when it is considered a fixed asset in accordance with accounting standards.

These assets shall be included in the fixed asset register. This requirement is to ensure that the asset value is written off over its economic life.

Assets in the fixed asset register shall be aligned to the assets in the asset register for maintainable assets when capitalised as a direct acquisition cost or by the aggregation of costs of the children assets rolled up to a parent asset level; for example, electrical substations and signal locations where the internal infrastructure asset costs are rolled up to the parent facility and capitalised at this level.

Asset classes used for maintainable assets as defined in Section 8.2 shall be related to one fixed asset class. The fixed asset classes are as follows:

- land
- buildings (leased or owned)
- infrastructure

- plant and equipment (leased or owned)
- fleet (leased or owned)
- intangibles

The relationship between maintainable asset classes and fixed asset classes is detailed in T MU AM 02002 TI.

8.10. Linear and non-linear assets and attributes

Assets shall be categorised as being linear, non-linear or mobile in accordance with Section 8.3.

A linear asset shall describe an asset with a defined start kilometrage and end kilometrage or distance reference. Linear assets include track, road pavement, tunnels, platforms, fencing, retaining walls and overhead wiring. Linear asset attributes, including physical and functional configuration characteristics and maintenance information, shall also be defined with start reference and end reference relative to the linear asset.

A linear asset can also have attributes or features and maintenance information along its length defined at a single point reference; for example, kilometrage along the asset such as weld, joint or sign.

Figure 18 provides an example of the linear data attributes for track.

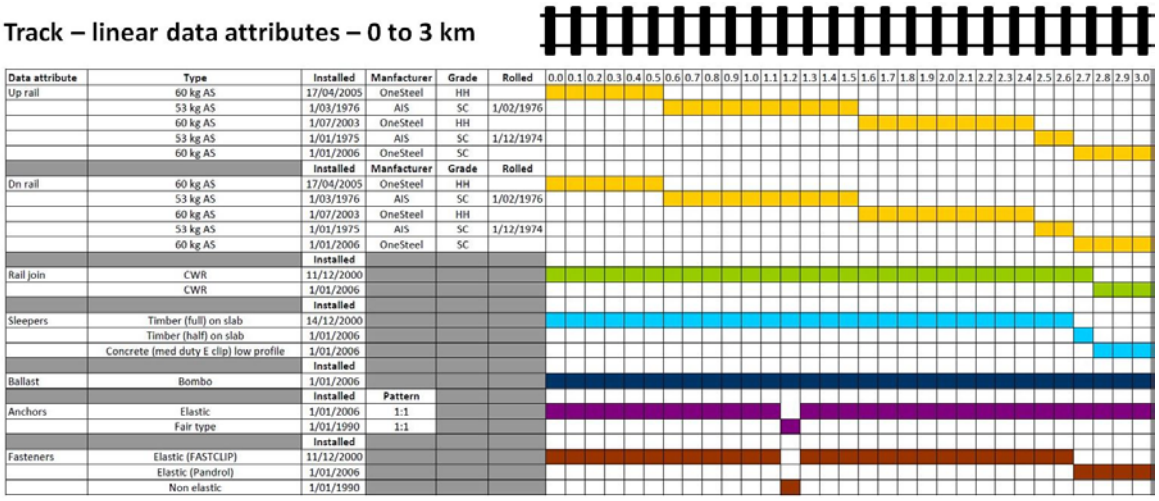


Figure 18 - Example of linear configuration data attributes for track

A linear asset shall also describe any asset having the same start kilometrage and end kilometrage or distance reference. These assets include turnouts, bridges, level crossings, signals and trainstops.

Non-linear assets have no kilometrage or distance reference and these assets include transformers, buildings, lifts and plant associated with facilities. Non-linear asset attributes, including physical and functional configuration characteristics and maintenance information, shall also be defined relative to each non-linear asset.

9. Asset classification system framework

The asset classification system establishes a consistent definition, structure and categorisation of assets across the asset portfolio for the following purposes:

- ensuring common terminology of assets and asset structuring within the asset register
- establishing a base for metadata standards
- supporting easy exchange or integration of asset information including asset registers, asset attributes and documentation
- establishing a base for structuring maintenance and renewal planning activities
- establishing a base for financial valuation and capitalisation activities
- supporting collaboration and building up of required asset information for asset handover and acceptance
- defining the level of asset information required to be captured and managed to support and substantiate decisions made over the asset life cycle
- supporting the development of a functional architecture model
- ensuring management of configuration change and risk
- enabling standardised and consolidated reporting
- enabling whole of portfolio investment decision making

9.1. Asset classification system

Each asset shall be defined according to the asset classification system. The applicable asset classification codes applied shall be in accordance with T MU AM 02002 TI.

The asset classification system is comprised of the following six levels:

- level 1 - asset discipline
- level 2 - asset class
- level 3 - asset function
- level 4 - asset type, defines the level at which different types of equipment essentially provide the same function
- level 5 – component, which is linked to the asset type (but derived from the asset specification – used to define the asset make and model or construction)
- level 6 - sub component, which is linked to the component

Figure 19 illustrates the asset classification system levels.

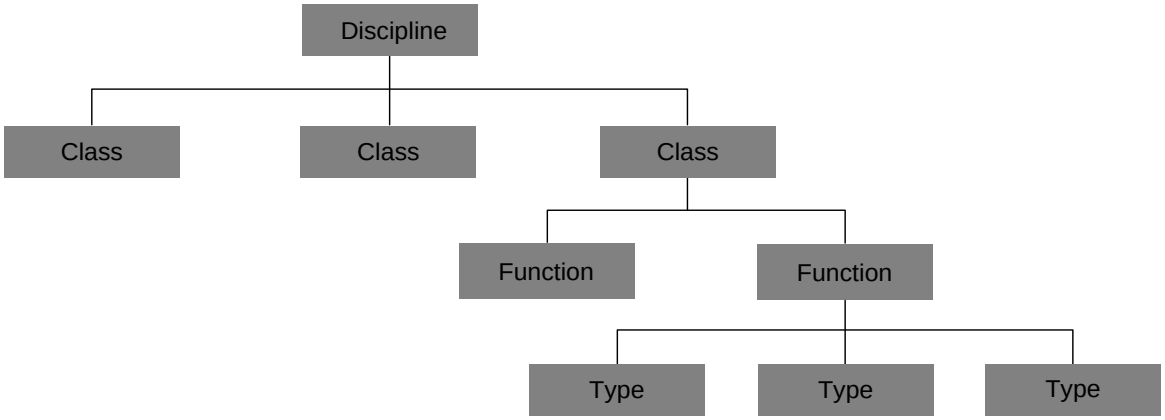


Figure 19 - Asset classification system level 1 – level 4

9.1.1. Asset discipline

The asset discipline represents a grouping of related asset classes; for example, civil and structures.

9.1.2. Asset class

The asset class shall be used to group one or more asset functions into a logical group. The asset class shall be a separate identifier in the asset register.

The asset class shall be the primary grouping of similar assets related to the asset discipline; for example, bridges.

Asset class shall define the grouping of asset functions.

9.1.3. Asset function

An asset function shall be associated with an asset class; for example, overbridges.

The asset function shall be used to group one or more asset types that perform the same function. The asset function shall be a separate identifier in the asset register. An asset function shall be associated with one asset class.

Asset function shall define the following:

- grouping of asset types
- non-graphical data attributes required to be captured and managed, including the physical data, functional data, operational data, organisational data and the asset condition
- standard for the associated data attributes, including the name, type, format, unit of measure, accuracy and value range (minimum and maximum)

9.1.4. Asset type

Asset types consist of groups of assets that have common characteristics which distinguish them from those assets that perform the same asset function.

Asset types shall not include differences in material construction or manufacturer. An asset type shall have unique characteristics that distinguish them from other asset types within an asset function. This detail shall be defined by the asset specification also known as the technical maintenance code (TMC) and contained in the relevant asset attribute metadata.

9.1.5. Asset specification

The asset specification is associated with an asset type or function.

The asset specification shall define the following:

- maintenance strategy to be applied including the technical maintenance plan (TMP) (different asset specifications for the same asset type within the same function may adopt the same TMP)
- component parts required to support defect identification and management (component and sub-components are not directly associated to each asset type but are linked via the asset specification that defines a common parts list for assets of that asset type)
- warranty to be applied
- materials list (inventory) required for service, maintenance and repairs

9.1.6. Components and sub-components

Component parts shall be related to the asset type, which defines the build of the asset. Sub-component parts are related to the component. The sub component may be used as a positional reference; for example, left, right, top, middle, bottom and number 1.

Components and sub components can vary across the different asset types; for example, different signal asset types can have different component builds.

Figure 20 shows an example of an asset classification system for a track asset.

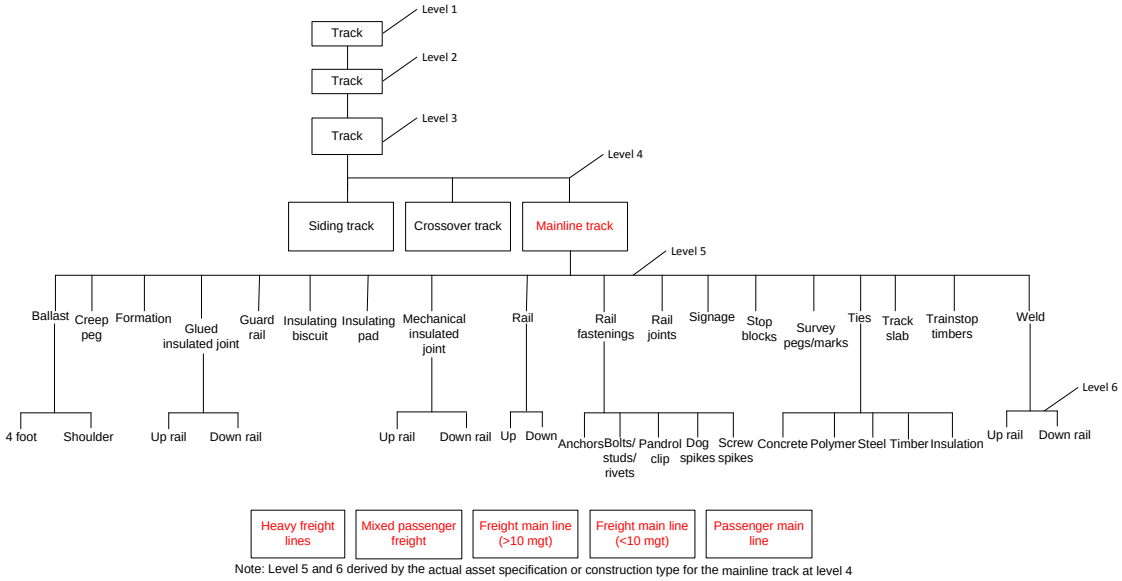


Figure 20 - Example of asset classification system for a track asset

Figure 21 shows an example of an asset classification system for a signal asset.

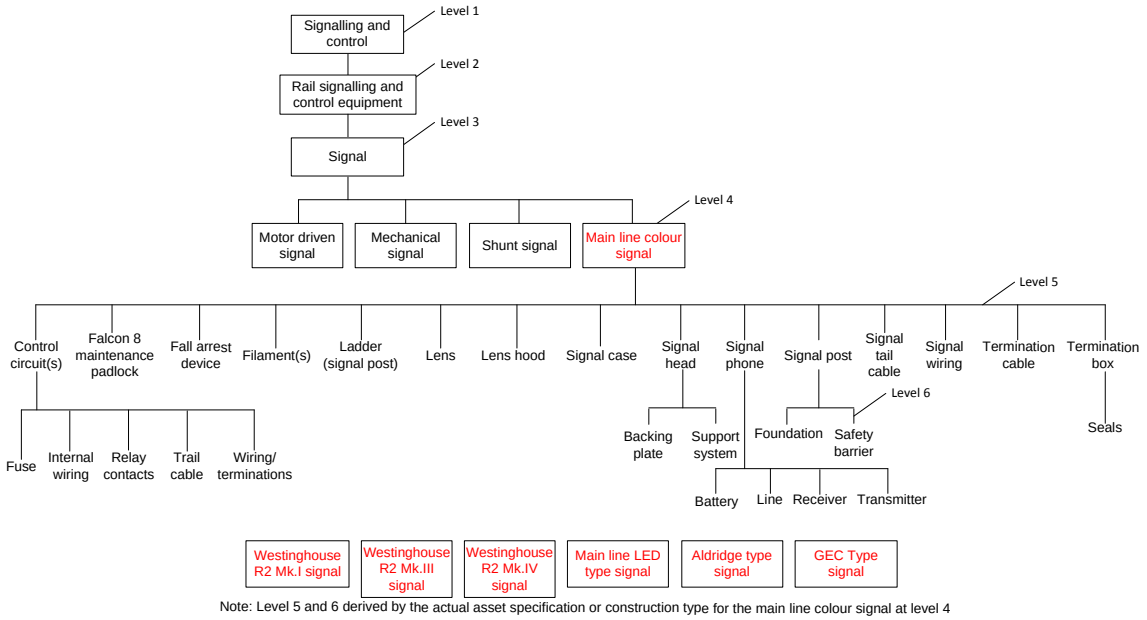


Figure 21 - Example of asset classification system for a signal asset

Figure 22 shows an example of an asset classification system for an electric substation asset.

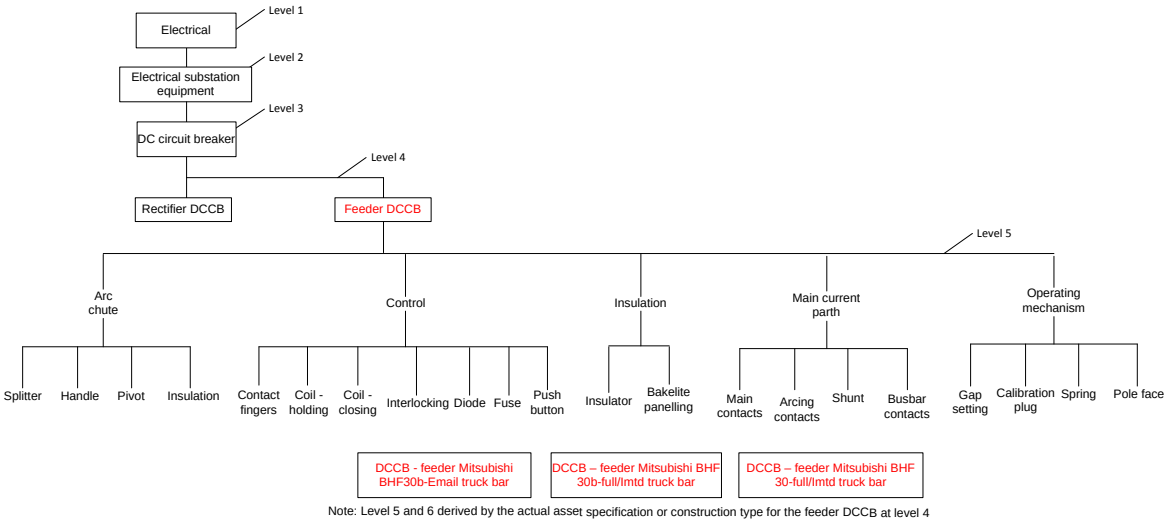


Figure 22 - Example of asset classification system for an electric substation asset

9.2. Asset information model

All assets shall be classified and contain a reference to an asset class, asset function and asset type.

Each asset in the asset register shall have an asset class, asset function and asset type reference assigned in accordance with T MU AM 02002 TI.

Each asset in the asset register shall have an asset specification (construction type) assigned in accordance with T MU AM 01008 ST and as listed in T MU AM 01009 TI.

The asset shall inherit the properties listed to its function, type and specification.

Documents and graphical data, including position and spatial data, shall be referenced directly to the asset in the asset register.

Figure 23 illustrates the information associated with the asset in the asset register in relation to its classification and specification.

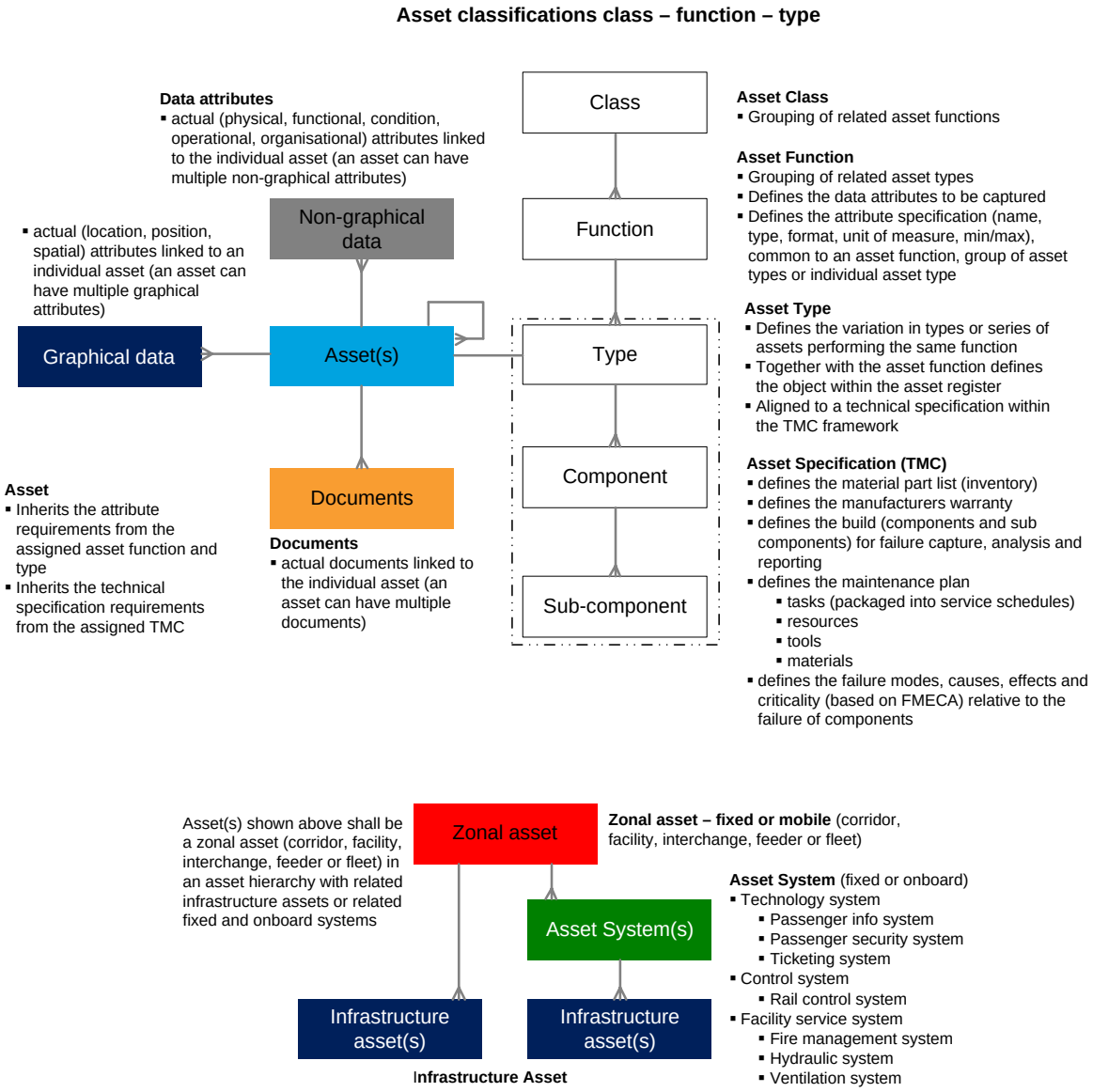


Figure 23 - Asset information model linked to the asset classification and specification

10. Asset information requirements

Asset information shall be derived from all stages of the asset life cycle. Figure 24 illustrates the asset life cycle stages.

Figure 24 - Asset life cycle stages

A formal approach to the governance of the asset information shall be required to ensure the information is current, accurate and complete to support and substantiate asset decisions to meet TfNSW objectives.

10.1. Asset data

Asset data and attributes associated with assets contained in an asset register is categorised into the following data groups:

- configuration – includes physical and functional data related to identifying and providing static referencing of manufacturer details, asset construction, asset procurement, technical characteristics and physical relationship with other assets
- location – includes data related to physical and geospatial attributes; for example, information on environmental and spatial relationship with other assets
- condition – includes data related to past and current condition such as information on residual life
- operational – includes data related to usage, tonnage, restrictions and criticality
- maintenance – includes data related to the management and recording of maintenance activities
- organisational – includes data related to responsibilities of the owner, operator and maintainer
- financial – includes data related to costing from capital acquisition, operation, maintenance to disposal

Asset data and attributes can be of a graphical or non-graphical nature and classified as follows:

- static data – requires a one-off capture and validation, infrequent update required
- periodic data – requires a regular collection and updating regime, periodic update required
- dynamic data – requires continuous updating in real or near real time

Asset data and attribute requirements shall support linear, non-linear and mobile assets.

10.2. Asset documents

Asset documents associated with assets contained in an asset register include manuals, plans, photos, drawings, models, certificates, licences and schematics.

All CAD drawings and models shall be defined and submitted in accordance with the requirements of T MU MD 00006 ST *Engineering Drawings and CAD Requirements* inclusive of required metadata.

10.3. Data quality

Asset data shall be continually assessed to ensure that the quality of data is maintained by the operator and maintainer and complies with the requirements defined in Section 13 of this

document together with targeted surveillance audits. The data quality shall be determined by the following categories:

- completeness – data shall be complete
- correctness – data shall be accurate and up to date
- consistency – data shall be defined including business rules and format
- clarity – data shall be clear and unambiguous
- integrity – data shall be structured and relationships maintained with other data repositories
- uniqueness – no duplication of the data shall exist

10.4. Pre-commissioning asset information and handover

The asset information system shall include asset specific pre-commissioning information for all assets.

As part of the asset handover during the asset acceptance phase, the asset information requirements detailed in this section shall be provided and updated within the asset information system as part of the existing staged commissioning and operational readiness project gates.

This is required for both new assets (investment) and for the renewal or refurbishment (sustainability) of existing assets as shown in Figure 25.

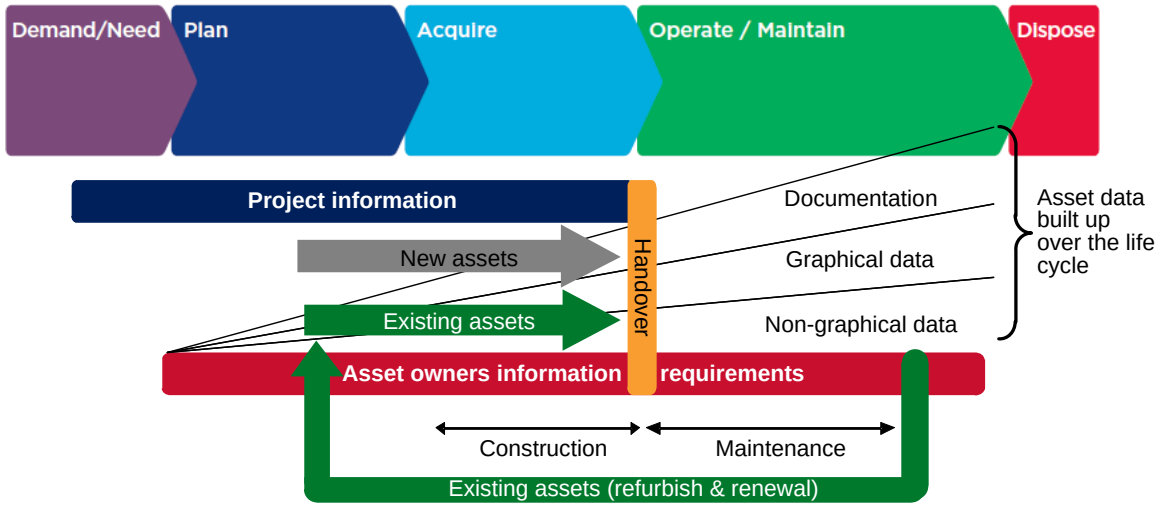


Figure 25 - Asset data built up across the life cycle including transition at handover

The following asset information requirements shall be captured and managed during the plan and acquire stages:

Plan

- documents
    - reports – requirements specification, feasibility, environmental, geotechnical reliability, availability, maintainability and safety (RAMS), system safety assurance plan and hazard log

Acquire

- configuration data
    - asset register identifier; a unique identification, serial number, label and description, and classifications of class, function and type
    - construction or build – manufacturer make and model – name plate details including configuration attributes both linear and non-linear. These are also applicable for type-approved assets and assets under trial
    - asset status (planned)
    - age – date commissioned and design life
    - design information – ratings, loadings, areas and lengths
    - supplier or vendor data
    - failure modes, effect and criticality (FMECA)
    - test and commissioning results
    - warranty data
    - survey data
    - heritage data
    - spare parts inventory
- location data
    - asset location including physical geographic and geospatial referencing data for fixed infrastructure assets, or home depot location for mobile fleet and plant assets
    - environmental data
- organisational data
    - asset ownership
    - asset maintainer including demarcation and interfaces
    - asset operator
    - third party agreements

  - land ownership, deeds and agreements
- operational data
  - asset criticality and assessment criteria (design)
  - operational settings such as circuit breaker trip setting
  - hazards – confined space and restrictions
  - risk level
  - energy usage
  - special requirements to operate and maintain
- financial data
  - capital acquisition cost – linked to financial fixed asset register for depreciation purposes
  - whole-of-life costs to operate and maintain
- documents
  - maintenance standards and TMPs (including maintenance service schedules)
  - maintenance manuals
  - operating manuals
  - drawings – concept, approved for construction (AFC) and as built drawings, schematics, plans and cad files, and models
  - regulatory – licensing and special conditions
  - certificates and compliance – in accordance with the *Disability Discrimination Act 1992*, *Building Code of Australia* , design certificates, construction and commissioning certificates
  - reports – design assumptions and calculations, inspection and test reports, commissioning reports and safety assurance reports
  - concessions provided to design and construction standards

Residual defects and risks remaining at handover shall be transferred to the operator and maintainer and managed within the asset information system.

10.5. Exchange of asset information at handover

The exchange of validated and assured data and documents shall be electronic and implemented through an agreed exchange process determined by TfNSW. This shall be managed between the information provider or project deliverer and the organisation responsible for maintaining the asset information on behalf of TfNSW.

The content of the information exchange shall be sufficient to meet the requirements of this standard. The time and delivery shall be in accordance with T MU AM 01005 ST *Asset Handover Requirements* and supported by T MU AM 02001 GU *Development of Configuration Information Delivery Plans*.

The frequency and scope of each information exchange shall be defined as part of the asset handover requirements and staged to align with the requirements of the operator and maintainer to meet operational readiness.

The format of data and documents shall support the requirements of the asset information system repository that contains the asset information such as a database, a register or plan room. The data shall be provided and validated in accordance with any existing data collection templates where applicable. A list of known asset information system repositories and associated data collection templates are provided in T MU AM 02003 TI *Register of Asset Information Systems and Repositories*.

The information provider or project deliverer shall ensure that the data quality is in accordance with the requirements defined in Section 10.3.

The organisation responsible for maintaining the asset information on behalf of TfNSW shall provide feedback to the information provider or project deliverer for any data quality issues or shortfalls. The organisation shall process or upload the data and documents provided at handover in accordance with the requirements defined in Section 13.

10.6. Post-commissioning asset information

The asset information system shall include asset specific post-commissioning information for all assets. Asset information shall be continually collected across the whole-of-life cycle including operation, maintenance and disposal as indicated in Figure 26.

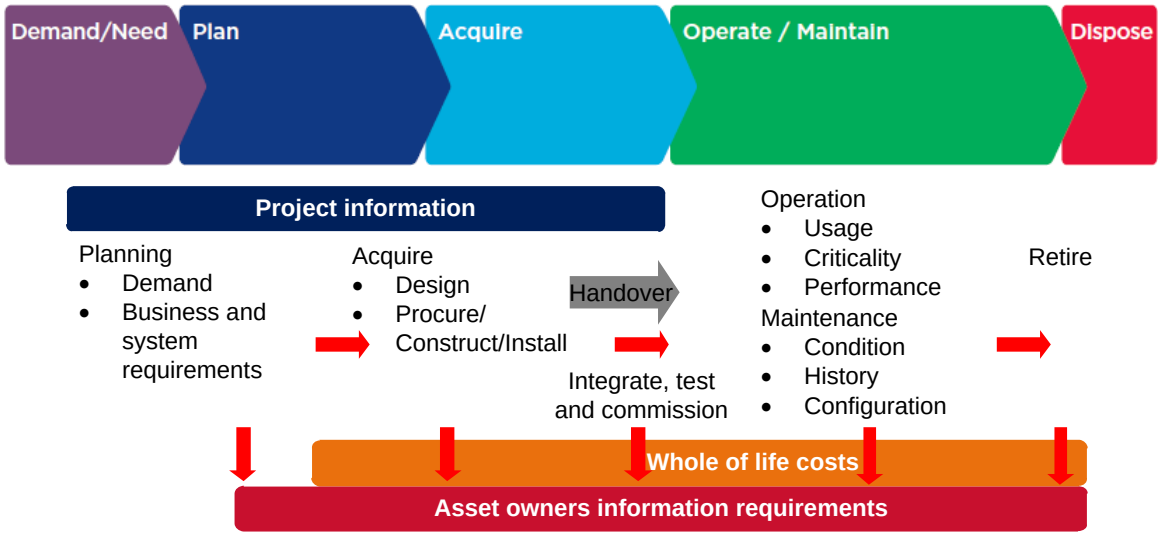


Figure 26 - Asset data drops across the life cycle

The following asset information requirements shall be captured and managed during the operate and maintain stage:

Operate and maintain

- configuration data
    - asset status (subject to change over the operational service life)
- condition data
    - asset condition and assessment criteria (subject to deterioration over the operational service life)
    - age – remaining life (reassessed based on design life, condition and utilisation of the asset)
- operational data
    - asset criticality and assessment criteria (subject to change over the operational service life)
    - asset utilisation and capacity including performance requirements – tonnage or volume, time in service, hours operated, number of operations
- maintenance data
    - maintenance activities data - preventive, corrective, breakdown and renewal including supporting activities, operational; for example, switching and standby, and event triggered - heat patrol and feeder trip
        - preventive service schedules including method of scheduling (time/frequency, usage or condition), criticality and latitude defined as part of the technical maintenance plan and generated as work orders
        - work orders created for every maintenance activity associated with the lowest asset in the hierarchy or rotable asset
        - defects (service request or notification) created for every conditional and functional failure associated with the lowest asset in the hierarchy or rotable asset - failure mode, operational consequence (including service delays), failure type both conditional and functional, defective part or part causing failure, root cause and action taken
        - work breakdown structures
        - unit rate estimates per activity
        - duration per activity
        - measurements, adjustments and calibration records captured in accordance with required maintenance activities

        - materials used
    - failure or incident management data (to support MTBF and MTTR)
        - time failed, time attended, time rectified and time in service
        - link defect and asset with the associated failure or incident
    - spares management data
        - spares including type, location, interchangeability and minimum stock levels
- financial data
    - maintenance costs – labour, material, plants and equipment and contract (by activity per asset captured on the work order)
    - capital value – changes to financial fixed asset register in relation to depreciation method, depreciation and revaluation
- documents
    - photos (asset configuration and condition)
    - reports – investigation (failure or incident, reliability and condition)
    - concessions provided to maintenance standards

10.7. Disposal asset information

The asset information system shall include the following asset specific decommissioning information for all assets:

- maintenance data
    - maintenance disposal activities
    - work orders for every maintenance activity
- financial data
    - disposal costs – including costs for labour, material, plant and equipment, and contract by activity per asset captured on the work order
    - residual capital value of the asset to be written off

The remaining capital cost shall be written off in the financial fixed asset register.

10.8. Supporting asset information

The asset information system shall contain the following information to support the asset over the life cycle:

- training materials
- competency and certification of staff
- tools and equipment
- asset maintenance plans, replacement or refurbishment plans

10.9. Asset data reference library

Asset data shall be collected and managed across the life cycle as defined in Section 10.4 and Section 10.6. The asset data reference libraries shall be used and consistently applied by all TfNSW cluster agencies and private operators and maintainers within their asset information systems and associated with assets contained within the asset register.

The asset data reference libraries include the following:

- asset classifications (refer to T MU AM 02002 TI)
- asset specifications or construction type (refer to T MU AM 01009 TI)

For all other key configuration asset data, the following metadata value lists shall be used and applied in accordance with T MU AM 01006 ST and as listed in T MU AM 01007 TI.

- asset locations or sites
- asset corridors
- asset base codes (track)
- asset status (life cycle)
- asset condition
- asset criticality
- asset work order and maintenance activity types
- asset work order priorities including maintenance service schedule classification
- asset owners, operators, maintainers

11. Events triggering changes to asset information

Across the asset life cycle various events can occur that trigger the requirement to update the relevant asset information. These events can result from changes in asset strategy, service

strategy, new asset type, maintenance strategy including maintenance requirements and asset configuration. Figure 27 illustrates some events that trigger updates to asset information.

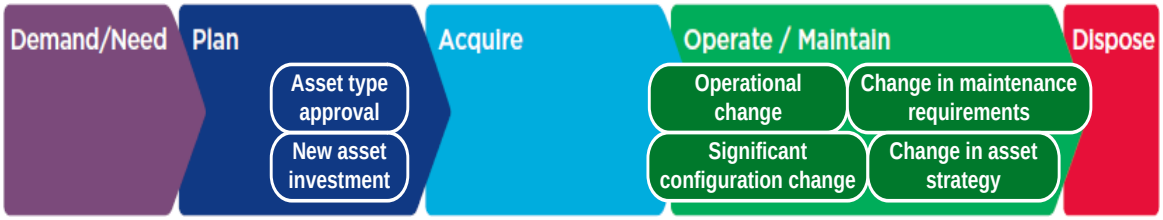


Figure 27 - Events that trigger updates to the asset information across the life cycle

The following list provides examples of events which occur over the life cycle that trigger the need for the asset information to be updated:

- introduction of new assets, whether it is an existing asset type or new asset type, including asset trials
- asset relocation including rotable movement
- asset decommissioning and disposal
- minor maintenance – preventive, corrective, breakdown including inspection, testing and calibration including component change
- major maintenance – refurbishment (component change out), upgrade (new asset type) or replacement (existing like for like asset)
- asset revaluation
- change in assessed risk level
- change in asset ownership, asset operator or asset maintainer (demarcation of responsibility)
- concession to a standard
- change in operation (timetable and usage) and asset criticality
- change in regulations and standards

These events may require additional asset key configuration data to be added to the standard library in accordance with the requirements stated in Section 10.9 and associated standards and registers.

The financial fixed asset register may need to be updated to reflect the change in asset value.

12. Asset information system requirements

The asset information system shall contain the following:

- a complete listing of the assets maintained by the operator and maintainer on behalf of the asset owner in an asset register aligned with the asset classification system including all asset metadata and reference data
- all the asset information associated with the assets in the asset register as specified in this standard

The asset information system shall be capable of the following:

- managing an asset register and all associated asset information, plans, manuals and activities into a consolidated system comprising one or more integrated repositories
- exporting data in commonly used industry standard formats
- providing integrated asset information within a reporting dashboard format to TfNSW and approved stakeholders
- planning, scheduling, prioritising and completing asset management activities
- storing the current and complete historical record of all asset information in a secured, controlled environment
- providing records in relation to inventory management, work order management, tracking of costs and asset warranty
- enabling the delivery of the following asset management functions:
    - plan and document management
    - work management, including capital work, recurrent maintenance work and costing
    - failure and defect management
    - asset condition management
    - configuration management
    - program and project management, including estimating
    - materials management
    - reporting
- integrating information with the following asset management related systems:
    - incident
    - financial
    - procurement

  - human resource and rostering
  - condition monitoring and SCADA
  - operational systems, including control and timetables
  - business intelligence reporting and analysis
  - maintenance requirements analysis
  - engineering design
  - information modelling
  - mobile technology systems and devices, including supporting remote information access, review, capture and update
- producing reports on the configuration, condition, planned work, work history and performance of all assets including defect and failure, and incident analysis
- integrating data
- being sustainable, maintained fit for purpose and scalable

13. Operator and maintainer requirements

The operator and maintainer shall comply with the following requirements:

- maintain and update the asset register and associated asset information on behalf of the asset owner (TfNSW)
- ensure the quality of the asset register and associated asset information is at the highest standards at all times
- ensure the asset register and associated asset information is a true and accurate representation of the asset condition and status of all assets including assets handed over as part of project commissioning (for both internal and external delivered projects)
- ensure all approved current TMPs and related service schedules are fully implemented relative to each asset within the asset register
- ensure all approved pending new or amended TMPs are fully implemented relative to each affected asset within the asset register within three months of being approved
- provide to the asset owner (TfNSW) the asset register, associated asset information and reports held in the asset information system in an agreed format
- handover the asset register, associated asset information and reports to TfNSW at the end of contract in an agreed format
- accept new assets and update the asset register and associated asset information prior to operational readiness, including asset modifications and disposals

- provide direct access and training in the use of the asset information system to TfNSW nominated staff where required, including user and training materials
- provide direct access and training in the use of the asset information system to third party maintainers where required
- ensure that all asset management activities are planned, scheduled, prioritised, controlled, recorded and monitored in the asset information system over the full life cycle of the asset, together with the planning and coordination of possessions and access to the asset
- ensure that all asset management activities are recorded in the asset information system within three business days of the activity taking place covering but not limited to the following:
    - spare parts and materials consumed on work orders including spares replenishment and the management of emergency (critical) spares
    - work order creation, management and cost collection for scheduled and unscheduled work, including work raised against the lowest asset in the asset register hierarchy where applicable
    - servicing records for measurements, condition assessment, photos, operating statistics, settings and adjustments to ensure asset remains within operating threshold or tolerance
    - defects or fault creation and management – part causing failure, size, criticality, status, root cause and corrective action for both functional and conditional failures (for both temporary and permanent repairs) including reference to the incident or event where applicable
    - incident management - capturing incident or event details including the impact on operations and delays
- record all asset information in the asset information system as a result of configuration change, including the following:
    - asset configuration changes or modifications including modifications to individual discrete asset and linear asset configuration changes over the length of the linear asset
    - installation and exchange of components including type approved products and products under trial
    - fitment and removal of rotable serialised assets including the location and status of the removed assets
    - changes to the TMP, including service schedules, frequency, tasks, latitude and criticality
    - changes as a result of failure and corrective action

  - changes as a result of a concession to a standard (the concession document shall also be linked to the asset in the document management system)
- generate reports to TfNSW as required from the asset information system on the following:
  - current performance of the asset
  - current condition of the asset
  - current asset duty and utilisation of the asset
  - annual works planning, delivery, production and backlog
  - maintenance compliance
  - asset register configuration and history
- conduct validation checks at intervals of at least six months to establish the accuracy, validity and currency of the asset register and associated asset information
- allow TfNSW to audit the accuracy, validity and currency of the asset register and associated asset information as requested by ASA
- monitor and analyse the asset information to detect the need for maintenance, indicated by the following:
  - a fault or defect requiring immediate attention
  - a series of faults or defects comprising separate events that individually do not require action but which collectively have passed a specified threshold of acceptability
  - usage that indicates the need for preventative maintenance
  - condition, where a physical property of an asset has fallen outside of acceptable limits
  - performance, where a measured factor has fallen below a specified level or outside of an acceptable range
  - predicted failure or the predicted and unacceptable decline of an asset
- ensure that the asset information is managed and secured by the following:
  - provision of disaster recovery and suitable storage
  - allocation of roles and responsibilities for the creation, maintenance, access to and assurance of the data

Appendix A Suggested reading

The following documents have not been directly referred to in this standard. However, these documents may assist in providing some contextual information on asset information management.

ISO 55001 (2014) – *Asset Management – Management Systems – Requirements*

ISO 55002 (2014) – *Asset Management – Management Systems – Guidelines for the application of ISO 55001*

PAS 1192-2:2013 – *Specification for the Information management for the capital / delivery phase of construction projects using building information modelling*

PAS 1192-3:2014 – *Specification for the Information management for the operational phase of assets using building information modelling*