Sydney Trains

Engineering System Integrity

Engineering Procedure
Signalling and Control Systems

PR S 47120

Inspection and Testing of Signalling: ETCS Level 1 Limited Supervision Integration of Trackside Alterations

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Document control

Version	Date	Author/Prin. Eng.	Summary of change
1.0	30 November 2020	Jesse Crick Colin Darmenia	First issue as Sydney Trains document.
2.0	21 September 2021	Jesse Crick	Consolidation of minor/major categories.
3.0	24 February 2022	Cyril Chéreau	Addition of ASDO alterations.

Summary of changes from previous version

Summary of change	Section
Add ASDO in the scope	2
Update in abbreviations	4
Add minimum test requirement for ASDO	5
Add clarification that no simulation is required for ASDO	7.1
Add clarification that there is no need for D_LINK validation for ASDO	9.1
Add new section for ASDO trackside integration	14

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1 Introduction

Automatic Train Protection (ATP) is implemented across the Sydney Trains maintained network. The type of ATP system that has been adopted is the European Train Control System (ETCS). There are different levels of ETCS these generally being:

- ETCS Level 0 the ETCS application level used on unfitted or uncommissioned lines.
- ETCS Level 1 involves continuous supervision of train movement while a non-contiguous communication between train and trackside (normally by means of balises). Lineside signals are necessary and train detection is performed by the trackside equipment ETCS Level 1 (L1).
- ETCS Level 2 involves continuous supervision of train movement with continuous communication between both the train and trackside. Lineside signals are optional in this case, and train detection is performed by the trackside equipment.
- ETCS Level 3 is also a signalling system that provides continuous train supervision with continuous communication between the train and trackside. The main difference with level 2 is that the train location and integrity is managed within the scope of the ERTMS system, i.e. there is no need for lineside signals or train detection systems on the trackside other than Euro-balises. Train integrity is supervised by the train, i.e. the train supervises being complete and not having been accidentally split.
- Limited Supervision is a mode in levels 1, 2 and 3 where the ETCS on-board equipment is responsible for the background supervision of the train movement to the extent permitted by the information provided by trackside.

  NOTE

  The Limited Supervision mode enables the train to be operated in areas equipped with lineside signals where ETCS does not have information regarding the status of some signals, i.e. not all signals are fitted with Lineside Electronic Units (LEU).

  NOTE

  The indications given to the driver by the ETCS on-board equipment do not substitute the observance of the line-side information.

- Full Supervision is a mode in levels 1, 2 and 3 where the ETCS on-board equipment is fully responsible for the train protection (except for the 2 situations described below):
  - The driver is responsible for respecting the End of Authority (EoA) when approaching an EoA with a release speed.
  - When “ENTRY IN FULL SUPERVISION” is displayed to the driver, the driver is responsible for respecting speed restrictions that apply for the part of the train that is not covered by Static Speed Profile and gradient data.

The electrified territory within the Sydney Trains managed network has ETCS L1 Limited Supervision implemented unless otherwise specified.

2 Scope

This procedure covers the trackside integration requirements for ATP associated with the implementation of ETCS Level 1 and Level 0 Limited Supervision (LS). This procedure also covers the trackside integration of ASDO (Automatic Selective Door Operation).

The implementation of ETCS Level 1 LS mode in Transport for NSW (TfNSW) territory uses the same equipment and architecture as ETCS level 1 Full Supervision (FS) mode but in a different configuration, and may provide the following functionality:

- Ceiling Speed Supervision for all Permanent Speed Signs.
- Target Speed Monitoring for High Risk Speed Signs, High Risk Turnouts and Deficient Overlaps.
- ETCS Trainstops where no mechanical trainstops are present.
- Buffer Stops and End of Line protection.
- Wrong Running Hazard protection.
- Automatic Selective Door Operation.

The ETCS system is identified as a signalling system, system integration shall be conducted in accordance with the relevant inspection and testing standards and procedures as published on the TfNSW Asset Management Branch and Sydney Trains websites.

2.1 Purpose

The purpose of this document is to specify the ETCS L1 LS integration requirements for all ETCS trackside alterations and new works.

The trackside system integration process validates and certifies trackside design, system integration and operational conditions.

This document shall be read in conjunction with TfNSW Inspection and Testing standard series, and Sydney Trains Signalling and Control Systems procedures safeworking series and manuals, as applicable. While this document generally complements these standards, it shall take precedence over requirements where this document applies a more stringent requirement.

2.2 Application

This procedure applies to all project delivery Rail Infrastructure Manager (RIM) and Technically Assured Organisations (TAO) delivering works affecting ETCS L1 LS or ASDO trackside equipment where Sydney Trains is the Maintainer RIM.

This procedure applies where ETCS L1 LS or ASDO has been implemented and requires further alterations as part of ongoing configuration changes.

Trackside and on-board subsystem commissioning as well as ETCS trackside design validation are excluded from this procedure as these are described in the reference documents. The relevant reference documents are as follows:

Trackside commissioning procedures: *MN S 41605 Alstom ETCS Set to Work Testing and Commissioning* Manual.

On-board commissioning Procedures: Set specific, e.g.: *AMS-H-120 - H-Set specific ETCS* maintenance instructions.

ETCS Trackside design validation: *PR S 45006 ETCS L1 LS Data Design Process*.

If changes are proposed to the trackside or on-board system ETCS baseline revision or manufacturer software, hardware or firmware a new project is required to determine the system integration, safety, technical and operational requirements.

System Validation activities such as ETCS and manufacturer generic system functions and degraded testing is excluded from this procedure as this testing occurs during type, factory acceptance and site acceptance testing.

Any new functions or packets not previously certified are excluded from the application of this document.

3 Reference documents

AMS-H-120 - H-Set specific ETCS maintenance instructions

GL S 45202 Geographical Data for ATP

GL S 47121 ETCS Master Simulator

GL S 47122 Inspection and Testing of Signalling: ETCS Test and Commissioning Virtual Balise Group Cover Balise Group Guideline

GL S 47123 ETCS Test Cases and Scenario Generation Guideline

MN S 41605 Alstom ETCS Set to Work Testing and Commissioning Manual

Network Rules and Network Procedures

PR R 90389 ERS – Procedure for Wheel Diameter Update via DMI, Radar and Accelerometer Calibration for the ATP System

PR S 40008 Securing Signalling Apparatus Out of Use

PR S 40010 Risks and Controls Associated with Testing and Certifying Equipment

PR S 40011 Renewals Work

PR S 40028 Automatic Train Protection – Alstom ETCS Trackside Equipment

PR S 40042 Safety Issues for Signalling Personnel

PR S 41037 Test Plans for Signalling Commissioning

PR S 41068 Assessment of Safety Change Requirements

PR S 45005 ETCS Data Storage and Access

PR S 45006 ETCS L1 LS Data Design Process

PR S 45009 ETCS L1 LS Trackside Design Process

PR S 47110 Inspection and Testing of Signalling

PR S 47112 Inspection and Testing of Signalling: Plans, Programs, Documentation and Packages

PR S 47116 Inspection and Testing of Signalling: Interface Requirements and Procedures for Alterations

T HR SC 07111 ST Mandatory Requirements for Inspection, Testing and Commissioning of New or Altered Signalling

T MU MD 20001 ST System Safety Standard for New or Altered Assets

4 Terms and definitions

The following definitions apply in this document:

ASDO	Automatic Selective Door Operation
BTM	Balise Transmission Module
CTE	Carte Transmission Eurobalise
DM	Design Manager
DMI	Driver Machine interface
DRU	Diagnostic Recording Unit
EB	Emergency Brake
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
ERA	European Union Agency for Railways
ETCS	European Train Control System
EVC	European Vital Computer
JRU	Juridical Recording Unit
JDRMDR	(ETCS) Juridical and Maintenance Data Reader
MSNG	Master Simulator New Generation
PFH	Probability of dangerous failure per hour (continuous operation)
RIM	Rail Infrastructure Manager
SIL4	Safety Integrity Level (4 is highest =10^−9 PFH)
SoM	Start of Mission
SFAIRP	So Far As Is Reasonably Practical
STN	Special Train Notice
TfNSW	Transport for New South Wales
TMS	Train Management System
TSM	Target Speed Monitoring

5 Application of testing procedures

The minimum tests as described in this procedure shall be completed for all ETCS Level 1 and Level 0 Limited Supervision (LS) trackside alterations:

- Simulation Testing, including any test cases exported from simulation
- On-board System Environmental Conditions
- D_LINK Validation.

Additionally if VBC's are used the following tests as described in this procedure shall be completed:

- VBC Test
- Border Linking Arrangement Test.

The minimum test as described in this procedure shall be completed for all ASDO trackside alterations:

- Testing of Packet 44.

6 Use of Test Train

Test trains shall be deemed fit for service.

The test train shall be fitted with a commissioned type approved EVC and compatible ETCS sub-system components (i.e.: antenna, radar, wheel sensor, accelerometer, etc.) as described in the type approval for the on-board ETCS subsystem.

NOTE
Type approval information is available from the TfNSW Asset Management Branch.

All on-board subsystem components shall be verified as maintained within the specified technical maintenance plan period and the EVC odometry shall be validated using the maintainer's most recent wheel mill laser measurement data, against the EVC maintenance data. All on-board sub-system data shall be sourced from the fleet specific Depot Engineering Manager or the authorised on-board tester.

The EVC maintenance data shall match the wheel mill laser data within the rounding error of the EVC. The specific wheel sensor used for the EVC shall be as per the set specific ETCS maintenance instructions and PR R 90389. The above maintenance information shall be prepared and issued to the tester in charge prior to dynamic testing.

All train movements shall be conducted in accordance with the network rules and network procedures.

For the duration of testing, the test train shall operate to a suitable level of operational management such as special train notice or local possession authority. The train crew shall be provided all applicable test train movement information at a time nominated by the train crew management team, the crew requirements shall be nominated by the train crew management team.

The test train shall be prepared for test conditions ready for clean JRU logs to be extracted post testing for interpretation. All members of the test team shall carry the relevant authority to enter the driver's cabin and the relevant license or authorisation and permit to work to conduct testing on-board.

7 Simulation Testing

7.1 Purpose

Simulation testing is testing of the certified designed ETCS trackside data to a type approved on-board EVC, certified with the relevant ETCS Baseline revision interfaced to an approved simulation test bench.

Simulation testing ensures that under simulated conditions the on-board system will react as intended to the ETCS L1 LS principles including system performance for normal operational conditions and targeted risk areas.

The Trackside data design is produced to SIL4 certification; this certification is a product of the Alstom design production process and allows the highest level of design production certainty, however there may still be latent design inputs affecting the Probability of dangerous Failure per Hour (PFH) that requires either testing or acceptance of risk to achieve SFAIRP risk levels depending on the significance of the change to design.

Simulation is not required for ASDO trackside testing.

7.2 Process

The simulation activities are outlined in PR S 45006 and GL S 47121. The activities shall be conducted on an approved on-board simulator test bench.

The process is summarised below:

- Collection of trackside inputs and ETCS data
- Test scenario creation
- Test Bench Setup
- Test Execution
- Defect analysis and recording
- Report Generation.

NOTE

The simulation report shall be included in the data design release note. The simulation report shall include the test cases conducted and certified outcomes.

Simulation testing may identify test cases that cannot be conducted in the simulated environment. Such test cases shall be exported from simulation to the system certifier or commissioning engineer for alternative testing.

Examples of test cases exported from simulation could include validation of speed signs or car markers identified in design but not included in data, testing of the initiation of target speed monitoring on site.

8 On-board System Environmental Conditions

8.1 Purpose

On-board System Environmental Condition testing is conducted to determine if any new or existing conditions exist that are abnormal to the ETCS and ASDO system.

Testing is completed using ETCS fitted trains running in the designed trackside area under static (timetabled non-intrusive) conditions; the on-board logs shall be extracted and reviewed to compare baseline environmental information to conditions under test.

Examples of abnormal environmental conditions include Balise Transmission Module (BTM) blind occurrences, Carte transmission Eurobalise (CTE) alarms and Electro-magnetic interference (EMI).

While there are existing design and type testing processes that can assess the probability of Big Metal Mass (BMM) (EGG 1656) or EMI issues, changes to the field layout or new infrastructure may introduce new conditions that require On-board System Environmental validation.

This test is not required where balise position and track infrastructure is not affected.

8.2 Process

On-board logs from a train fitted with a commissioned and operational ETCS system shall be extracted and reviewed pre-alteration to determine if any conditions that may affect the ETCS system are present.

The following conditions shall be observed using on-board logs inside the ETCS design affected area:

- Review logs prior to alteration in order to baseline the EMI, CTE and BTM Blind conditions.
- Review logs from a test train post-alteration (prior to commissioning) once any environmental conditions have been changed. Examples include new or altered cross-overs or turnouts, bridges or ground based steel structures, communications based transponders, wayside detection systems and other systems that have the ability to introduce EMI to the area in design. This step may not be applicable where trackside alterations are made at the same time as commissioning.
- Review logs post commissioning once all alterations have been made and revenue services have been running for more than 24 hours to compare the baseline logs to commissioned state.
- Generate a test report for the defects register in commissioning works package identifying any defects and abnormal behaviour as well as corrective actions required to close defects
- Correct and close all defects.

The logs used shall be a recording of typical traffic conditions or conditions determined by test cases. This shall be completed within seven (7) days from commissioning. Where movements over the affected area are seldom used or routes are booked out of use, the responsible test engineer shall plan for logs to be reviewed as early as practicable as the affected routes are used.

9 D_LINK Validation

9.1 Purpose

D_LINK is the packet five (5) linking variable assigned to nominate the distance between linked balise groups; the distance is taken from the reference balise.

D_LINK validation of balise position is required to verify the certified trackside sub-system balise position correlates to the on-board linking information.

D_LINK validation is conducted prior to commissioning of the ETCS system.

D_LINK validation is not required for ASDO trackside testing.

9.2 Application

Unless specifically identified as not required these processes are applicable for balises that have data alterations.

These processes are not required for balise groups that have had data altered but do not contain linking information, or where balise groups are not moved and the D_LINK variable is not altered.

These processes are not applicable to the movement of balises for maintenance purposes where balises have moved within the specified maintenance tolerance.

Figure 1 identifies a simplified process for selecting a test method.

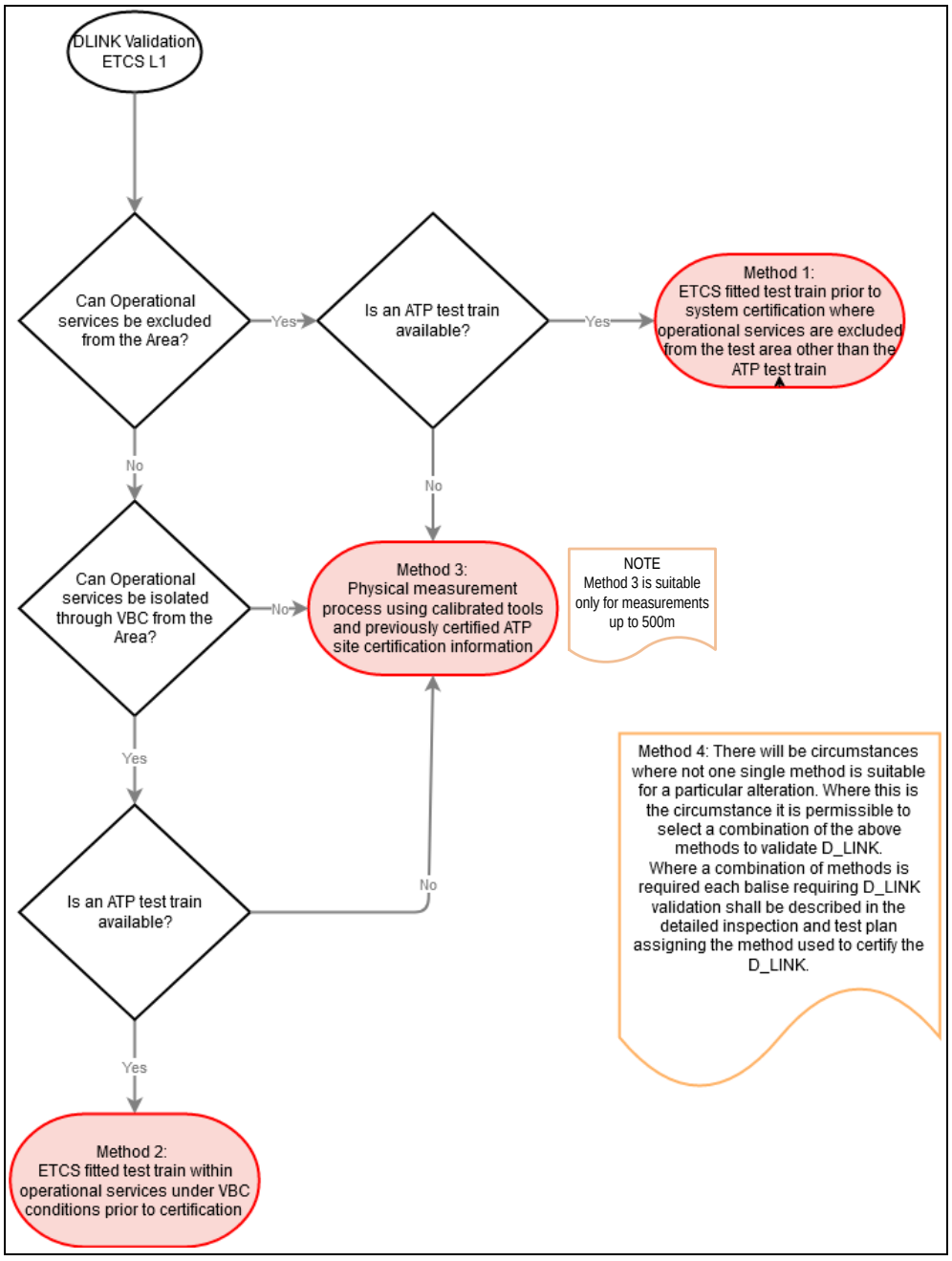

Figure 1: DLINK Methodology Decision Tree

9.3 Process

There are 4 methods for validating D_LINK information as follows in no particular order:

- **Method 1:** ETCS fitted test train prior to system certification where operational services are excluded from the test area other than the ATP test train.
- **Method 2:** ETCS fitted test train within operational services under VBC conditions prior to certification.
- **Method 3:** Physical measurement process using calibrated tools and previously certified ATP site certification information.
- **Method 4:** Allows for flexibility to select a mixture of appropriate methods (above) as required on a case by case basis.

9.3.1 Method 1: ETCS Test Train Exclusive Track Access (No VBC)

A test train is required utilising a test team competent in ETCS on-board systems and train crew under a suitable operational authority with all balises installed in the certified position and no VBC set on-board.

This method may be utilised where there is a test train available and all operational services over the test area are excluded between trackside commissioning and first revenue service, for example during a Local Possession Authority.

The test train shall be prepared for test conditions ready for JRU logs to be extracted post testing for interpretation, the test train shall run to a test plan that reads all balises intended to be commissioned. Once the testing is completed the logs shall be extracted from the on-board JRU and interpreted prior to certification, a calculation may be used to determine how the balise is positioned inside the window of expectation.

NOTE

Any calculation shall consider how the on-board ETCS subsystem calculates the balise group's expectation window.

The balise group under assessment shall be no greater than 35% variance from centre of the window of expectation. If a variance greater than 35% cannot be resolved a defect shall be raised and the commissioning engineer or the delegated competent person shall consider the operational impacts prior to certification.

Application: While this methodology is particularly suitable for trackside alterations that occur within a single possession event, and move balises further than 500 m from their original designed position, it is also suitable for all other scenarios where balise positions are altered. Examples include major track or signalling remodelling.

9.3.2 Method 2: ETCS Test Train In Live Operational Conditions (VBC)

A test train is required utilising a test team competent in ETCS on-board systems and train crew operating within an operational area, fitted with VBC's for all new balises installed in the new certified position.

This method may be utilised where there is a unique VBC marker allocated for the designed works in order to delineate the balises under test from any existing balises.

The test train shall be prepared for test conditions ready for JRU logs to be extracted post testing for interpretation, the test train shall run to a test plan that reads all balises intended to be commissioned. Once the testing is completed the logs shall be extracted from the on-board JRU and interpreted prior to certification, a calculation may be used to determine how the balise is positioned inside the window of expectation.

NOTE

Any calculation shall consider how the on-board ETCS subsystem calculates the balise group's expectation window.

The group shall be no greater than 35% variance from centre of the window of expectation. If a variance greater than 35% cannot be resolved a defect shall be raised and the commissioning engineer shall consider the operational impacts prior to certification.

Application: This methodology is suitable for trackside alterations where the area has commissioned VBC balises used to manage the designed works.

Examples include major track or signalling remodelling.

9.3.3 Method 3: Physical Measurement

Physical measurement of D_LINK may be used where there is an existing ETCS commissioned system using Packet 5 sending valid D_LINK information to the on-board subsystem.

A desktop assessment by a person competent in ETCS trackside data and signal design shall be conducted using current valid on-board JRU logs to validate the existing commissioned D_LRBG values (with the L_DOUBT and antenna positions accommodated) from the JRU data to the re-certified balise position and the current WebGIS flat file data in accordance with the GL S 45202.

The data collected from the on-board JRU shall be no older than 6 weeks from commissioning.

Prior to assessment the installation of the existing commissioned balises used to measure from, shall be re-certified to the certified office copy or as-built site certification form. The results shall be communicated to the person conducting the assessment. If the re-certified balise position, the WebGIS and actual D_LRBG (with the L_DOUBT and antenna positions accommodated) values are within 5 m of each other the WebGIS data is valid to use for calculation purposes. The assessed position of the existing balises should be identified in reporting to enable the calculation to assess any position error.

NOTE
The 5 m margin is derived from the measuring tool tolerance.

If the assessed distance is greater than 5 m the specific information shall be sent to the detailed design AEO for analysis and recommendation to proceed. It is appropriate to proceed using the advice given by the design AEO in their assessment.

If no advice is given or the advice is to not depend on the geodata or on-board JRU data for measurement then Method 1 or Method 2 for D_LINK validation shall be used.

If the re-certified balise position, geodata and the on-board JRU data align within 5 m the new D_LINK value may be calculated from the existing commissioned balise to the new balise for validation of new D_LINK.

Alternatively if the re-certified balise position, geodata and the on-board JRU data align within 5 m, then the D_LINK variable may be validated by physical measurement with the following conditions:

- Up to 500 m from new to existing commissioned balise where a measurement tool with a calibrated 1 % or less error is used, or
- Up to 250 m from new to existing commissioned balise where a measurement tool with a calibrated 2 % or less error is used,

An example of the calculation is shown in Figure 2 where:

- (a) – in red, is the distance between the new balise groups.
- (b) – in green, is the distance between existing balise groups.
- (c) – in blue, is the distance between the furthest existing and a new balise group.
- (d) – in black, is the distance between the closest existing and a new balise group.
- The example calculation is a=b+c-d.
- All balise groups are calculated to the reference balise.

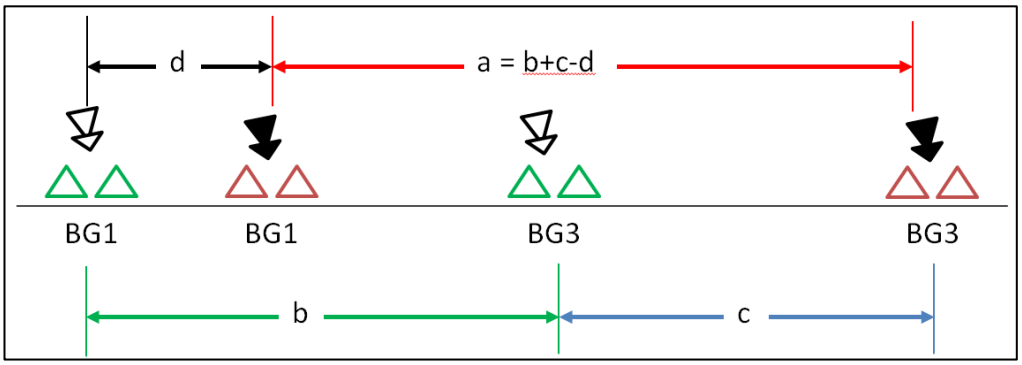

Figure 2 – DLINK Measurement Example

Once a valid balise position is established any balise can be validated by physical measurement with the following conditions:

- Up to 500 m from new to existing commissioned balise where a measurement tool with a calibrated 1 % or less error is used, or
- Up to 250 m from new to existing commissioned balise where a measurement tool with a calibrated 2 % or less error is used.

The measuring method used shall be capable of measuring with accuracy of +/-2%. Refer to GL S 45202 for measurement processes.

If any distance required to be measured is greater than 500m Method 1 or Method 2 shall be utilised.

NOTE

Post commissioning, it is recommended that the altered balise position should be reviewed using post commissioning on-board JRU logs to validate the position of the altered D_LRBG values (with the L_DOUBT and antenna positions accommodated). The group should be no greater than 35% variance from centre of the window of expectation. If a variance greater than 35% is observed refer to GL S 45202.

Application: Method 3 is suitable where new balises are less than 500m from an existing certified balise. Examples include turnout renewals, signal position changes and speed-board position changes.

9.3.4 Method 4: Combination of Methods

There will be circumstances where not one single method is suitable for a particular alteration. Where this is the circumstance it is permissible to select a combination of the above methods to validate D_LINK. Where a combination of methods is required each balise requiring D_LINK validation shall be described in the detailed inspection and test plan assigning the method used to certify the D_LINK.

Application: This methodology is suitable for any alteration to trackside where the individual requirements are met, subject to agreement and endorsement of the commissioning engineer.

10 Border Linking Arrangement Test

10.1 Purpose

Projects may require alterations to the ETCS trackside subsystem to implement project borders, in order to implement or alter the borders linking changes may be required to be introduced or altered.

In these cases the linking arrangement at the borders are required to be tested in their altered state each time they are altered.

This test provides assurance that any staged and the final arrangement will seamlessly continue in the designed ETCS level and mode without intervention and the system will perform safely according to design.

This test may be conducted using Simulation Testing of the border arrangement and at-least independent certification of the trackside balise positions additional to the set to work and commission process defined out in MN S 41605.

The risks associated with using the simulation and independent balise position certification methodology shall be controlled so far as is reasonable practicable. The risk assessment is performed using a subject matter expert based on their extensive knowledge of signalling and ETCS principles and practices.

If it is assessed that the risks associated with using simulation and independent balise position checking are not adequately controlled, a test train shall be used to conduct this testing following a prepared test case designed by a person competent in ETCS trackside data and signal design.

10.2 Examples of border arrangements

These examples are for illustrative purposes only and shall not be used to determine design arrangements.

- Project border with VBC's and new level transition to Level 0:

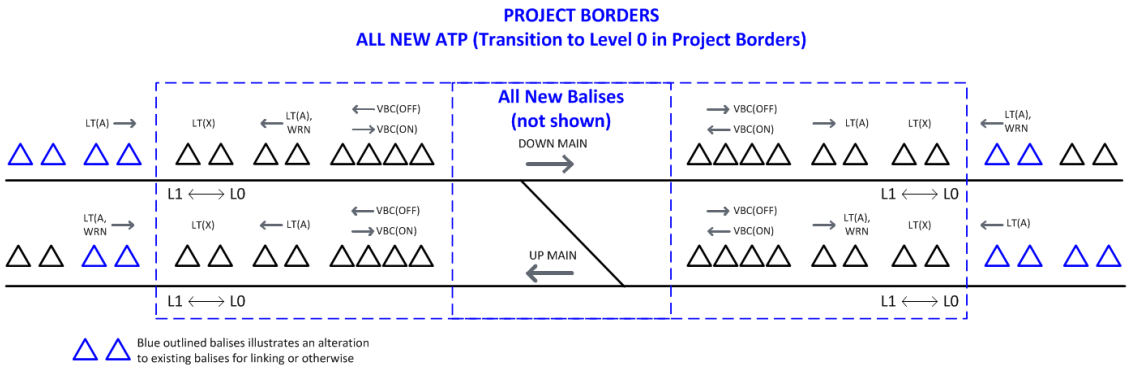

Figure 3: Project Border to Level 0

- Project border with VBC and interlaced balise arrangement:

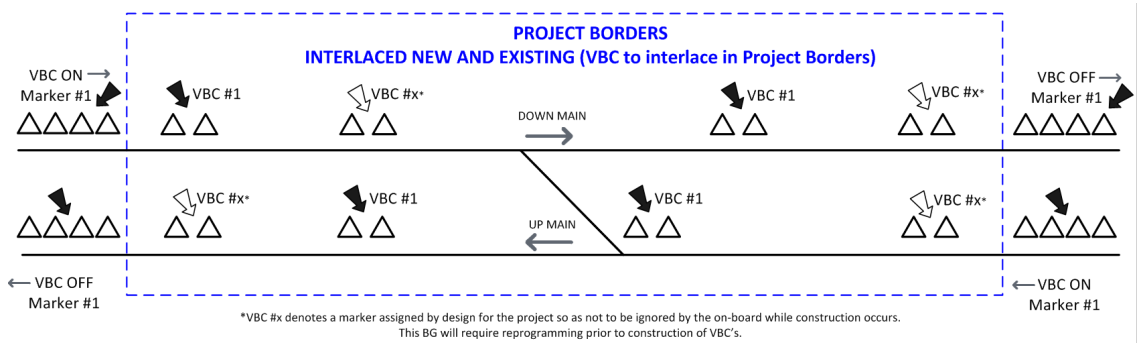

Figure 4: Border with VBC Interlaced

10.3 Process

10.3.1 Simulation and independent balise position certification

The process for simulation shall be completed in accordance with Section 7.2.

Independent balise position certification shall be conducted using a suitably competent and authorised person, who is independent of balise installation and the ATP trackside set to work and commissioning process.

That person shall ensure the balises identified to be certified are:

- identified on the controlled signalling plan, balise plan and site certification form and each form of design correlates to the other, and
- installed in field, in the orientation as drawn in the signalling plan in reference to the balise label (on the balise) and the balise location label (on the sleeper or vortok beam), and
- recorded on the signalling plan as certified once the orientation inspection has been made.

10.3.2 Test train

A test train utilising a dedicated test team and train crew under a special train notice or possession is required with all balises installed in the certified position.

The test train shall be prepared for test conditions ready for JRU logs to be extracted post testing for interpretation, the train shall run to a test plan that reads all balises and on-board interactions intended to be commissioned for staging or final design. The test plan shall detail the on-board interaction that is expected, as identified by the Signalling Tester in Charge or the delegated competent person.

NOTE

If the JRU test logs are desired to be "clean" the tester may cover or remove the existing Level Transition balises although these balises should be ignored by the on-board system as their NID_BG will not appear in the new linked balises linking information. "Clean" is interpreted to mean that only the expected balises are read.

The following conditions shall be observed using on-board DMI and JRU logs at the ETCS border design area:

- Test train conducts Start of Mission Sequence (SoM) at nominated position and approaches transition area in the designed ETCS mode (L1 – LS or L0).
- Test train traverses and reads the balise group under test at nominated test speed, observations on DMI should be noted according to the test plan depending on the designed conditions.
- All interactions in the test window and the point where they occur shall be noted for the test report, items that require notation include, DMI needle colour change, DMI text message, speed at time of interaction, geographical position where the interaction occurred, braking interventions.
- Change of mode DMI icon may be used as visual indication of mode change where level transitions are used.
- VBC set and remove on Alstom fitted trains are visually indicated in the DMI Data View Menu by "VBC set code" where VBC's are used, more detailed information regarding VBC testing is described in the Test and Commissioning Balise Guideline.
- Test notes taken in field shall be referenced post testing to the JRU log for validation of observations.
- Methods to capture test observations may be direct or remote observation, examples of remote observations include direct video and monitoring at the time of test or review of JRU logs after the testing.
- All observations shall be captured in a test record, examples may include direct observation checklists, work instructions or JRU logs.

11 VBC Test

11.1 Purpose

Projects may require VBC balises to implement ETCS alteration. In these cases the VBC arrangements are required to be tested each time they are introduced or altered.

This test provides assurance that any staged and the final arrangement will seamlessly continue in the designed ETCS level without intervention and the system will perform safely according to design.

This test may be conducted using Simulation Testing of the border arrangement and at-least independent certification of the trackside balise positions additional to the set to work and commission process defined out in MN S 41605.

The risks associated with using the simulation and independent balise position certification methodology shall be controlled so far as is reasonable practicable. The risk assessment is performed using a subject matter expert based on their extensive knowledge of signalling and ETCS principles and practices.

If it is assessed that the risks associated with using simulation and independent balise position checking are not adequately controlled, a test train shall be used to conduct this testing following a prepared test case designed by a person competent in ETCS trackside data and signal design.

11.2 Process

11.2.1 Simulation and independent balise position certification

The process for simulation shall be completed in accordance with Section 7.2.

Independent balise position certification shall be conducted using a suitably competent and authorised person, who is independent of balise installation and the ATP trackside set to work and commissioning process.

That person shall ensure the balises identified to be certified are:

- identified on the signalling plan, balise plan, ETCS tables and site certification form and each form of design correlates to the other, and
- installed in field, in the orientation as drawn in the signalling plan in reference to the balise label (on the balise) and the balise location label (on the sleeper), and
- recorded on the signalling plan as certified once the orientation inspection has been made.

11.2.2 Test train

A test train utilising a dedicated test team and train crew under a special train notice or possession is required with all balises installed in the certified position.

The test train shall be prepared for test conditions ready for JRU logs to be extracted post testing for interpretation, the train shall run to a test plan that reads all balises and on-board interactions intended to be commissioned for staging or final design. The test plan shall detail the on-board interaction that is expected, as identified by the Signalling Tester in Charge or the delegated competent person.

NOTE

If the JRU test logs are desired to be "clean" the tester may cover or remove the existing Level Transition balises although these balises should be ignored by the on-board system as their NID_BG will not appear in the new linked balises linking information. "Clean" is interpreted to mean that only the expected balises are read.

The following conditions shall be observed using on-board DMI and JRU logs at the ETCS border design area:

- Test train conducts Start of Mission Sequence (SoM) at nominated position and approaches transition area in the designed ETCS mode (L1 – LS or L0).
- Test train traverses and reads the balise group under test at nominated test speed, observations on DMI should be noted according to the test plan depending on the designed conditions.
- All interactions in the test window and the point where they occur shall be noted for the test report, items that require notation include, DMI needle colour change, DMI text message, speed at time of interaction, geographical position where the interaction occurred, braking interventions.
- Change of mode DMI icon may be used as visual indication of mode change where level transitions are used.
- VBC set and remove on Alstom fitted trains are visually indicated in the DMI Data View Menu by "VBC set code" where VBC's are used, more detailed information regarding VBC testing is described in the Test and Commissioning Balise Guideline.
- Test notes taken in field shall be referenced post testing to the JRU log for validation of observations.
- Methods to capture test observations may be direct or remote observation, examples of remote observations include direct video and monitoring at the time of test or review of JRU logs after the testing.
- All observations shall be captured in a test record, examples may include direct observation checklists, work instructions or JRU logs.

12 Changes that only affect the balise VBC marker

12.1 Purpose

Projects may require alterations to the ETCS trackside subsystem to enable the ATP system to continue working normally while ATP construction takes place. The design to alter the ATP trackside subsystem to enable this arrangement may require changes only to packet 0 NID_VBCMK for balises other than VBC balises.

Where designed changes to the ATP arrangement are limited to only packet 0 NID_VBCMK, testing may be limited only to checking the VBC marker has changed.

12.2 Process

The specified set to work and commissioning process shall be implemented as described in MN S 41605.

After approved design has been received and the balise is programmed, the telegram information on the new balise shall be checked and recorded that the specified new NID_VBCMK is present and valid. This check shall be conducted prior to the commissioning of the balise.

The balise serial number and balise label shall be independently checked on site post installation to ensure the correct balise has been installed, this check may be recorded on the balise test certificate.

13 Use of Test and Commissioning VBC Balise Group (VBC Marker 63)

13.1 Purpose

The test and commissioning VBC balise group is in effect a VBC for VBC balises.

This balise will allow the test train to run under test without the need to remove or cover VBC balises installed in field, greatly reducing test resource and work on track safe working requirements.

The test and commissioning balise group is a balise group used to ignore balises marked as 63 (NID_VBCMK) within the telegram's packet 0, marker 63 is reserved for the VBC function.

13.2 Process

A detailed guide on the use of the test and commissioning VBC balise group is set out in the GL S 47122.

When using the test and commissioning VBC balise the test train shall not be handed back or re-enter into normal service until it is tested and recorded that only the designed VBC order (if any) is present on-board.

VBC marker 63 set on orders shall only be present on-board for trains used exclusively for testing as the order allows the test train to not read commissioned balises in a Level 1 area or read not yet commissioned balises in a Level 0 area.

14 ASDO: Testing of Packet 44

14.1 Purpose

The testing of Packet 44 is used as final verification of the ASDO trackside system of any new or altered ASDO BG. The testing will provide an opportunity to ensure that the Trackside ASDO balises have been installed correctly and are working as expected (e.g. the correct side of train passenger doors and the platform location (distance to end and length) are received by the on-board EVC as expected).

The other packets present in the ASDO message (Packet 0 and Packet 145) are generic and are not required to be designed individually for each balise group. These packets are designed the same for all ASDO messages and have been assured through the system integration process during type approval. These functions are not required to be tested during ASDO trackside integration.

14.2 Process

A prescribed list of ASDO test cases are defined in GL S 47123.

Any trackside testing activities shall be conducted on a rolling stock type with an approved onboard system utilising packet 44 for ASDO function.

The ASDO testing should start after the set to work and certification of the trackside is completed.

The process is summarised below:

- Collection of trackside inputs and ETCS data.
- Test scenario creation (GL S 47123).
- ASDO trackside integration testing.
- Defect analysis and recording, including JRU logs (GL S 47123).
- Test report generation and integration certification.

To conduct ASDO trackside integration testing, a test train utilising a dedicated test team and train crew under a special train notice or possession is required. All balises shall be installed and certified on track.

During the ASDO testing, the train will follow normal operating scenarios and stop at designated car marker. The prescribed test cases do not include any degraded scenarios.

The test train shall be prepared for test conditions ready for JRU logs to be extracted post testing for interpretation, the train shall run to a test plan that reads all ASDO balises. The test plan and test cases shall detail the on-board interaction that is expected, as identified by the Signalling Tester in Charge or the delegated competent person.

14.3 Methodology

The ASDO trackside Integration methodology verifies the on-board EVC has received:

- the correct side of door information for the direction of travel (as per design information from the ETCS Balise Table)
- the correct number of doors are enabled at a given platform (as per design information from the ETCS ASDO Model - PR-S-45013-FM01)

Each ASDO balise group shall be read at least once.

When an ASDO balise group contains a packet 44 for each direction (bidirectional platform), the function for the other direction may be confirmed from the JRU logs. However, both test cases for each direction should be created, to provide more flexibility during testing.

14.4 Defects

An ASDO Network Integration Defect Register shall be created.

The Onboard integration tester shall document any issues found during testing. The Onboard integration tester and the Design Integration Certifier shall determine if the issue is related to testing conditions. Any issue that is not related to testing shall be registered as a defect against a specific ASDO requirement and sent to the system certifier for analysis and resolution.

14.5 ASDO System Constraints

The ASDO system constraints consist of an error zone (uncertainty) which cannot be eliminated by design. Any door within the error zone will not be released to open. The error zone is a combination of ASDO on-board sub system error and trackside sub system error. The maximum system error zone is 900mm for a 10 car train which implies that any doors within 900mm of (end of) platform limits will not be enabled.

During the course of ASDO trackside testing, it may be observed that an additional door may be enabled to open, this is due to the below-listed possibilities. The test cases should be reviewed and passed, based on input from the ASDO model:

a. An additional door (last door on the platform) may be enabled due to the fact that trackside reference balise fitment tolerance is (+/-350mm) being taken into account during design and the determination of advertised number of doors. However, the actual balise can be installed much closer to the reference balise marker plaque than 350mm. This may result in the enabling of an extra door during a NIT test case which is not an issue for concern and is expected system behaviour as this door will still be on the platform.

b. During an undershoot (up to 1m) stopping scenario, the last door on the platform, which would be operational when stopping at the nominal location, may not be enabled, depending on the extent of undershoot, due to rear door margin and ASDO error zone being small.

c. During an overshoot stopping scenario (up to 1m), an additional door (the last door on the platform which is non-operational for stopping at the nominal location) may be enabled, depending on the extent of overshoot, due to rear door margin and ASDO error zone being small.

As the ASDO trackside testing is not considering any ASDO sub-system beyond the EVC, these conditions may be observed for review with a person competent in the ASDO on-board system.

14.6 Testing Logistics

ASDO trackside Integration test scenarios will not require any active interaction with drivers.

During testing, the train shall be stopping at nominal Stations as per planned Special Train Notice (STN). The Onboard integration tester should check that the Driver stops at the correct car marker within tolerance, check the correct side of the platform and record the timestamp.

For information only (and not to be used as an input or evidence for trackside validation during testing activities), the Onboard integration tester could observe system behaviour information through TMS & DMI screen.

There is no interaction between Onboard integration tester and signaller required during the testing.

Mariyung trains have multiple driver cabs. It is preferred for the Onboard tester to be in the active drivers cab to observe each stopping location but if not possible, another unoccupied cab could be used and monitor the testing progress via TMS. Note: Observation of the TMS screen only for progress status, not for testing results

14.7 Test Report

A test report shall be prepared following completion of each ASDO trackside integration stage. The test report shall detail the trackside testing performed for the respective ASDO trackside integration stage.

The test report shall include:

- An overview of the Trackside ASDO scope
- Trackside ASDO Configuration
- List the applicable procedures, requirements and standards followed
- Describe the testing methodology adopted and support processes, and the associated rules, methods and tools used
- ETCS On-board Software Configuration
- Provide a description of the test results with any defects raised, and their impact
- Summary of all test cases performed including outcomes of log analysis and a certification of the results.

The test report will support the deliverables applicable to the Sydney Trains and TfNSW safety assurance and configuration management plans.

15 Risks Associated with ETCS Alterations

15.1 Virtual Balise Cover Orders

If “VBC Off” is identified in ETCS tables approved for construction design, while the area is pending commissioning and the area being altered is under VBC conditions, the telegram from any “VBC(Off)” balise shall not be read by any ETCS fitted train.

NOTE
“VBC(Off)” explicitly identifies the VBC order is designed as OFF also known as “VBC removed” in both directions.

A register shall be kept in the relevant inspection and test packages detailing any ETCS apparatus that can transmit a telegram containing packet #6 VBCO information.

15.2 Test Trains

For the purposes of testing described in this document, a test train shall not exceed the limits of an exclusive local possession authority or an applicable (STN). Outside these conditions the train shall operate in the certified design ETCS level and mode unless specifically identified in a TOC waiver to allow the test train to operate without ETCS protection.

The authority to operate a test train is granted by Network Operations. Additionally, where the test train is not a set that operates in ATP revenue service, then the Sydney Trains Rollingstock Professional Head or delegate shall also authorise the use of the train.

16 Commissioning Reporting

16.1 Design Status

Prior to commissioning the commissioning engineer shall check the design status within the Sydney Trains design management application. A new folder shall be made available for the signal design job number as an “Interim As-built” folder with a planned commissioning date as per the requirements set out in PR S 45005.

16.2 Commissioning Notification

Within the first hour of commissioning, the commissioning engineer shall notify ICON Infrastructure that the design has been commissioned and the associated folder shall now be used as the certified source of ETCS design. If partial ETCS design implementation or rollback has been commissioned the design control shall remain with the commissioning engineer in consultation with the stakeholders nominated in the interface co-ordination plan.

At the time of commissioning, or where this is impracticable no later than 24 hours after commissioning, the commissioning engineer shall notify the Sydney Trains Signal Design Documentation Manager of the commissioning status with submission of any certified office copies of the ETCS installed data forms and site certification forms.

17 Competency and Authorisations

The competency and authorisation requirements to conduct testing activities contained within this procedure are set out in *MN S 41412 Process for Signalling and Control Systems Personnel – Authorisations and Licensing*.