Reference material

AMS Project Specifications:
AMS Trackside Design Guideline

This document is published as reference material to support the implementation of Automatic Train Protection as part of the roll out of the Advanced Train Control Migration System project.

The content described might be of assistance to individuals and organisations performing work on NSW Rail Assets.

When reading this document, any inconsistencies with Transport for NSW Network Standards shall be raised with the Asset Standards Authority (ASA) for clarification.

This document does not comply with accessibility requirements (WCAG 2.0). If you are having trouble accessing information in these documents, please contact the ASA.

Authorised by: Chief Engineer, Asset Standards Authority
Published: November 2018

AMS PROJECT SPECIFICATIONS: AMS TRACKSIDE DESIGN GUIDELINE

DeskSite Reference: 5188811

Principle – Applicable to Transport Projects AMS Program

Quality Management System

Status:	Draft
Version:	V3.0
Branch:	Infrastructure and Services
Business unit:	ATP Program
Date of issue:	08/03/2018
Review date:	08/03/2018
Audience:	**AMS Project Specific Document**
Asset classes:	☒ Heavy Rail; ☐ Light Rail; ☐ Multi Sites; ☒ Systems; ☐ Fleets
Project type:	Major
Project lifecycle:	☐ Feasibility; ☐ Scoping; ☒ Definition; ☐ Construction readiness; ☐ Implementation; ☐ Finalisation; ☐ Not applicable
Process owner:	Project Director

Document Approval:

Authored by: Colin Oxborrow Signal Design Engineer		**Date:** 9-3-2018
Reviewed by: Adam Bird AMS Design Engineer Trackside		Digitally signed by Adam J Bird Date: 2018.03.13 07:47:38 +11'00' **Date:**
Reviewed by: Anthony Samaan Manager Safety Assurance		13/3/2018 **Date:**
Reviewed by: Andre Younes Manager Operational Integration		13/3/2018 **Date:**
Reviewed and Accepted by: Frederic Tricoche Principal Engineering Manager Systems		13/3/18 **Date:**
Approved for Release by: Geoff Webb ATP Project Director		14/03/18 **Date:**

Document History

Version	Date of Issue	Author	Summary of change
0.1	13/05/2016	L. Williams	Initial draft
0.2	18/07/2016	L. Williams	Update to stakeholder comments
0.3	20/07/2016	L. Williams	Development of ETCS tables, draft released for GSFT/SIT tender.
0.4	06/09/2016	L. Williams	Update to review comments
0.5	21/09/2016	L. Williams	Update to final review comments
1.0	22/09/2016	L. Williams	Issued
1.1	08/02/2017	J. Paw	Update to include latest ETCS Balise and LEU Table Template (CR-406)
1.2	20/03/2017	S. S. De	Update to CR376 (CI436), CR406 (CI432), CR481 (CI578) , CR482 (CI537), CR554 and CR571 (CI599)
1.3	12/05/2017	S. S. De	Updated CR574, CR626, CR628 and CR652
2.0	12/05/2017	S. S. De	Issued for Approval
2.1	08/03/2018	C. Oxborrow	Update to latest ETCS Balise and LEU Table Template
3.0	08/03/2018	C. Oxborrow	Issued for Approval

Foreword

This guideline forms a part of the AMS Project Specifications which detail the requirements for the implementation of ATP / AMS on the TfNSW heavy rail network. This guideline specifically covers the ETCS Level 1 System using Limited Supervision.

To gain a complete overview of ATP / AMS signalling design requirements, this document should be read in conjunction with the AMS suite of signalling design principle and guideline modules.

Note

The following guideline is to be used by AEO's engaged by the ATP program for the ATP / AMS detailed design implementation. This is to ensure that a consistent methodology is applied.

It has been produced during the development of the AMS Project Specifications and subsequent further updates may be required as the specifications evolve.

It is an interim document until the ASA guideline is published.

Table of contents

1. Introduction

Transport for New South Wales (TfNSW) is using the European Train Control System (ETCS) to provide Automatic Train Protection (ATP) functionality on the TfNSW heavy rail network.

In ETCS, trackside equipment transmits information (track gradients, speed limits, signalled proceed authorities, and other related data) to on-board equipment. The on-board equipment uses this information and pre-programmed rolling stock parameters to calculate brake interventions to the train to remain within safe speed and distance limits.

ETCS operates in numerous levels (defined mainly by the type of communication between trackside and on-board equipment). Level 0 is defined for operating an ETCS fitted train on track which is not fitted with ETCS trackside equipment. The Level 1 trackside equipment transmits information to the train primarily by track-mounted transponders called Eurobalises (balises), and is intended to overlay on existing signalling without alteration of the signalling system. In Level 2, balises are primarily used for position reference and some fixed values, with operational information transmitted to the train by radio. Level 2 still relies on fixed block train detection (track circuits and/or axle counters), but lineside signals become redundant. Level 3 is specified as a moving block system with responsibility for train integrity moved from track based detection to an on-board function.

It is intended that the TfNSW network will eventually use a mixture of Level 1 and Level 2, dependent on operational characteristics of given areas, operating primarily in Full Supervision (FS) mode, to enforce speed and distance limits. This combined with intelligent rail traffic management systems, will be known as Advanced Train Control System (ATCS).

Due to the operational complexities of the TfNSW network and services (size of network, and size and deployment of rolling stock fleet and train crewing workforce), the path to FS is long and complicated. As a transitional arrangement, the Advanced train control Migration System (AMS) has been devised. Using Limited Supervision (LS) mode in Level 1, AMS is designed primarily for rapid deployment to manage risks which are not already protected by other engineered systems, and enable personnel to become familiar with the equipment before a more complex functionality is introduced.

Note – AMS is not intended to address/mitigate driver incapacitation, although it will keep the train within safe speed and distance limits (limit of authority management is only applicable to the buffer stop protection) until the driver incapacitation defences intervene.

2. Purpose

The purpose of this guideline is to provide further details of the design documentation associated with the ETCS Level 1 AMS trackside design process. This document incorporates and supersedes the ETCS design elements from the following:

- SPG 0703 - Signalling Documentation and Drawings
- QSDP 72 - Trackside ETCS Data Preparation And Validation
- QSDP 75 - Configuration Change and Control of ATP Data
- QSDP 81 - ATP Trackside Design
- QSDP 82 - ETCS Control Tables

Each document in the design process shall be subject to the review, verification and approval process.

Note that QSDP's contained under QSDP 1 are subject to review therefore the following may be affected:

- QSDP 3 - Circuit Books
- QSDP 7 - Design Review Process
- QSDP 29 - Standard Forms

3. Terms and definitions

The following terms and definitions apply in this document:

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

AFC Approved For Construction

ASA Asset Standards Authority

AMS Advanced train control Migration System

ATP Automatic Train Protection; a system which supervises train speed and target speed, alerts the driver of the braking requirement, and enforces braking when necessary. The system may be intermittent, semi-continuous or continuous according to its track-to-train transmission updating characteristics

BG Balise Group; a set of 1 to 3 balises

Controlled Balise Group consists of minimum one controlled balise and one fixed balise

Conventional Trainstop refers to physical contact type trainstop

DMI Drivers Machine Interface

EBI Emergency Brake Intervention

ERA European Rail Agency

ERA Braking Curve Tool customised for AMS and is used to calculate the braking curves of an ETCS fitted train

ESAP ETCS Signalling Application Principles

ESCD Encoder Standard Configuration Definition

ETCS European Train Control System; a three level, unified, modular automatic train protection specification to enhance interoperability across Europe

Fixed Balise Group consists of fixed balises only

GIS Geographical Information System

High Risk Turnout refers to turnout or crossover where there is a risk of derailment due to high speed differential between the line speed and the turnout speed. Other contributing factors include running line geometry, configuration of the turnout and surrounding infrastructure

IBJ Insulated Rail Joint

LEU Lineside Electronic Unit; equipment that controls the balise output based on the state of the signal aspect control

Level Crossing refers to road and pedestrian crossing

LS Limited Supervision; an operation mode in ETCS Level 1

LSSMA Lowest Supervised Speed within the Movement Authority

MTP Mechanised Track Patrol

Overlap deficiency refers to high risk deficient overlaps, high risk catch points within an overlap and high risk level crossings within an overlap; refer to the *Deficient Overlaps, Catch Points and Level Crossings Report* for definitions, criteria and recommendations

QSDP Quality Signal Design Process

Repositioning is used to manage linking of balise groups at facing turnouts/crossovers when specific route information is not given

Rolling stock refers to Electric Multiple Unit (EMU) train. The ETCS on-board equipment will be fitted on A-Sets, C-Sets, H-Sets, K-Sets, M-Sets, T-Sets, V-Sets and S-Sets

RVK Revoke (refers to revoking of previously applied TSM/s and applying linespeed)

TfNSW Transport for New South Wales

TOC Train Operating Conditions manual

TSM Target Speed Monitoring

VAD Vertical Alignment Database

WebGIS Browser based tool containing accurate locations of railway infrastructure

4. Reference documents

To gain a complete overview of the signalling design requirements, the following external documents should be read in conjunction with this AMS Trackside Design Guideline.

European Rail Agency (ERA) Specifications, Baseline 3 Maintenance Release 1:

Subset 026 – System Requirement Specifications

Subset 036 – Form Fit Function Interface Specification (FFFIS)

Subset 040 – Dimensioning and Engineering Rules and Subset

Subset 041 – Performance Requirements for Interoperability

Subset 091 – Safety Requirements for the Technical Interoperability of ETCS in Levels 1 and 2

5. Design Process

5.1. Overview

Refer to the following figure for the trackside design process overview. The figure below identifies the key elements of each design phase.

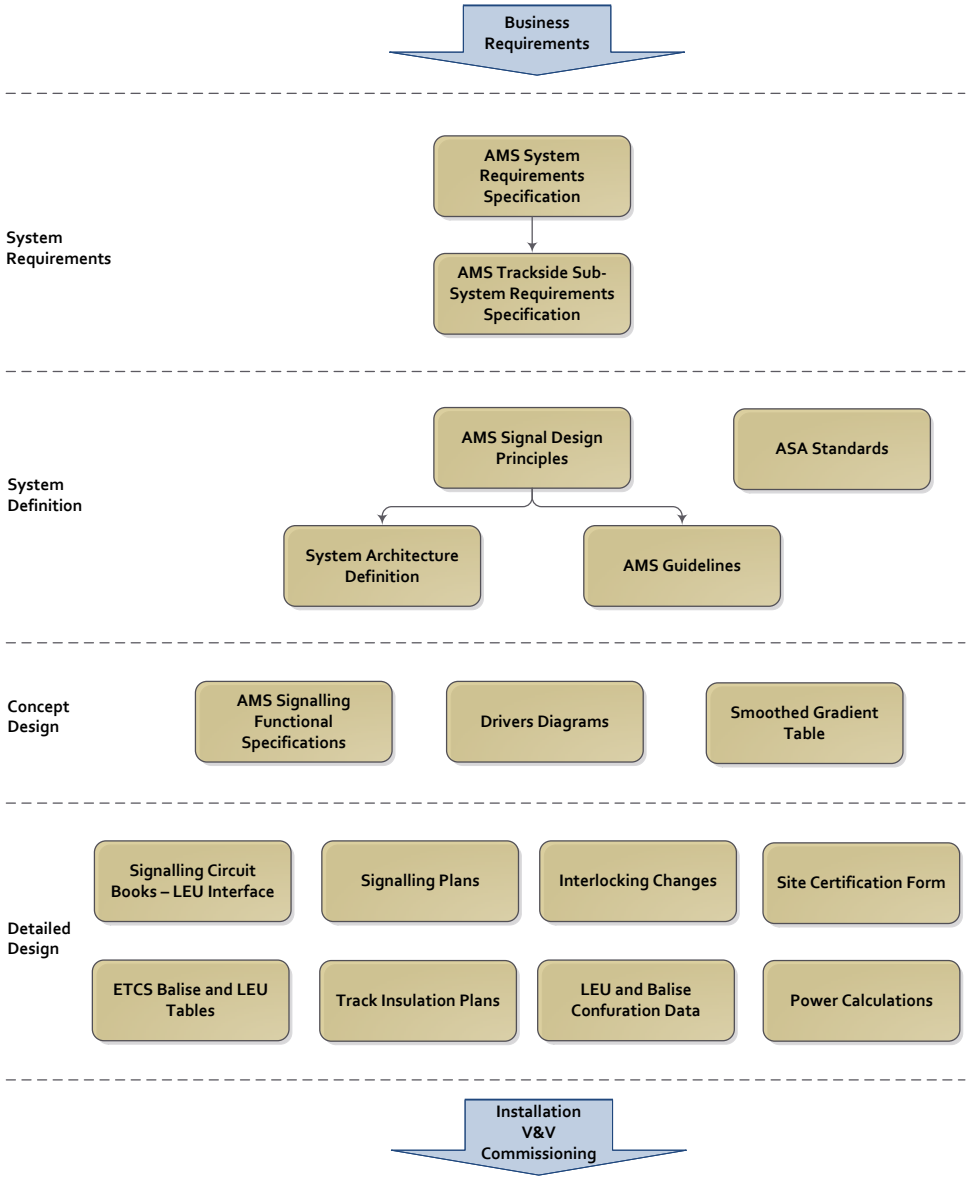


Figure 1: AMS Design Documentation

6. System Requirements

6.1. AMS System Requirements Specification

The System Requirements are developed for the application of AMS on the TfNSW network. This document specifies the functional and non-functional requirements that AMS needs to fulfil in order to satisfy the business needs of TfNSW.

6.2. AMS Trackside Sub-System Requirements

The AMS Trackside Sub-System Requirements define the system design, equipment, installation and maintenance requirements for AMS implementation of the trackside subsystem.

7. System Definition

7.1. AMS Signal Design Principles

The AMS Signal Design Principles have been produced as an AMS project specific document. The principles govern the design and implementation of the AMS as ETCS Level 1 operating in Limited Supervision mode on the TfNSW network until ASA publish the updated ESG 100.31 to include the ETCS principles for LS mode. The principles have been derived from the AMS system requirements documents.

7.2. AMS Standards and Guidelines

The AMS guidelines, including this document, further expand on the AMS Signalling Design Principles and provide detailed information on specific areas of the AMS implementation. The documents are as follows:

- Alstom ETCS Trackside Equipment Set to Work, Testing and Commissioning
- Approach Balise Group Selection and Position Design Guideline
- Balise Arrangement for High Risk Location Design Guideline
- AMS Circuit Design Standard
- AMS Identification of High Risk Speed Sign Reductions
- AMS Identification of High Risk Turnouts (Guideline)
- AMS Look-Ahead Design Guideline
- AMS Trackside – Project Technical Description
- AMS Trackside - Signalling Interface Description
- ATP Construction Drawings M05 500 – 599
- Balise Placement where there is no space
- Cascading Cases - Application Example
- Geographical Data for AMS
- Gradient Simplification Design Guideline
- Resolving Maximum Speed in Areas where Speed Signs are Deficient

7.3. Trackside System Architecture Definition

The purpose of the System Architecture Description (SyAD) is to describe the Advanced train control Migration System (AMS) trackside architecture based on the ETCS trackside equipment supplied by Alstom (see Figure 2).

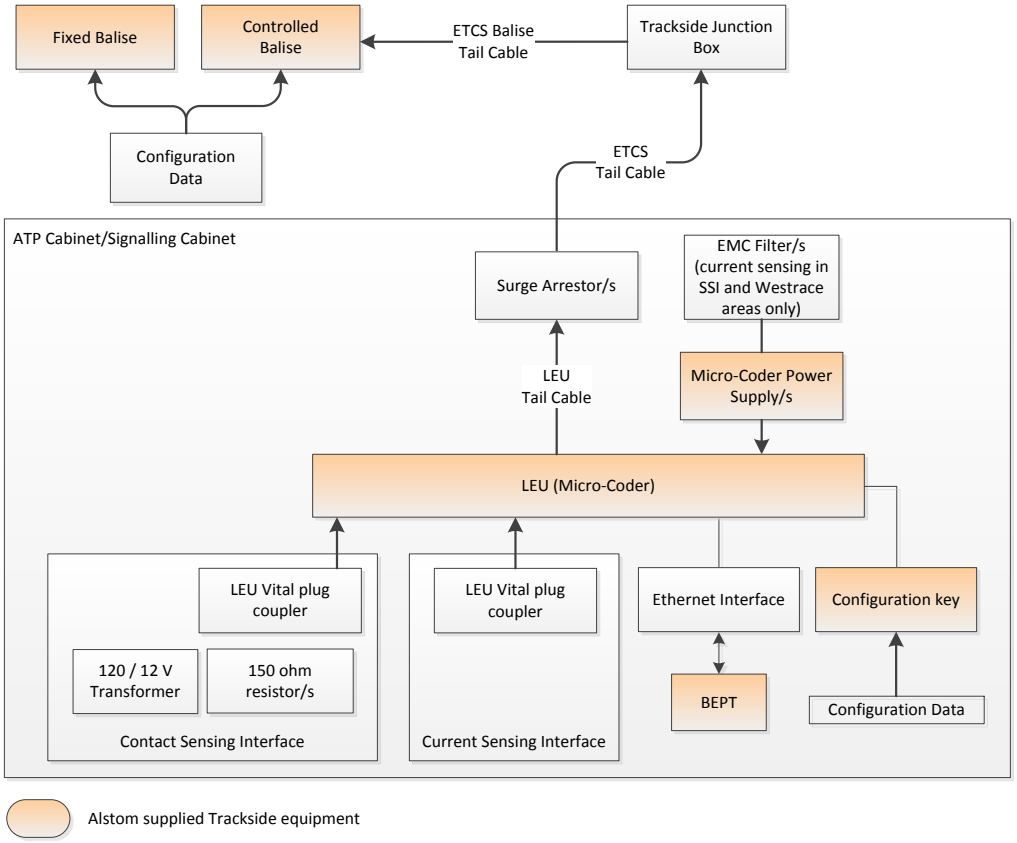


Figure 2: AMS Typical Trackside Architecture

There are four subordinate documents to the SyAD which are:

- Signalling Interface Description (SID)
- Project Technical Description (PTD)
- Power Supply Arrangement Description (PSAD)
- Network Architecture Description (NAD)

7.3.1. Signalling Interface Description

The purpose of the Signalling Interface Description (SID) is to provide detailed technical information that defines the interface between existing signalling equipment and the ETCS Level 1 trackside equipment supplied by Alstom. The SID defines:

- type of elements to be interfaced,
- interface's supported functions,
- interface's general constraints,
- identification of the interface as applicable for the interface addressed (mechanical, electrical, hardware, software or human).

This interface enables the AMS trackside equipment to acquire the status of signals and to send the appropriate telegrams to the Balise groups for high residual risks locations of the networks.

7.3.2. Project Technical Description

The purpose of the Project Technical description (PTD) is to describe the general architecture of the ETCS trackside system that is deployed for the TfNSW AMS project.

7.3.3. Power Supply Arrangement Description

The purpose of the Power Supply Arrangement Description (PSAD) is to provide technical information that defines the interface between existing power supply arrangements and the ETCS trackside system, composed basically of LEUs and balises used for AMS.

7.3.4. Network Architecture Description

The purpose of the Network Architecture Description (NAD) is to provide the general description of the trackside Ethernet network architecture used for the vital communication between the LEUs.

For each subsystem, the list of connections to the trackside Ethernet network is defined.

In particular, the NAD defines:

- trackside network architecture,
- networked elements,
- protocols used for the network.

7.4. Encoder Standard Configuration Definition

This document describes all the standard LEU configurations for data production. It also describes all the standard definitions and abbreviations when implementing the signalling interface.

7.5. ASA Standards

The majority of ASA standards regarding AMS will initially be superseded by the AMS project guidelines and specifications. As the ASA documents are updated and released, they will again become the reference document.

AEO design responsibilities are governed by the ASA standards.

8. Concept Design

The concept design phase includes all the activities needed to define the scope and facilitate the implementation of detailed design.

8.1. Signalling Functional Specification (SFS)

Signalling Functional Specifications are designed to assist client, operators, maintainers and constructors as well as designers in understanding the scope outline and define the scope of the project/scheme, focusing on AMS related aspects, to identify and capture the requirements by the customer and develop a document which provides the scope of works to the designer for the AMS design arrangements and the installer.

The project roll-out specifies the limits of the AMS implementation for each Signalling Functional Specification. As part of the approval process, rail operations and relevant stakeholders shall be consulted and provide input into the Signalling Functional Specification as necessary.

The following design elements shall be summarised in the Signalling Functional Specification:

- The start and end level transition borders, including wrong running at level transition (AMS Signal Design Principles, AMS Functions Network Map).
- The lines within the AMS sector that are not considered for fitment
- Define a continuous speed profile:
    - Speed Signs (AMS Site Surveys, GIS/WebGIS, TOC Manual, Weekly Notices and AMS Identification of High Risk Speed Sign Reductions Guideline)
    - Document discrepancies between the TOC Manual and posted signs on site (TOC Manual, Weekly Notices and MTP)
    - Document the new line speeds where none exist today (Apply the AMS Resolving Maximum Speed In Areas Where Speed Signs Are Deficient Guideline and consult with ASA/ST)
    - Document non-standard speed signs where the spacing between the two speed signs is less than the ERA calculated braking distance for high risk speed signs (AMS Signal Design Principles)
- ETCS Trainstop signals (Circuit Books, Signalling Plans).
- Fixed red signals and permanent stop signs that require either fixed trainstop or ETCS trainstop arrangements (MTP, AMS Signal Design Principles, Circuit Books, Control Tables, Signalling Plans).
- High risk turnouts including repositioning and LSSMA balise groups (GIS/WebGIS, AMS Identification of High Risk Turnouts Guideline, AMS Balise Arrangement for High Risk Location Design Guideline and AMS Signal Design Principles).
- Look ahead requirements to facilitate high risk turnouts and overlap deficiency (AMS Signal Design Principles, AMS Look Ahead Design Guideline and Circuit Books/Control Tables/CBI Data).

- Overlap deficiency (Deficient Overlap, Catch Point and Level Crossing Report, AMS Signal Design Principles).
- Approach balise requirements to facilitate high risk turnouts and overlap deficiency (AMS Signal Design Principles, AMS Approach Balise Group Selection and Positioning Design Guideline).
- Buffer Stop configurations (WebGIS, MTP, Signalling Plans).
- Wrong Running Hazard Balise placement (AMS Signal Design Principles, Signalling Plans).
- BMM placement (MTP).
- Fitment of terminating and/or turnback platforms (AMS Signal Design Principles, Signalling Plans).
- Fitment of AMS yards (AMS Signal Design Principles, Signalling Plans).
- Non-standard balise group configurations / placement (AEO Site Survey, Balise Placement Where There is No Space Guideline and AMS Signal Design Principles).
- Balise placement areas impacted by existing transponders, concrete plinths & guard rails (Metronet / DTRS maps, MTP).

A Signalling Functional Specification (SFS) is produced, based on information available from the signalling plan/s and circuit book/s. It includes the Drivers Diagram (developed from the signalling plan) to reflect positions of the balises.

8.1.1. Design Inputs

- TOC Manual
- Weekly Notices
- MTP Video
- VAD – primary source for gradient data
- GIS/WebGIS – primary source for location data
- Detailed Site Survey (DSS) drawings, MetroNet Transponder Maps – alternative source for location data
- Geographic Data for AMS – details on when alternative source is used for gradient and location data
- AMS Signal Design Principles
- AMS Standards and Guidelines
- AMS Site Surveys
- Existing signalling plans, circuit books and control tables
- System Architecture Description (SyAD) and subordinate documents

It is the AEO's responsibility to ensure that the latest design inputs are used.

8.1.2. Design Outputs

- AMS Signalling Functional Specifications including drivers diagrams (using signalling plans with balise information as a base).
- Smoothed Gradient Table
- AMS SFS Documentation Baseline Pack

9. Detailed Design

The diagram in Appendix A shows the process and documentation flow from detailed design through to final records handback.

9.1. Signalling Plan Design for AMS

Signalling Plans shall cover the whole of the works including interface details at the scope of work limits.

The signalling plan shall be designed to reflect the Signalling Functional Specifications, the details shown on signalling plans shall include:

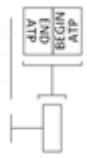
- Balise symbols including:
  - AMS Symbols (see section 9.1.1)
  - Balise Names (see section 9.1.2)
- Big Metal Mass – start and finish locations

Accurate geographical measurement of Balise Group positions is critical to the safe operation of AMS, refer to the Geographic Data for AMS Guideline.

9.1.1. ATP Symbols

The following symbols shall be used to update ETCS information on signalling plans.

Symbol	Description
	Fixed balise (line represents the track shown on the signalling plan)
	Controlled balise (line represents the track shown on the signalling plan)
	Begin ATP marker (transition from level 0 to level 1), orientation and size to be consistent with yard limit boards.
	End ATP marker (transition from level 1 to level 0), orientation and size to be consistent with yard limit boards.

Symbol	Description
	Double sided ATP marker (transition from level 1 to level 0 and vice versa), orientation and size to be consistent with yard limit boards.
 ETCS hazard point	Denotes a hazard point in relation to an overlap deficiency

9.1.2. Balise and Balise Group Naming

Each balise must have a unique name following the below format:

WWWXXXXXXXX_YYYY_Z_T

Where:

- **WWW** is the Location/Site Code of the nearest station as listed on the "1. Location or Site" worksheet of "T MU AM 01007 TI *Asset Reference Codes Register*".
- **XXXXXXXX** is a maximum of eight characters that describe the signal name, the points number or the balise group kilometrage.

  Signal name

  - The signal name shall be used for balises in controlled balise groups, using the name of the signal interfaced to the LEU.
  - The signal name shall be used for balises in fixed balise groups where the primary purpose of the balise group requires it to be positioned a relative distance to a signal. Examples include dedicated balise groups that toggle-off the display of the lowest supervised speed within the movement authority (LSSMA) near the protecting signal of an overlap deficiency, wrong running entry/exit balise groups on a plain line and dedicated balise groups near signals that perform an early mode change after a turnback.
  - Where the signal name is used it shall be as per the signal identification plate however it shall not include spaces, decimal points or any suffix denoting line name.
  - Where more than one balise group on the same line is required to be named after the same signal, a suffix shall be appended to the signal name to maintain uniqueness. Examples of suffixes include 'L' for toggling-off LSSMA, 'C' for an early mode change after a turnback, 'A' for an approach balise group or 'A1', 'A2', etc. for multiple approach balise groups, starting at 1 for the approach balise group farthest in advance.

  Points number

- The points number shall be used where the primary purpose of the balise group is for repositioning.
- The points-end letter is typically not required as the included line name abbreviation usually removes any ambiguity. No interlocking prefix is required.

Balise Group Kilometrage

- The approximate kilometrage of the reference balise shall be used for balises that are not required to include the signal name or points number.
- The kilometrage shall be based upon kilometrages given by the Sydney Trains GIS, rounded off to the nearest 10 m. The decimal point shall be omitted.
- The kilometrage used in the balise name shall consist of five digits, padded with leading zeros where necessary.

- **YYYY** is the four-character track code as listed on the "13. Track Names" worksheet of "T MU AM 01007 TI *Asset Reference Codes Register*". These track codes are the abbreviations of the line names shown on the signalling plan.
- **Z** is the number denoting the 'Position In Group' also known as N_PIG.
- **T** is the letter denoting the balise type (i.e. 'F' for Fixed or 'C' for Controlled).

The corresponding balise group ID will only consist of "WWWXXXXXXXX_YYYY".

9.1.3. Design Inputs

- Signalling Functional Specification
- MTP Video
- AMS Signal Design Principles
- AMS Standards and Guidelines
- AMS Site Surveys
- GIS/WebGIS
- Smoothed Gradient Table

9.1.4. Design Outputs

- Signalling Plans (AFC)
- Site Certification Forms

9.2. ETCS Balise and LEU Tables

The Balise and LEU tables shall be combined into a single book that aligns with circuit book areas, consisting of the following pages:

- Cover Page
- Control Sheet(s)
- ETCS Balise Table(s)

- ETCS LEU Table(s)

The ETCS Balise and LEU Tables shall be named by prefixing the circuit book number with ET. If a section of line is not part of a circuit book, then any tables required for that section may be included within the ETCS Balise and LEU Tables that provides the best fit.

The ETCS Tables are used to assist data preparation, verification, validation and commissioning activities. ETCS Tables shall be maintained as a signalling record following the trackside commissioning, in the same way as signalling control tables are maintained.

9.2.1. ETCS Balise and LEU Tables Cover and Control Sheets

The Cover and Control sheets shall be completed in the same way as those used for the control tables.

9.2.2. ETCS Balise Table Design

The ETCS Balise Table(s) shall provide details of every ETCS balise group used. A template is provided in the *ETCS Balise and LEU Tables – Template* Excel workbook. The information required in each column is described in the Balise Table Guide worksheet of the workbook.

9.2.2.1. NID_BG

The balise group identity number (NID_BG) shall be allocated during the detailed design phase as per the range shown below.

Area	Range
1	1000 - 1499
2	1500 - 1899
3	1900 - 2299
4	2300 - 2699
5	2700 - 3599
6	3600 - 4299
7	4300 - 4799
8	4800 - 5599
9	5600 - 6799

9.2.3. LEU Table Design

An ETCS LEU Table shall be provided for every LEU used. A template and examples are provided in the *ETCS Balise and LEU Tables – Template* Excel workbook. The information required in each field is described in the LEU Table Guide worksheet of the workbook.

9.2.4. Design Inputs

- Signalling Plans

- Circuit Design Standard
- Signalling circuit books
- Interlocking Control Tables/Interlocking Data
- AMS Signal Design Principles
- Signalling Functional Specification

9.2.5. Design Outputs

- ETCS Balise and LEU Tables

9.3. Track Insulation Plans

The Track Insulation Plan describes the bonding and track circuit information on the rail network. The implementation of AMS may require an insulated block joint (IBJ) to be moved or the removal of a section of guard rail (necessitating the insertion of Benkler Joints). These situations will require the relevant Track Insulation Plan to be updated as part of the AMS design.

9.4. Circuit Book – LEU Interface Design

For each LEU interface to the signalling system, configuration is required for:

- High risk turnouts
- Overlap deficiency
- ETCS Trainstops (at signals)

The AMS Circuit Design Standard shall be used to determine the base interface design. Where no applicable standard circuit exists, the closest configuration shall be selected from the standard circuits and design alterations shall be carried out to suit the particular application. Any interface design shall comply with the AMS Signal Design Principles. The ETCS additions to the circuit book will be in the following sections:

- LEU to signalling interface shall be included in the circuit book between H30 and I29.
- LEU to balise interface shall be included in the circuit book between H30 and I29.
- LEU input analysis shall be included in the Y sheets of the circuit book.

LEU name on the interface design shall follow the naming convention as described in T HR SC 10031 ST while LEU sub-assets such as resistors, LEU power supply units, bypass terminals, Ethernet switches etc. shall omit the location code denoted by “WWW”.

For each circuit book design, an installed data form to record the version of the applicable data files for the LEU and balises shall be included as part of the design.

9.4.1. Design Inputs

- AMS Signal Design Principles
- AMS Circuit Design Standard
- Signalling Plan

- Signalling Functional Specification
- Signalling Circuit Book
- ETCS Balise and LEU Tables

9.4.2. Design Outputs

- Circuit Book – LEU Interface Design
- Signalling control tables (where applicable)

9.5. SSI/CBI Data

In certain look-ahead scenarios, a significant cost saving can be made if look-ahead is implemented through SSI/CBI data modification. This solution is acceptable provided that there is no impact on the project schedule and safety of the existing system.

9.6. Data Production

9.6.1. Overview

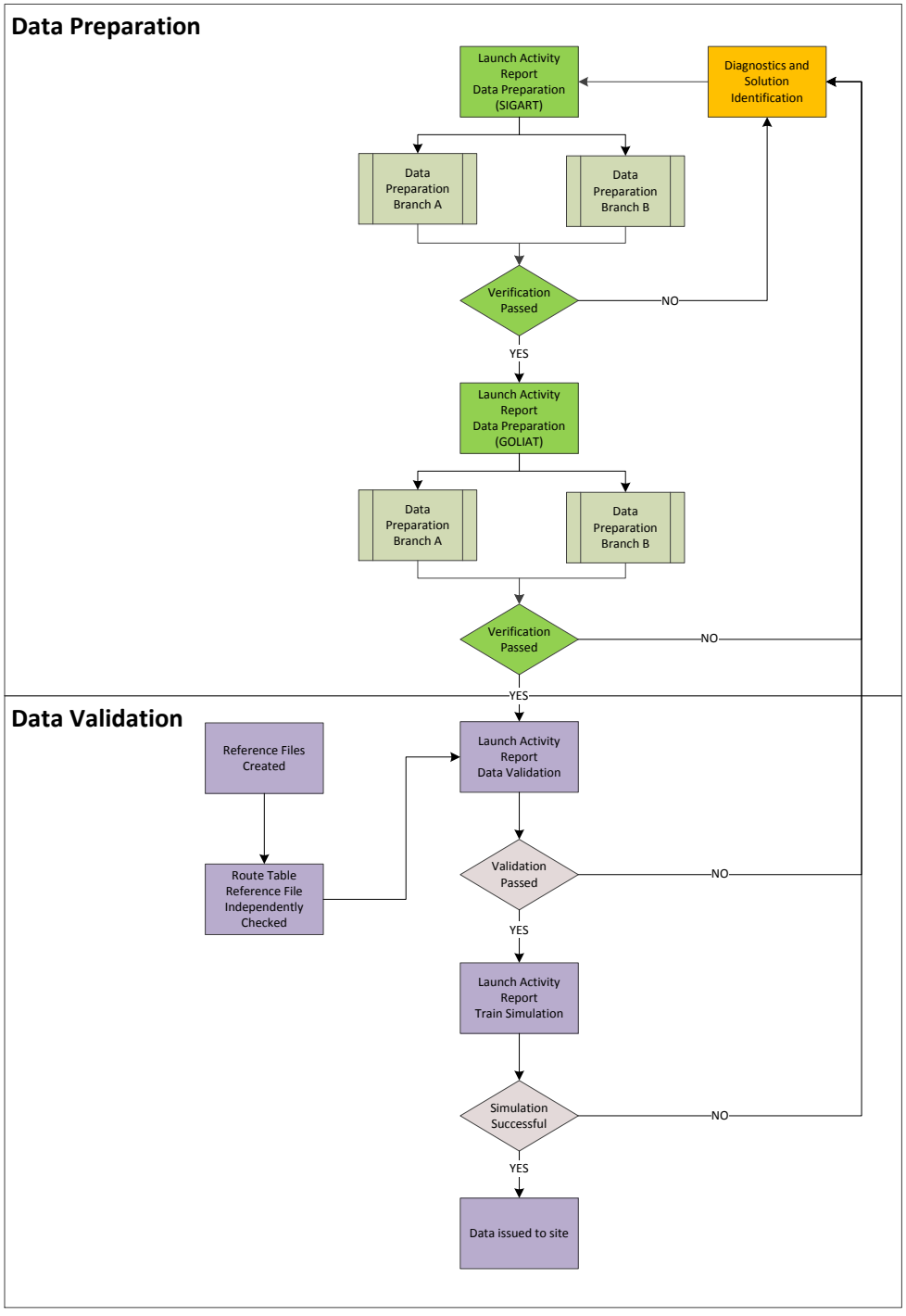


Figure 3: AMS Data Production Process

9.6.1.1. Design Inputs

- Signalling Plan
- Signalling Functional Specification
- AMS Signal Design Principles
- AMS Standards and Guidelines
- Geographical data including manual measurements
- ETCS Balise and LEU Tables
- ETCS Signalling Application Principles
- Encoder Standard Configuration Definition
- AMS Data Preparation Process
- AMS Manual Modification Rules
- Smoothed Gradient Table
- Validation reports (applicable during data modification only)
- Release Note for data preparation (applicable during data modification only)
- Site Certification Forms (applicable during data modification only)

9.6.1.2. Design Outputs

- Configured RailML database (from SIGART)
- LEU and Balise configuration data (including Release Note) for validation

9.6.2. Data Validation

9.6.2.1. Design Inputs

- Signalling plans
- Signalling Functional Specification
- Generic and Specific Data Validation rules
- AMS Data Validation Process
- AMS Data Validation Manual and Exception Rules
- ETCS Signalling Application Principles
- Encoder Standard Configuration Definition
- Geographical data including manual measurements
- ETCS Balise and LEU Tables
- Smoothed Gradient Table
- LEU and Balise Configuration Data (including Release Note) from Data preparation

9.6.2.2. **Design Outputs**

- Data Validation Test Reports
- Encoder Configuration Mask Activation Test Report
- LEU and Balise Configuration Data
- Approved Data Release note for Construction

Appendix A AMS Roadmap

The following diagram shows the documentation flow from detailed design through to final records handback.