Transport for NSW

Reference material

Advanced train control Migration System (AMS) Specifications – Balise Placement Where There is No Space

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 Transport for 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.

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AMS PROJECT SPECIFICATIONS:
Balise Placement Where There is No Space

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Guideline – Applicable to Transport Projects AMS Program

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Document History

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0.1	17/03/2016	J Firmstone	Minor formatting and AMS introduction updates. Initial AMS review.
1.0	11/04/2016	J Firmstone	First review and update. Final

Foreword

This design guideline forms a part of the TfNSW suite of railway signalling principles and standards which detail the requirements for use on the TfNSW heavy rail network. This AMS Project Specification design guideline specifically covers the design application for non standard balise placements at a signal.

To gain a complete overview of signalling design requirements, this document should be read in conjunction with the suite of ASA and AMS Project Specific signalling design: principles, standards and guideline modules.

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1. Introduction

ETCS Train Stops, High Risk Turnouts and some High Risk Reduced Overlaps will require a balise group (containing a controlled balise) to be located just before a signal.

Signals are located near insulated joints, about 1m before the tuning unit of a tuned loop or 2.5m into a tuned loop (latest standard).

The train must receive information from a controlled balise before the A track is occupied to ensure the intended information is read. This, coupled with the location of the antenna on the rollingstock relative to the first axle, places requirements on the positioning of balises relative to the track circuit boundary.

Also, all balises of a balise group which contains a controlled balise should be located beyond the reading range of the antenna on the train, to prevent the on-board equipment prematurely receiving balise information if the train has stopped close to the balise group.

Hence the controlled balise is placed about 6m before the signal. However there are some locations on the network where it may not be possible to obtain the necessary distance. These places include where signals are mounted on platforms and where turnouts are located extremely close to the platform end. A good example is Hornsby Platform 2.

2. Purpose

This design guideline forms a part of the TfNSW suite of railway signalling principles, standards and guidelines that detail the requirements of the design to be used on the TfNSW heavy rail network for ETCS signal balises.

The primary purpose of this document is to define the design requirements, such that situations where the train receives update information from a controlled balise after the A track is occupied, are avoided.

A secondary purpose is to provide guidelines to enable consistency of the design of trackside ETCS systems.

2.1. Scope

This document provides guidance to AEOs on ATP ETCS AMS integration.

This document provides requirements for the option of changes to the signal interlocking where the balise group at a signal cannot be placed in the standard arrangement.

2.2. Application

This document applies to AEOs engaged to carry out signal design for ETCS works.

3. Reference documents

The following documents provide additional requirements information. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document applies.

Transport for NSW standards:

ESG 100 Signal Design Principles

4. 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

AMS Advanced train control Migration System

ASA Asset Standards Authority

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.

ETCS European train control system; a three level, unified, modular automatic train protection specification to enhance interoperability across Europe

IASS Indicating Automatic Signal Sections (system)

TfNSW Transport for New South Wales

TVS Train Visibility System

5. Strategy

In situations where the standard balise placement relative to the signal cannot be achieved due to physical constraints, if it is possible to relocate the signal (and associated equipment) without adversely affecting sighting or maintainability, then this shall be the preferred course of action. This maximises consistency of design and consistency of driver experience.

In cases where this cannot be or is impractical to be achieved, the following may be designed. This is based on removing the A track from the immediate restoring of the LEU. It is considered safe because the condition can only exist when a train is occupying the A track, (ie the train is effectively over the balise, so it cannot be falsely read by another train) and is similar to last wheel replaced signals, but does not have the disadvantage of a potential read through by a train following.

6. Definition of When Required

The controlled balise location must be beyond the train antenna range at the stopping point.

If this requires the controlled balise to be placed closer to the track circuit boundary than the distance between the first axle and the antenna, then this strategy is required to be implemented.

It is expected that this modification will only be necessary for platform departure signals, where trains will need to regularly pull up close to the signal to fit the rear of the train on the platform. At other locations, there will generally be no adverse impact if the train is required to stop 2 – 3 metres earlier than today.

7. Signals at Tuned Loops

When the track circuit boundary is a tuned loop the shunting point plus equipment delay time makes it very unlikely that a LEU valid movement authority would be removed before the antenna had passed the point of track dropping. In such situations, this modification is not required.

8. Automatic Signals

Where the signal is an automatic signal, the balises may be placed in a position just past the usual stopping place for the train. This is likely to be closer to the insulated joints but could be into the next track circuit, and even into the points area, however this would be an extreme case.

A new signal control relay is to be provided for the LEU HR which shall not take the 'A' track, but otherwise contains all the same controls as the signals HR.

The LEU HR shall prove the Signal HR up which would then be stuck out by a contact of the LEU HR. The LEU HR is also used in the HDR to prevent the higher aspect relays dropping when the signal HR drops due to A track occupancy.

The LEU HR shall also have an additional control of berth track occupied. This is to replace the LEU control relays to stop once the train is past. The berth track occupied should be in series with the LEU stick path so that the stick is only effective with the berth occupied.

If the signal is directly fed from a CBI where current sensing of lamps would otherwise be used to provide inputs to the LEU, then it will be necessary to provide additional outputs specifically for the LEU similar to the relay option above. This will need a data change.

The LEU control relays will need to be proved de-energised in the track stick circuit. The LEU inputs should not contain any trainstop reverse functions as this would restore on A track dropping and negate the intended function of the LEU HR.

The LEU HR is not to be provided in IASS/TVS inputs.

9. Controlled Signals

9.1. Most Relay Interlockings

Where the signal is a controlled signal the same principles as for an automatic signal apply. However in order to ensure that all signal interlocking functions are included in the LEU control, an LEU UCR function is needed in the relay room. This will need to exclude the A track the SR and RUR. The replacement functions described above for the automatic signal will need to be provided in this circuit. The LEU UCR shall prove the main UCR energised and then this is stuck out with the LEU UCR and an occupied contact of the berth track, same as for an automatic signal. This permits the dropping of the LEU UCR with route cancellation under all circumstances except A track occupation. The UCR is then sent to the field location via a new LEU HR normal double switch HR circuit. At the field location the suite of signal control relays is the same as the automatic signal arrangement. The LEU HR is to be back proved in the NGPR, but not the NGK. As the NGK does not include the LEU HR, there is no change to signallers indications.

A function to replace the LEU UCR in the event of a signaller cancelling the route needs to be provided to break the stick path. This could be a contact of the (N)R.

9.2. Direct Lamp Fed Installations & CBI Hybrid Arrangements (eg SSI and Microlok)

The LEU aspect controls will need to be provided as new outputs from the CBI (similar to the auto signals above). This will involve data changes. The data will need to be configured as described above for the relay interlocking. To permit the signaller to restore the signal in the event of berth track occupancy the cancelling control needs to be included. In the case of Microlok interlockings, the UN function can be utilised.

10. FMEA Analysis of LEU HR Configuration

Situation	System Response	Satisfactory Yes/No	Safe Yes/No	Comments
1 'A' Track fails, signal at Stop, train present or not present.	Neither HR nor LEU HR can pick. Safe side failure.	Yes	Yes	
2. Signal clear then 'A' track fails, no train on berth track.	Both HR and LEU HR drop. Safe side result.	Yes	Yes	
3 Signal clear then 'A' track fails with train on berth track.	HR drops, signal and train stop returns to stop. LEU HR remains up. If 'A' track fails and is corrected, track will not restore as LEU HR up. For controlled signal, Signaller will need to cancel route to drop LEU HR. For Auto signal, first train will need to follow procedure to pass signal at stop. A track will pick up after train. Because 'A' track was up this situation is the same as a RIFOD. If trains runs past will pick up new MA, hence RIFOD did not occur, although signal will be at stop.	Yes	Yes	Same scenario as designed functionality. Cancellation of route by signaller will occur as he will attempt to reclear signal. Hence no residual failure – circuit is functional. For Auto signal, present rules require the driver having observed the signal return to stop then re-clear to report the incident and proceed with caution. Additional delay by passing signal at stop by procedure is minimal.
4. Signal clear and signaller cancels route.	Both HR and LEU HR drop.	Yes	Yes	

5. Signal clear and loss of route control due to detection loss, SPAD etc.	Both HR and LEU HR drop For 'A' track SPAD see 2 and 3 above	Yes Yes	Yes N/A	While the LEU HR does not drop if a train is in a position to read it, the potential for collision has already occurred. If opposing SPAD causes this, the signal and LEU would have been at stop.