Function: Engineering (Signalling)
Document Type: Standard

Train Order Working

ESS-08-02

Applicability

ARTC Network Wide

Publication Requirement

Internal / External

Primary Source

ESD-08-01

Document Status

Version #	Date Reviewed	Prepared by	Endorsed	Approved
1.0	22 May 26	Engineering Services	Principal Signalling Engineer	A/Manager Engineering Services 22/05/2026

Amendment Record

Amendment Version #	Date Reviewed	Clause	Description of Amendment
1.0	22 May 26	Multiple	Signages aligned with the operational rules and other editorial changes throughout the document. The document has been renumbered as per EGP-01-02.

Table of Contents

1 Introduction

1.1 Purpose

The purpose of this document is to describe the trackside infrastructure arrangements, generic types of layouts, signage, and indicators required for the rail traffic movement in the Train Order Working (TOW) territories. It is intended to accommodate all ARTC TOW operating environments.

1.2 Scope

This document applies to the TOW territories of the ARTC Network. This document does not cover the operational requirements of the TOW.

1.3 Responsibilities

The Manager Engineering Services is the Document Owner. For any query, initial contact is to be made at standards@artc.com.au. The Signal Designer is responsible for the implementation of this standard in any new/upgraded signalling designs.

The Signal Design Manager/Signal Designer/Project Manager is responsible for managing the process, ensuring consistency with the current practices in a specific jurisdiction, and ensuring consultation with stakeholders. The Signal Design Manager/Signal Designer/Project Manager is responsible that the signalling design meets the operational requirements and is safe So Far as is Reasonably Practicable (SFAIRP).

1.4 ARTC Reference Documents

The following documents support this standard:

- Applicable rules for respective TOW territory, including:
  - National Safeworking Framework Rule NSFS 502 Train Order
  - National Safeworking Framework Rule NSFR 604 Indicators and Signs
  - National Safeworking Framework Rules applicable to CoP Territory
  - TA20 – ARTC Code of Practice for the Victorian Main Line Operations
  - ARTC Network Information Books (as applicable for the corridor)
- ETA-11-01 Trackside Signage
- ESD-03-01 Level Crossing Design
- ESD-05-01 Common Signal Design Principles S1
- ESD-08-03 Placement of Yard Limit Signs
- ETS-03-00 – Points and Crossings
- ESS-06-02 – Points

1.5 Definitions

Term	Description
Active Control (Level Crossing Equipment)	Track crossing incorporating physical barriers, warning signs, line marking, lights, and audible devices to alert vehicular or pedestrian traffic that rail traffic is approaching or crossing. Examples include gates, booms, flashing lights, bells and sirens.
Crossing Loop	A running line in single-line territory, with entry and exit ends connected to a main line, that is used to hold rail traffic to allow other rail traffic to cross or pass.
Electrical Indicator	Electrical Indicator is the generic term used for the various types of electrical (colour light) indicators on ARTC's TOW territories.
Main Line	The running line generally used for the through movement of rail traffic between locations.
Mechanical Indicator	Mechanical Indicator is the generic term used for the various types of mechanical indicators on ARTC's TOW territories.
Network Controller	A Competent Worker who authorises, and may issue, occupancies and Proceed Authorities, and who manages train paths to ensure safe and efficient transit of rail traffic in the ARTC Network.
Shunt / Shunting	To move trains, rakes of vehicles, or vehicles on tracks for purposes other than through-movement.
Siding	A portion of track where vehicles can be placed clear of the running lines.
Train Order	An authority issued by a Network Controller in Train Order territory to direct the movement of rail traffic.
Train Order Working	Train Order Working (TOW) is a system of safeworking in which written or electronic authorities for the occupancy of the track and movement between and within TOW Locations are issued to, and acted upon, by rail traffic crews.

2 Train Order Working Trackside Infrastructure

2.1 Introduction

Train Order Working (TOW) is a system of Safeworking in which written or electronic authorities are issued to authorise rail traffic movements and Safeworking activities.

Trackside TOW signage is provided to identify the limits of authority at a TOW location and to provide advanced warning of an approaching TOW location.

Trackside TOW infrastructure is provided as required, this includes mechanical or motorised points and active level crossings.

Indicators are provided to confirm the TOW infrastructure conditions and status are correct for the required rail traffic movement. Infrastructure conditions may include points (set and locked), and active level crossings are operating or will operate on approach by rail traffic. In TOW territory, Indicators do not provide the movement authority for rail traffic to proceed. A TOW authority is the movement authority.

ARTC Network Information Books and respective Rule Book shall be reviewed to determine local operating procedures associated with trackside infrastructure at specific TOW locations. The NIBs define the operating procedures for the local area.

An Operational Requirements Specification should be developed for new works to define specific operational and TOW infrastructure requirements.

2.2 Trackside Signage

Trackside TOW signage arrangements are detailed below, also refer to ETA-11-01 Trackside Signage Standard for more details around signage configuration and standard drawings.

Existing signage in some TOW sections or corridors may not be compliant. If existing legacy signage is retained for new works, consultation is required with ARTC Operations, and a waiver shall be submitted if required.

2.2.1 Location Ahead Sign

A Location Ahead sign indicates an approaching TOW location, including the location name and distance between the Location Ahead sign to the corresponding Yard Limit sign.

2.2.2 Landmark Sign

A Landmark sign indicates advance warning of an Electrical Indicator ahead.

2.2.3 Yard Limit Sign

A Yard Limit sign defines the geographical limits of a TOW location.

2.2.4 Shunt Limit Sign

A Shunt Limit sign defines the shunting limits of a TOW location.

2.2.5 Clearance Post Sign

A Clearance Posts sign defines the authority limits of the Main Line or Crossing Loop at a TOW Crossing Location.

2.2.6 Begin Train Order Working Sign

A Begin Train Order Working sign defines the beginning of the TOW territory at an adjacent Safeworking interface boundary.

2.2.7 End Train Order Working Sign

An End Train Order Working sign defines the end of TOW territory at an adjacent Safeworking interface boundary.

2.2.8 Network Control Boundary Location Sign

A Network Control Boundary sign defines the limits of the Network Control Boundary where an interface boundary exists between two adjacent TOW Network Control Boards.

2.2.9 Train Order Kilometrage Signs

Signs defining the kilometrage of a specific sign (e.g. Yard Limit or Shunt Limit) may be mounted on the same post. The kilometrage shown on these signs shall align with the kilometrage data used by the TOW System.

2.3 Mechanical Indicators

Mechanical Indicator is the generic term used for the various types of mechanical indicators across ARTC's TOW territories.

Mechanical Indicators confirm the setting and locking status of points.

Mechanical Indicators shall be consistent for a specific section or corridor to ensure consistency in the TOW territory.

2.3.1 Mechanical Point Indicator

A Mechanical Point Indicator (MPI) indicates if the points are set and locked, or not set and locked either:

- For the normal position, where the points can only be locked in the normal position, or;
- For the normal and reverse position, where the points can be locked in either position.

Where the points can be set and locked in either the normal or reverse position, a Mechanical Points Setting Indicator may be provided to indicate the direction for which the points are set and locked. Refer to Section 2.3.2 Mechanical Point Setting Indicator.

2.3.2 Mechanical Point Setting Indicator

A Mechanical Point Setting Indicator (PSI) indicates the status of points, where the points can be locked.

2.3.2.1 Mechanical Point Setting Indicator – Main Line

A Mechanical PSI may be provided in conjunction with another indicator that shall display the points status (e.g. locked) as detailed below:

- Green – Points set for main line.
- Yellow – Points set for crossing loop or branch line.
- Red – Points set for siding or dead end.

The indicator body shall rotate by 90º around a vertical axis as the points change position to provide the relevant indication. The indication shall be double-sided.

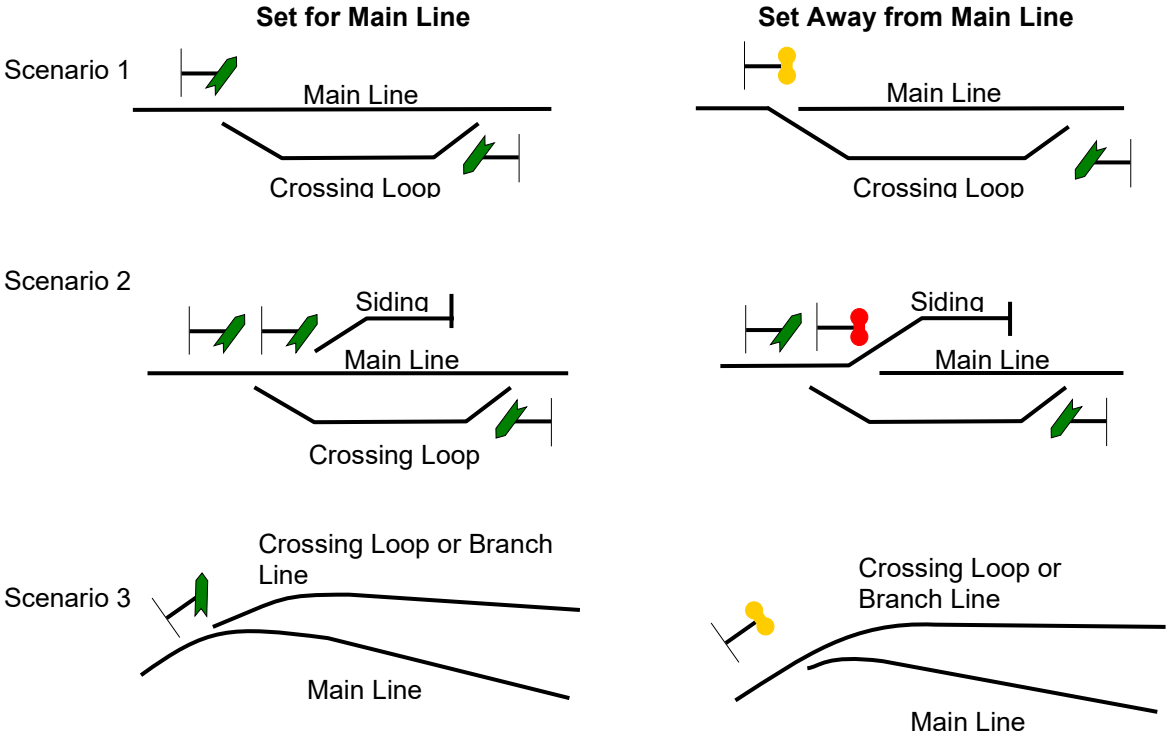

Figure 1: Example of point setting indicator scenarios

2.3.2.2 Point Setting Indicators - Not On The Main Line

Yellow Circle: Indicates the crossing loop points are set for the crossing loop or yard points are set for the straight.

White Square: Indicates the crossing loop points are set for the siding or yard points are set for the turnout route.

2.4 Electrical Indicator

Electrical Indicator is the generic term used for the various types of electrical (colour light) indicators across ARTC's TOW territories.

Electrical Indicators confirm the status of trackside TOW infrastructure.

Electrical Indicators shall be consistent for a specific section or corridor to ensure consistency in the TOW territory.

2.4.1 Electrical Point Setting Indicator

Electrical Point Setting Indicators (PSI) can be provided to indicate the status of catch points, derailer, or points. A PSI shall consist of a dwarf colour light point indicator.

For catch points, 2 red lights indicate that the points are open (derailing) position or not set. A steady white arrow indicates that the points are set and locked.

For derailers, 2 red lights indicate that the derailer is in the raised position (derailing) or not set. A steady white arrow indicates that the derailer is lowered.

For points, 2 red lights indicate that the points are unlocked. A steady white arrow indicates that the points are set and locked.

2.4.2 Main Line Indicator

Main Line Indicators (MLI) are provided on approach to facing points and should be visible to approaching rail traffic at a distance of 800m. MLIs may also be provided at the trailing point end in lieu of a PSI.

A pulsating white light indicates infrastructure conditions are set for the rail traffic to proceed at normal speed. A red light indicates an infrastructure item past the MLI is not set correctly.

Where MLIs and motorised points are used, an angled steady white band of lights shall be used to indicate facing points are set for the turnout. This may be provided at mechanical points where a both-ways lock is used.

Where the MLI reads up to a point where the rail traffic may be required to stop, a yellow indication shall be used. Examples of such a situation include:

1. Where multiple MLIs are installed, a yellow light is used in the first indicator encountered to indicate that the next MLI may be displaying red.
2. Where a Point Indicator is installed in advance of the MLI and the points are not detected by the MLI (normally in conjunction with a level crossing located in the centre of a location.
3. Where the MLI reads up to a "STOP' sign (normally at a line terminus).

MLIs shall be identified by a single black letter on a white retro-reflective diamond attached to the front of the MLI post. The white diamond is provided in place of a marker light.

Where necessary for sighting reasons, a Repeater may be provided. The repeater shall take the same form as an MLI.

2.4.3 Light Indicator

Light Indicators display the setting of facing and trailing main line points and may be provided in addition to Mechanical Points Setting Indicators.

Light Indicators may be a single head with a tricolour indication or multi-head with red, yellow and green indications. Light Indicators shall be positioned on approach to facing points, and where possible, be visible to approaching rail traffic at a distance of at least 2500m. Where necessary for sighting reasons, Light Indicator Repeaters may be provided.

2.4.4 Approach Locking on Electrical Indicators

Where a rail vehicle approaches an Electrical Indicator displaying an aspect other than red, the MLI shall be approach locked.

The time releases shall ensure a rail vehicle is nearly at or has come to a stand at the approach locked Electrical Indicator.

The minimum time for releasing for approach locking of Electrical Indicators shall be 120 seconds. However, a longer timer release may be required based on the site-specific requirements e.g. longer crossing loops.

Approach locking may be released by either:

- The Electrical Indicator at stop and the passage of the train past the Electrical which is approach locked.
- The train being otherwise proved to have come to a stand.
- Where there is no train within the approach area, the approach locking may be released upon replacing the Electrical Indicator to stop.

2.4.5 Signals within TOW Territory

In some situations, a signal may be located within the TOW authority limits. In this situation, the signal may not be passed without the Rail Traffic Crew being in the possession of a TOW Authority.

Advisory signage maybe provided stating that Rail Traffic Crews must be in the possession of a TOW Authority before passing the signal.

2.5 Points

Points in TOW territories may be mechanical or motorised as determined by the operational requirements for the TOW section or corridor.

The point operation may be released by an Operating Key, or a secondary secured key released from a Releasing Switch or Duplex Lock.

Where the operation of the points is released by an Operating key, the lever lock is arranged so that the key may only be removed when the points are locked and are in the normal position. Where a both-ways lock is provided, the points may be locked in normal or reverse position.

Mechanical Ground Frames shall be identified by a single letter e.g. ‘A’ or ‘B’ or ‘C’ etc. Where a new connection is required, the next letter after the existing Ground Frame shall be used. When a Ground Frame is removed, existing Ground Frames do not require renaming.

Where trailable points are provided, advisory signage shall be provided.

Where Electrical Indicators are provided at facing points, the status of the points detection and facing point lock shall be proved in the aspect of the Electrical Indicator.

2.5.1 Track Locking

A rail vehicle detection system shall be provided over motorised points, which when occupied, locks the points in a set position. The section for track locking of points shall extend up to the clearance points on the turnout.

The occupation status shall be used for track locking of the points motor circuit and is not included in the aspect of Electrical Indicator.

When an Electrical Indicator has displayed an indication that the points are set, locked and detected, approach track locking to the points shall be applied as detailed in Section 2.4.4 Approach Locking on Electrical Indicators. Release of approach

Refer to ETS-03-00 and ESS-06-02 for more information around the application of derailers and catch points.

Where derailers and catch points are provided, advisory signage shall be provided.

2.6 Level Crossings

Active level crossings located within or adjacent to a TOW location may be interfaced with the trackside infrastructure including Electrical Indicators, Pushbutton Control Units and Operating keys to ensure safe operation and prevent unnecessary activation (e.g., tail flashing) during shunting or when rail traffic is standing at a Yard Limit sign.

Where required, the level crossing shall be interlocked with Electrical Indicators to prove the crossing is operational before a proceed indication is displayed.

Refer to ESS-03-02 Section 10 and Section 4.8 Train Order Locations with Level Crossings of this standard for the principles around the operation of level crossings in train order working territory.

2.7 Local Push Buttons Control Units

Where required for operational purposes, local push button control units shall be provided to enable rail traffic crew to manually operate trackside TOW infrastructure.

Typical applications for local push button control units in TOW territory include:

- **Electrical Indicators:** Clearing (setting to proceed) and restoring (cancelling to stop).
- **Power Operated Points:** Operating point machines to the required position.
- **Active Level Crossings:** Manually activating or cancelling the operation of active level crossing warning devices.
- **Local Operations:** Controlling site-specific interlocking functions to facilitate shunting movements or local isolation.

2.8 Operating Keys

Operating keys shall be used and secured in a locking mechanism when unlocking or initiating the operation of trackside TOW infrastructure. This includes:

- Mechanical points and ground frames.
- Pushbutton controls that operate / set Electrical Indicators, motorised points and active level crossings.

The type of Operating keys and the locking mechanism should be consistent with the existing arrangements within a TOW section or corridor.

2.8.1 Operators Key

Operators key may be used to operate points, electrical indicators, or active level crossings. Operators Keys are individually numbered and are a controlled personal issue.

2.8.2 Master Key and Safes

Master keys may be used to unlock and operate points. Master keys shall be secured in a trackside safe for the TOW section.

3 Types of Train Order Working Locations

3.1 Introduction

The configuration of TOW locations shall be in accordance with the TOW Safeworking system.

3.2 Block Location

A Block Location may be used to divide a TOW section to increase the capacity for follow-on movements.

A Block Location has no crossing loop or siding infrastructure and consists of Yard Limit signs to define the limits of the location.

The Yard Limit signs shall be located a minimum 500m apart to ensure a safety overlap for opposing movements.

Location Ahead signs shall be located a minimum 2000m or train service braking distance (whichever is the greater) from the corresponding Yard Limit sign.

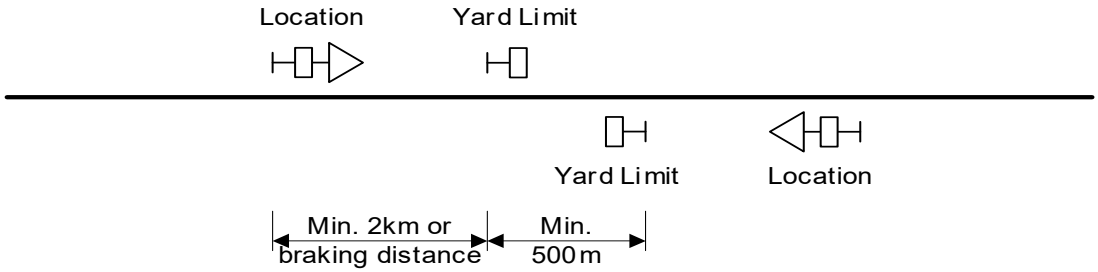

Figure 2: Example of block location

3.3 Crossing Location

A Crossing Location consists of rail infrastructure to allow the crossing and passing of rail traffic.

A Crossing Location may also include siding infrastructure for shunting or storage of rail vehicles. Where sidings are located at Crossing Locations, they may be considered outside of the TOW territory.

The authority limits of a Crossing Location are defined by Clearance Posts and/or Electrical Indicators (e.g. EPIs or MLIs).

Shunt Limit signs may be provided and located as required. The requirement and location of Shunt Limit signs shall be in consultation with ARTC Operations.

Yard Limit signs shall be provided for Crossing Locations to define the limits of the location.

If Shunt Limit signs are required, the Yard Limit shall be located at a minimum of 500m apart from the opposing Shunt Limit sign to ensure a safety overlap for opposing rail vehicle movements.

Location Ahead signs shall be located at minimum of 2000m or train service braking distance (whichever is the greater) from the corresponding Yard Limit sign.

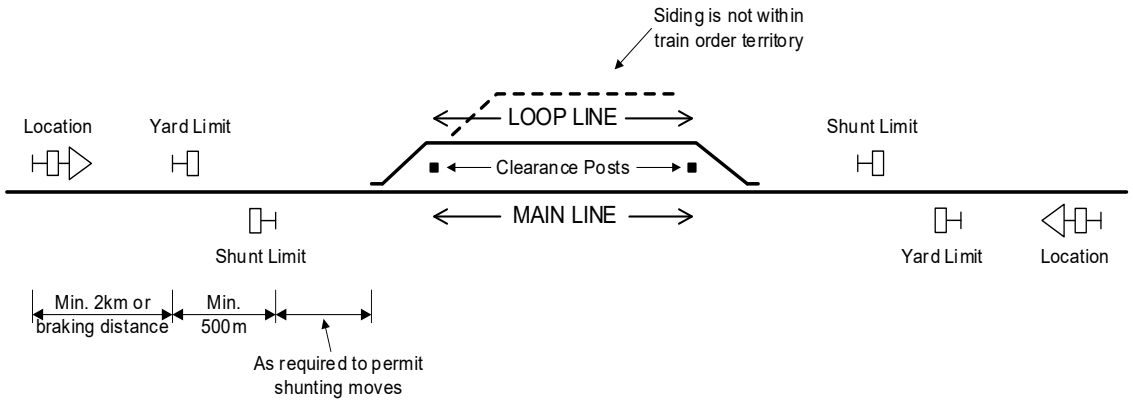

Figure 2: Example of a crossing location

3.4 Interface Location

A TOW Interface Location defines the interface between either:

- An adjacent Safeworking system, or;
- Separation of TOW Network Control Boards.

3.4.1 Adjacent Safeworking Systems Interface

A TOW interface to an adjacent Safeworking system is defined by a Begin and End Train Order Working sign. The location of these boards shall be determined to align with the trackside Safeworking infrastructure at the interface boundary.

A Do Not Proceed Past This Point Unless Authorised sign shall be located prior to or at the Begin Train Order Working sign.

3.4.2 TOW Network Control Board Interface

An interface between two TOW Network Control Boards is defined by Network Control Boundary signs.

Location Ahead signs shall be located at a minimum of 2000m or train service braking distance (whichever is the greater) from the corresponding Network Control Boundary sign.

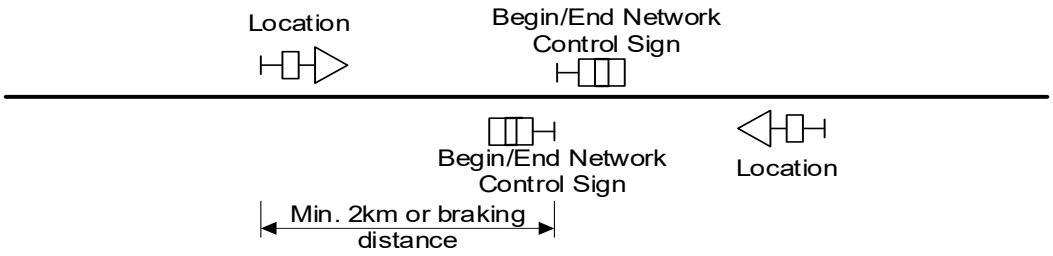

Figure 3: Example of TOW location with Network Control Board Interface

3.5 Siding Location

A Siding Location may be provided. The siding is considered outside of the TOW territory.

Shunt Limit signs may be provided to identify shunting limits. The distance between the points and the Shunt Limit signs shall be determined in conjunction with ARTC Operations.

Yard Limit signs shall be located at a minimum of 500m beyond the Shunt Limit sign at each end of the location, to provide separation between approaching rail traffic and any shunting movements.

Location Ahead signs shall be located at a minimum of 2000m or train service braking distance (whichever is the greater) from the corresponding Yard Limit sign.

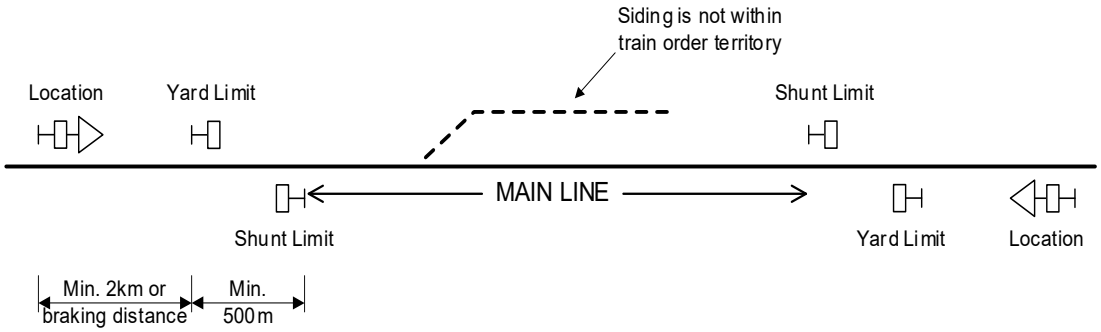

Figure 4: Example of TOW location with siding

4 Typical TOW Layout Guidelines

4.1 Introduction

TOW trackside infrastructure layouts should be in accordance with this section. Types of Electrical Indicators (e.g. MLI, PSI or Light Indicator), Mechanical Point Indicators (e.g. MPI) and Operating keys shall be consistent with the existing arrangements for the TOW section or corridor.

ARTC Network Information Books and the respective Rule Book shall be reviewed to determine local operating procedures associated with trackside infrastructure for the TOW corridor, prior to commencing design modifications. The NIBs define the local operating procedures and form an important role in the allocation or modification of infrastructure associated with TOW.

In some instances, the infrastructure arrangements at a particular location may not suit the typical layouts detailed below. In these instances, it is necessary to discuss the specific arrangements at that location with ARTC Operations and in accordance with ARTC Standards.

4.2 TOW Locations within Close Proximity

Where Locations are within close proximity, the following configurations may apply:

1. Where a section between two locations is required the configuration in Figure 6 applies. In this case, the Location Ahead sign shall not be within the Yard Limit of the departing location.
2. Where distance between locations does not support the configuration in Figure 6 the locations may be separated by back-to-back Yard Limit signs as per Figure 7.
3. Where the distance between locations does not support the configuration in Figure 7, the locations may be separated by a reduced separation distance between Yard Limit and opposing Shunt Limit signs as per Figure 8.

Note: In this configuration the TOW Safeworking system should provide a procedural control to ensure safe separation between opposing rail traffic movements.

Where the distance between locations cannot support any of the above configurations, the locations should be considered as a single location.

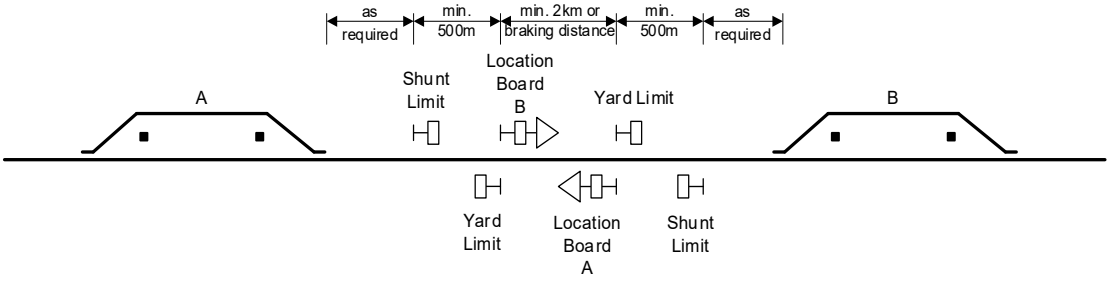

Figure 5: Example of a section between two TOW locations

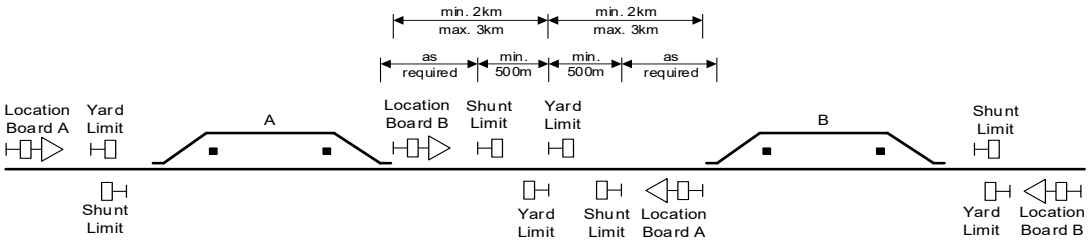

Figure 6: Example of TOW locations with back-to-back yard limits

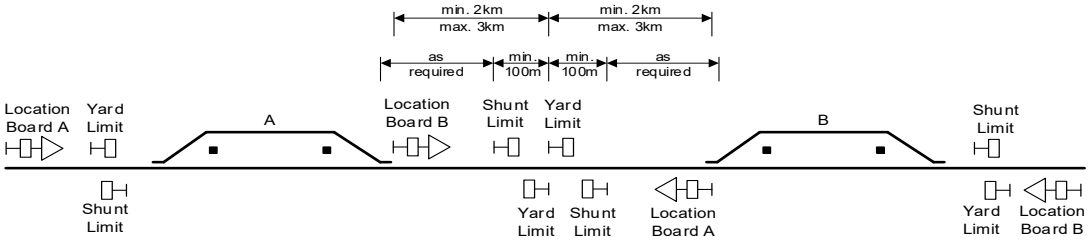

Figure 7: Example of TOW locations with reduced separation distance with back-to-back yard limits

4.3 TOW Locations with Mechanical Points and Mechanical Indicators

In some instances, the infrastructure arrangements at a particular location may not suit the typical layouts detailed below. In these instances, it is necessary to discuss the specific arrangements at that location with ARTC Operations and in accordance with ARTC Standards.

All main line mechanical points shall have a Mechanical Indicator, unless an Electrical Indicator is provided. Where Mechanical Indicators are operated from the facing point lock, a means should be provided to protect the points from being run through and damaged in the reverse position. Such a device would be a derail or catchpoint. Trailable point mechanisms do not require this protection.

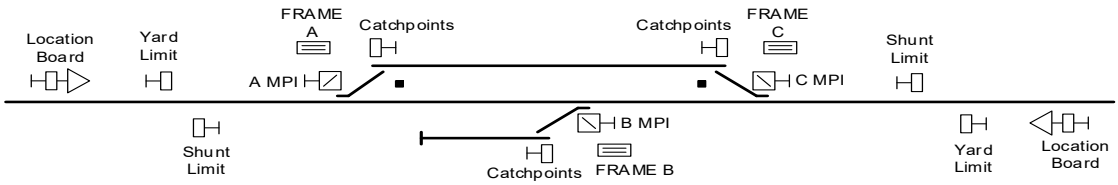

Figure 8: Example of TOW location with point indicators

Some examples where the use of Mechanical Indicators are not suitable, consideration should be given to the use of Electrical Indicator.

1. Sighting time of the indicator is insufficient such as track geometry, geographical, etc.
2. At locations known to be affected by environmental impacts.
3. Where Electrical Indicators are predominantly used at other locations on the line (i.e. for consistency of indication).

4.4 TOW Locations with Mechanical Points and Electrical Indicators

Electrical Indicators can be used in lieu of Mechanical Indicators where required for rail traffic operations, in conjunction with other infrastructure (e.g. level crossings or motorised points).

Where Electrical Indicators are located at the facing point end, they should be positioned no further than 300m from the point end.

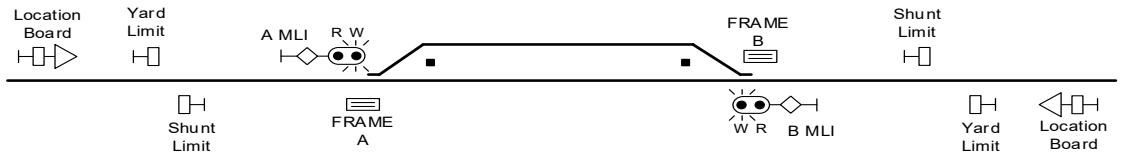

Figure 9: Example of train order location with main line indicators

4.4.1 TOW Locations with Mechanical Points and Electrical Repeater Indicators

When an Electrical Repeater Indicator is used, read-through issues between the Yard Limit sign and the repeater should be considered. The Yard Limit sign shall not be located within 300m of the Repeater.

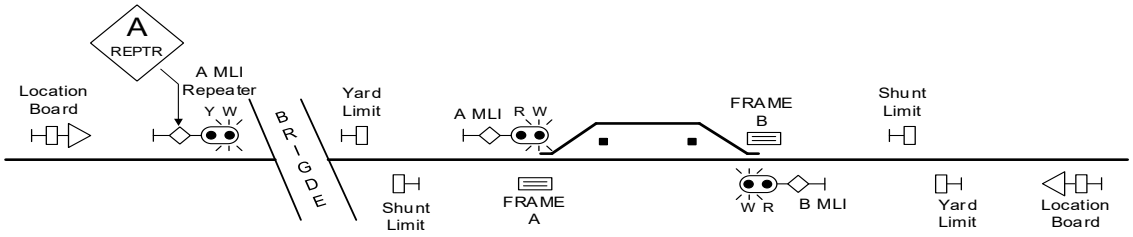

Figure 10:Example of TOW location with repeaters

4.5 TOW Locations with Electrical Indicators and Motorised Points

4.5.1 General Arrangement

Electrical Indicators shall be provided at the facing point end and may be provided at trailing end. Electrical Indicators at the facing end may be supplemented by a turnout indicator.

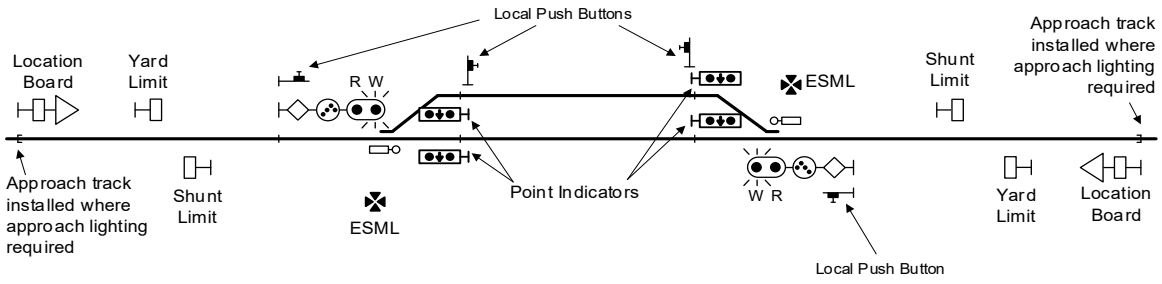

Figure 11: Example of TOW location with motorised points

4.5.2 Points Setting

Examples of interlocking of points at locations permits the following movements:

1. Up through rail traffic
2. Down through rail traffic
3. Up rail traffic to Loop
4. Down rail traffic to Loop
5. Loop Up rail traffic departure
6. Loop Down rail traffic departure

Setting of points can be achieved by:

- Controlled remotely from a locomotive,
- Controlled remotely from a Network Control Centre, or
- Local pushbuttons.

Cancellation of the points setting shall be performed by local pushbutton operation using Operating keys. Loop departures shall be controlled by local pushbutton operation using Operating keys.

4.6 TOW Locations with Multiple Electrical Indicators within a Location

Additional Electrical Indicators may be provided to indicate the status of points and level crossings within TOW locations. Some examples include:

1. Multiple points within a location, and
2. One or more active level crossings within a location.

The first Electrical Indicator repeats the indication of the second Electrical Indicator and provide the status of all main line points between the two Electrical Indicators. A caution (yellow indication) shall be displayed on the first Electrical Indicator when the second Electrical Indicator displays a stop (red indication).

Alternatively, a separate landmark sign may be provided for the second Electrical Indicator.

Additional Electrical Indicators should be provided where the distance from the first Electrical Indicator to the facing points exceeds 3km, or for specific site and/or operational requirements.

Refer to Section 4.8 Train Order Locations with Level Crossings for examples of level crossings within TOW locations.

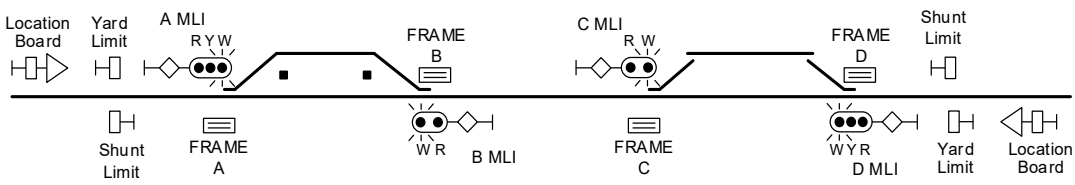

Figure 12: Example of additional electrical indicators within TOW locations

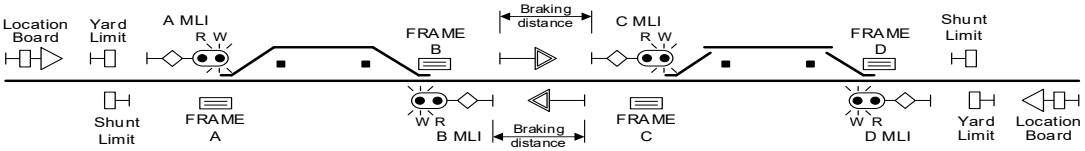

Figure 13: Example of additional electrical indicators within TOW locations with a landmark sign

4.7 Arrangement of Train Order Locations with In Cab Activated Points and Local Push Button Control

4.7.1 General Arrangement

This section provides infrastructure arrangements at a TOW location using In Cab Activated Points System (ICAPS).

The status of the facing and trailing points shall be displayed by an Electrical Indicator.

Self-restoring points shall be provided and the ability to be operated by either local push buttons or remotely from the locomotive by the rail traffic crew.

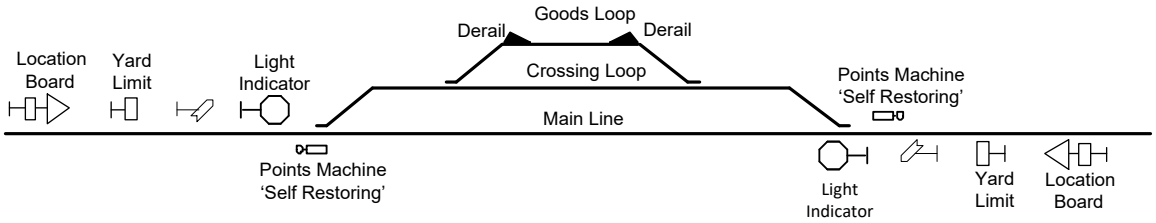

Figure 14 Example of a TOW location with ICAPS

4.7.2 Points Setting

Examples of interlocking of points at locations permits the following movements:

1. Up through rail traffic
2. Down through rail traffic
3. Up rail traffic to Loop
4. Down rail traffic to Loop
5. Loop Up rail traffic departure
6. Loop Down rail traffic departure

Setting of points can be achieved by:

- Controlled remotely from a locomotive, or
- Local pushbuttons.

Loop departures shall be controlled by local pushbutton operation using Operating keys.

When points are requested to reverse to enter the loop, the indicator shall restore to 'red' and a 90 second timer shall commence. At expiry of the 90-second timer the points shall then set for the loop, and the indicator shall then display the 'flashing yellow'.

After the movement has proceeded over the points and clears the track circuit, the points shall restore to the normal position upon the expiry of a 90-second timer.

4.7.3 Operating Points from Local Pushbutton

Local pushbutton control panel for points shall be installed at each end of the loop.

The panel shall consist of 3 push buttons to operate the points to either normal or reverse, and to cancel. Two indicator lights shall indicate if the points are occupied, or if the points are available for operation.

The push buttons and indicator lights shall be contained within a control box. The control box shall have a contact switch. When the door of the box is opened it will place the indicator at the respective end of the location to a red indication and initiate a 90-second timer during which points cannot be operated.

Upon initiating a command from the pushbutton panel, the points will be locked, and no other command can be initiated unless the control box door is closed and re-opened (timer sequence will recommence).

Upon selecting the command to enter the loop and successful communication of the command has been received, the indicator shall restore to ‘red’ and a 90 second timer shall commence. At expiry of the 90 second timer the points shall then set for the crossing loop, and the light indicator shall then display the ‘flashing yellow’.

Where applicable, after the movement proceeds over and clears the points track circuit, the points shall restore to the normal position automatically upon the expiry of a 90 second timer.

4.7.3.1 Push Button Controls:

Pushbuttons that shall be provided inside the control box**:**

Normal (Coloured Green): Operates the points to the ‘Normal’ position provided, no ICAPS command has been entered, and the 90-second timer has expired.

Reverse (Coloured Red): Operates the points to the ‘Reverse’ position provided, no ICAPS command has been entered, and the 90-second timer has expired.

Cancel (Coloured Black): After a command has been initiated and the points are locked, selecting this command shall start the 90-second timer to allow the points to be reset.

4.7.3.2 Control Box Lights

Lights within the pushbutton control box shall display the status of the points as follows:

Track Occupied (Coloured Red): Indicates that the points track circuit is occupied, and the points are locked. This indication may also be displayed if a fault exists at the points.

Points Released (Coloured Green): Indicates that the 90 second timer has expired, and the points are available to operate.

4.7.4 Operating Points from a Locomotive

Locomotives shall be provided with ICAPS to allow rail traffic crew to remotely operate points. The points control is only available when the locomotive is within the set limits of the 'strike in' zone.

The 'strike in' zone shall be located 2km from the facing points, with a length of 3-6km. Refer to Figure 16.

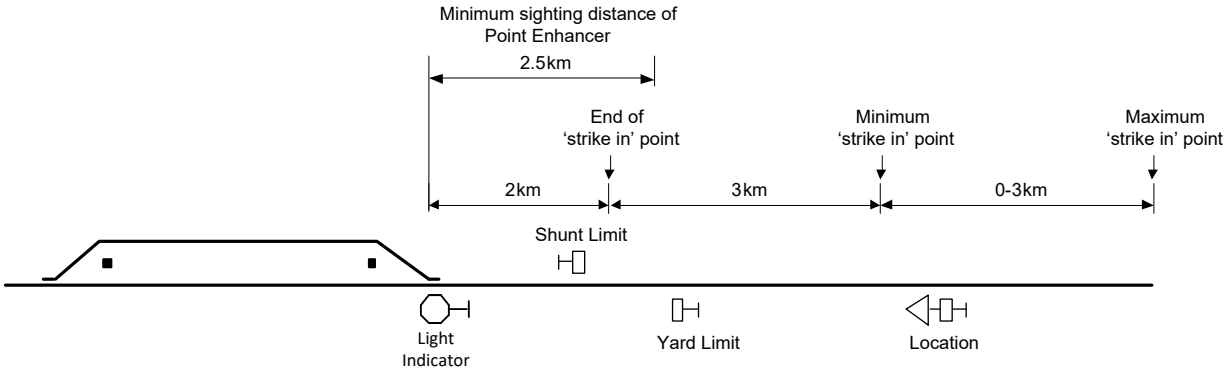

Figure 15: Example if ICAPS 'Strike In" zone

4.8 Train Order Locations with Level Crossings

4.8.1 Introduction

The layout of TOW locations with active level crossings should be in accordance with this section. This section should be read in conjunction with ESS-03-02.

4.8.2 Arrangement where the Level Crossing is some distance from the Loop/Siding

Where a level crossing is located some distance from the loop/siding at a TOW location, the Yard Limit and Shunt Limit signs should be located to avoid the unnecessary operation of the level crossing.

Examples of arrangements are:

1. If there is sufficient distance between the loop/siding and the level crossing, the Yard Limit sign shall be located so rail traffic standing at the Yard Limit sign is clear of a level crossing at the rear and does not cause tail-flashing. Refer to Figure 17.
2. The Yard Limit and Shunt Limit signs shall be located at the extremities of the level crossing approach tracks so that the level crossing falls between the signs. Refer to Figure 18.

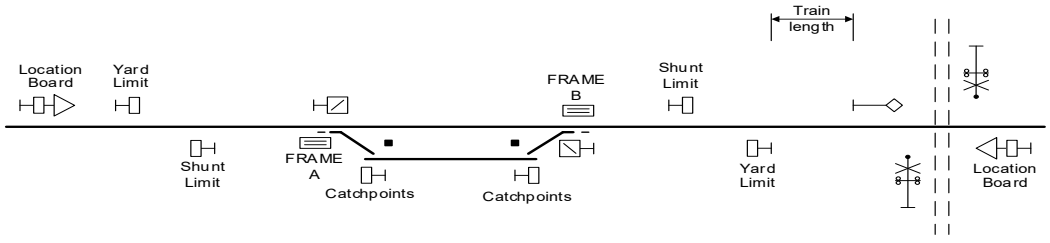

Figure 16: Example of level crossing some distance from a TOW location

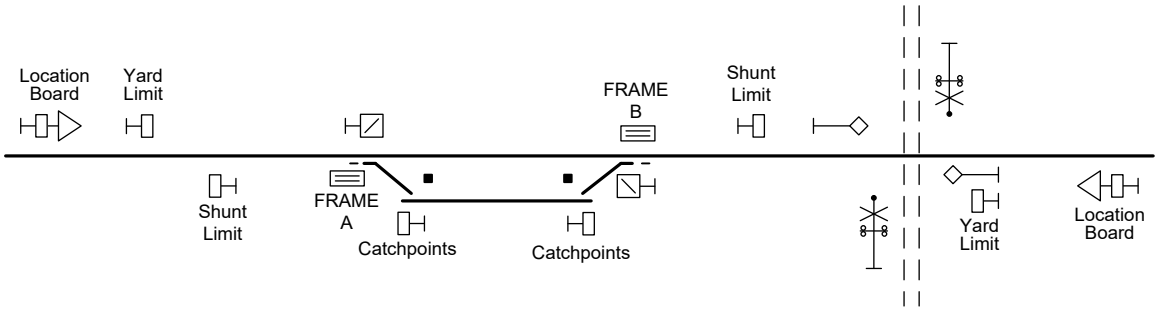

Figure 17: Example of level crossing some distance from a TOW location

Where above implementations are not possible or causes additional complications (for example, due to the proximity of a second level crossing or TOW location), an Electrical Indicator may be used to prevent unnecessary operation of the level crossing. The Electrical Indicator should be at stop and clears when rail traffic has authority to proceed. Refer to Figure 19.

Clearing of the Electrical Indicator can be achieved by:

a. Controlled remotely from the locomotive,

b. Controlled remotely from a Network Control Centre, or

c. Local pushbuttons.

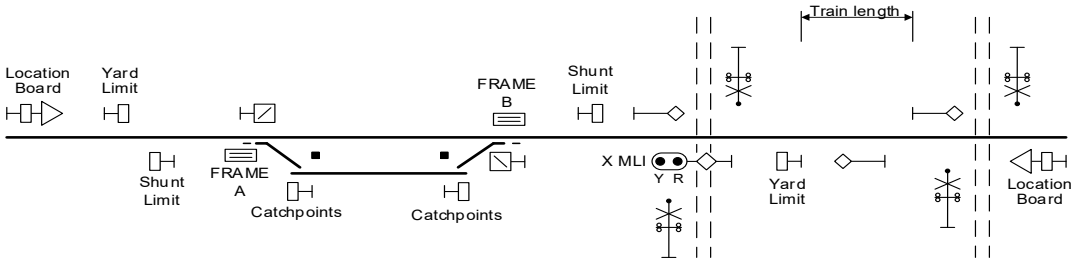

Figure 18: Example of level crossing some distance from a TOW location with electrical indicators

Electrical Indicators may also be used to prevent tail-flashing of a level crossing due to rail traffic standing at a Yard Limit sign. The Electrical Indicator should show a pulsating white aspect but should revert to stop until the departure track section is unoccupied. A Landmark sign should be provided. Refer to Figure 20.

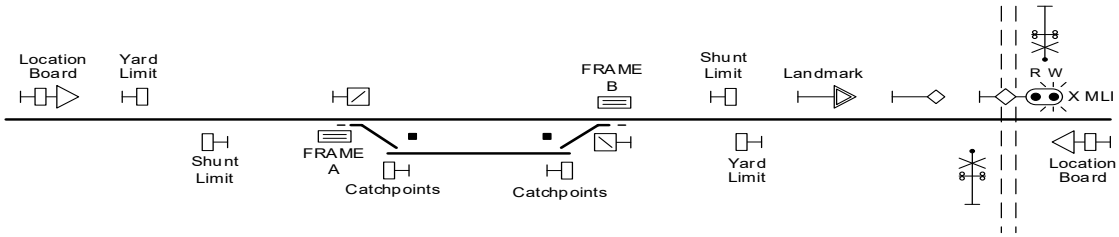

Figure 19: Example of level crossing some distance from a TOW location with electrical indicators to prevent tail flashing

4.8.3 Arrangement where the Level Crossing is close to the Loop/Siding

Where a level crossing is located close to the loop/siding and the level crossing approach track will be occupied in shunting moves, an Electrical Indicator shall be provided.

Points at the location are released by an Operating key. A releasing switch or duplex arrangement may be provided. Removing the Operating Key or key from the releasing switch will cause the Electrical Indicator to revert to red and the level crossing to cease operation after the approach release timeout period.

Local Push Buttons shall be used to operate the level crossing during shunting operations. Local push buttons should be provided at the points and at the Electrical Indicator. If shunting space is available, the Shunt Limit sign may be located adjacent to the Electrical Indicator.

Operation of the local push button shall activate the level crossing to enable rail traffic to shunt across the level crossing. The cancel button shall deactivate the level crossing operation. Refer to Fig 21.

An Electrical Indicator can display red and indicates that the level crossing is operating before the Electrical Indicator clears.

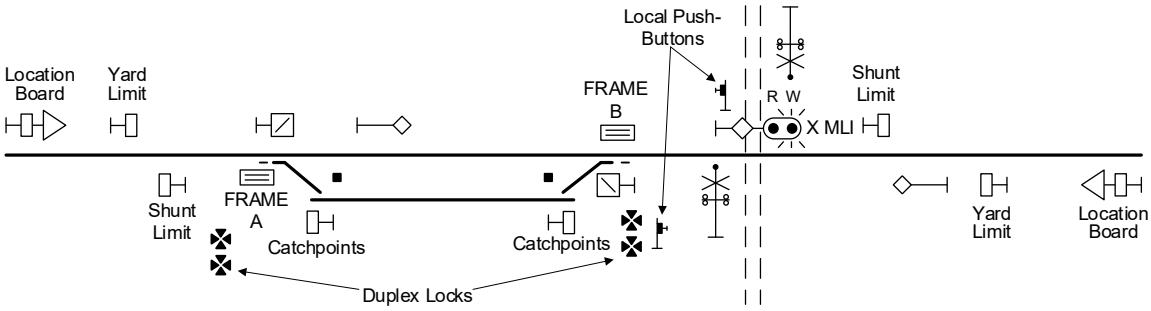

Figure 20: Example of level crossing close to a TOW location

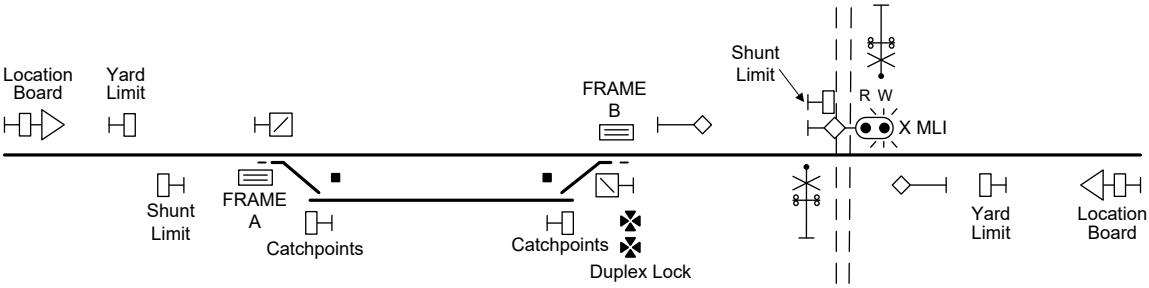

Figure 21: Example of level crossing close to a TOW location

4.8.4 Arrangement with Sidings on each side of the Level Crossing

At locations with sidings on or near the approach track on each side of a level crossing, a combination of the arrangements as described in Section 4.8.1 and Section 4.8.3 shall apply, with the arrangements on each side of the level crossing considered separately.

To eliminate the need to detect points through the location where Point Indicators are used, an Electrical Indicator located at the level crossing may indicate yellow in lieu of a pulsating white. When the points are provided with point indicators and are located 300m or less from the Electrical Indicator, the ground frame should be proved in the yellow indication of the Electrical Indicator. Refer to Figure 23.

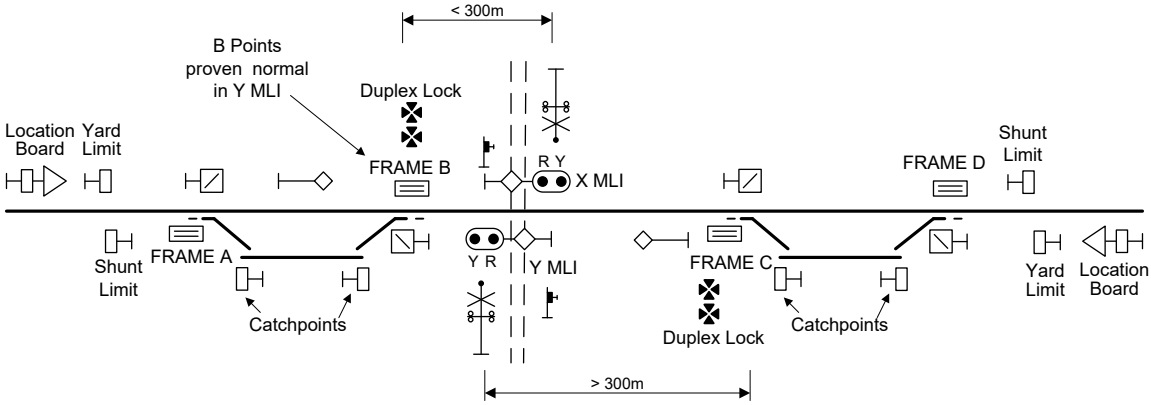

Figure 22: Example of level crossing with sidings on each side

4.8.5 Arrangement where Rail Traffic Stops on Approach to a Level Crossing

Where rail traffic regularly stops on the approach to a level crossing, steps should be taken to prevent the level crossing from operating until the rail traffic is ready to proceed (refer to ESD-03-01). In TOW territories, the Electrical Indicator at the level crossing shall indicate red on the approach of the rail traffic. Once the rail traffic is ready to proceed, the level crossing may be operated as per ESD-03-01.

Where the rail traffic is scheduled to regularly stop (typically a passenger train), a timer may be used to hold the Electrical Indicator at red until the rail traffic is scheduled to proceed. The Electrical Indicator should display a pulsating white light at other times.

4.8.6 Arrangement with Level Crossings at Locations with Electrical Indicators

Where active level crossings are located adjacent to locations equipped with an Electrical Indicator, multiple Electrical Indicators may be required at one or both directions of travel as per Figure 24.

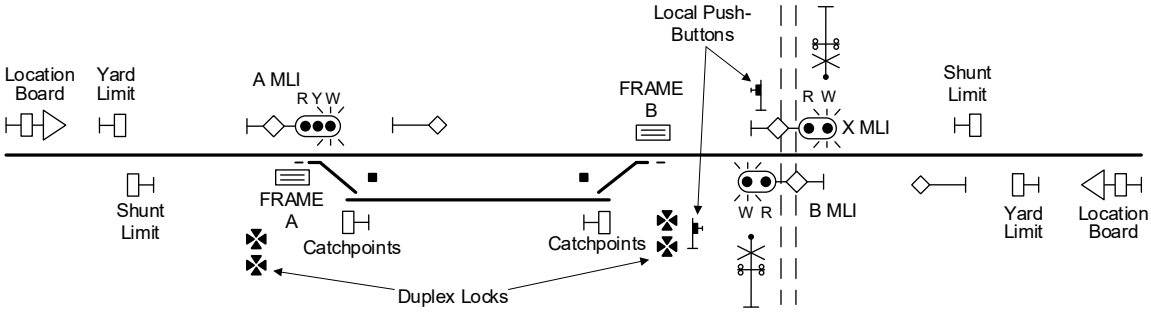

Figure 23: Example of TOW location with level crossing and main line indicators Junctions at Train Order Working Locations

4.8.7 Introduction

This section describes examples of the infrastructure arrangements to be used at branch line junctions in TOW locations.

The normal arrangement at a junction within a TOW location is in line with types and layouts as per Section 3 Types of Train Order Working Locations.

Typically, motorised points or ground frames are used to operate turnouts at a junction as detailed in the section below.

4.8.8 Arrangement using Mechanical Trailable Points

Trailable points should be used where one route through the junction has priority. The use of trailable points will result in the same operational impact on rail traffic taking the branch line. Rail traffic exiting the branch line should be able to proceed according to its movement authority, without the need to stop. For rail traffic using the main line, trailable points should be treated in the same way as a normal set of points with an MPI.

The application of trailable points shall be as per ESD-05-01.

4.8.9 Arrangement using a Both-Ways Lock

Both-ways locks should be used where it is desirable to give both routes equal priority through the junction allowing for points to be set and locked in either direction.

4.8.9.1 Arrangement with Mechanical Indicators

When using mechanical indicators, it is necessary to provide both a MPI and a PSI. These should be installed on the same post with the PSI positioned above the MPI.

A derail or catchpoint should be provided to prevent the points being run through and damaged when in the incorrect position for a trailing movement.

Advisory “CHECK POSITION OF POINTS” signs should be provided on the approach to the junction from each direction with white text on red retro-reflective background. Refer to Figure 24.

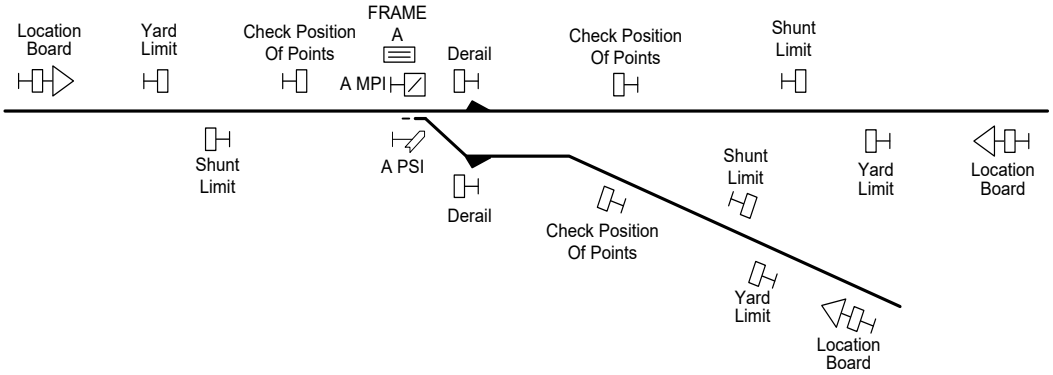

Figure 25: Example of junction location with both-ways lock and mechanical indicators arrangement with electrical indicators

When using Electrical Indicators, a turnout indication (steady white band of lights) should be used to indicate the facing points are set for the turnout route. Refer to Figure 26.

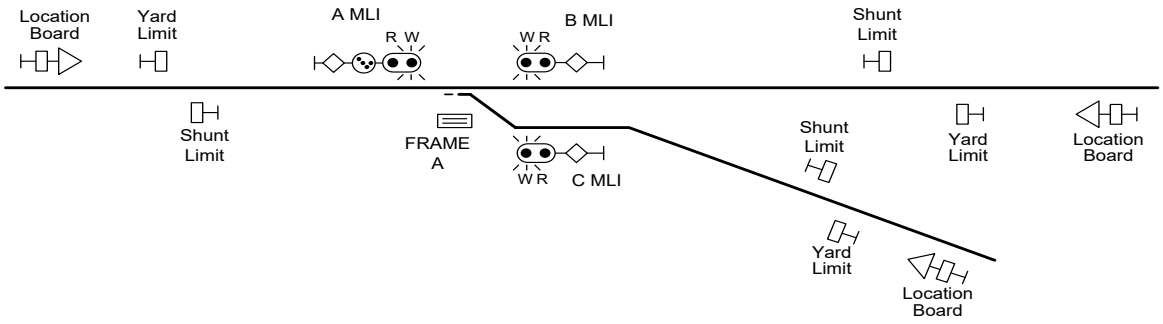

Figure 26: Example of junction location with both-ways and main line indicators

4.8.9.2 Arrangement using Motorised Points

Self-restoring points should be provided where motorised points are used at a junction, general arrangements are as per Section 4.

For trailing moves from the branch line, an approach train detection section may be provided to drive the points to reverse position.

An approach train detection section shall be provided on the main line. The approach of a rail traffic on either line shall qualify out the other approach train detection section. The approach train detection section shall not extend beyond the Yard Limit sign on either line. Refer to Figure 27.

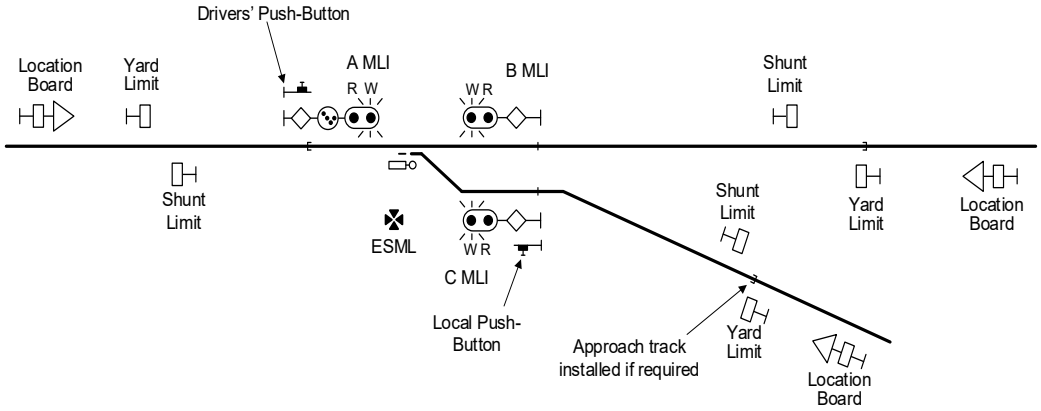

Figure 27: Example of junction location with motorised points

4.9 Infrastructure at Train Order Working Interfaces

4.9.1 Introduction

This section provides infrastructure arrangements at the interface between TOW and signalled rail vehicle detection territories.

4.9.2 Arrangement where Shunting Outside of the Home Signal is Not Required

If rail traffic is approaching signalled territory from TOW territory a landmark sign should be provided before the home signal.

An "End Train Order Working" sign shall be located adjacent to the home signal.

If rail traffic is approaching TOW territory from signalled territory, the starting signal shall display a proceed aspect.

A “DO NOT PROCEED UNLESS AUTHORISED” advisory sign should be provided adjacent to the starting signal.

A "Begin Train Order Working" sign shall be located adjacent to the “End Train Order Working" sign. Refer to Figure 28.

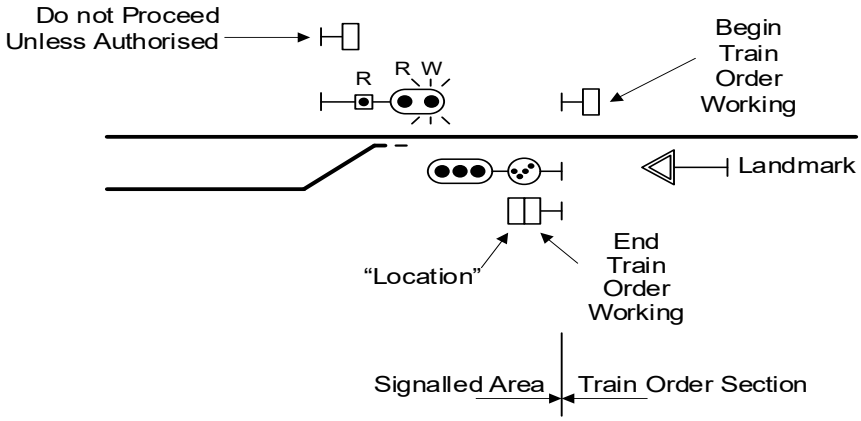

Figure 28: Example of TOW/signalled territory interface – no shunting

4.9.3 Arrangement where Shunting Outside the Home Signal is Required

This arrangement may be adopted where it is necessary to shunt outside the home signal, but it is not desired to block the TOW section.

A "Yard Limit" sign should be located a minimum of 2000m from the home signal and the Location Ahead sign should be positioned at a minimum of 2000m or train service braking distance (whichever is the greater) from the Yard Limit sign.

To define the start of the train order location for rail traffic entering TOW territory from signalled territory, a Begin Train Order Working Sign and location name plate shall be installed adjacent to the home signal.

To distinguish between the signalled location and the TOW location, that exists between the home signal and a "Yard Limit" sign, a separate location name shall be given to the TOW location. The TOW location name may be the signalled location name plus "North, South, East or West," or an alternative location name.

The starting signal into the TOW section shall display a proceed aspect. A "DO NOT PROCEED UNLESS AUTHORISED" advisory sign should be provided adjacent to the starting signal.

A "Begin Train Order Working" and "End of Train Order Working" signs shall be located adjacent to the home signal. Refer to Figure 29.

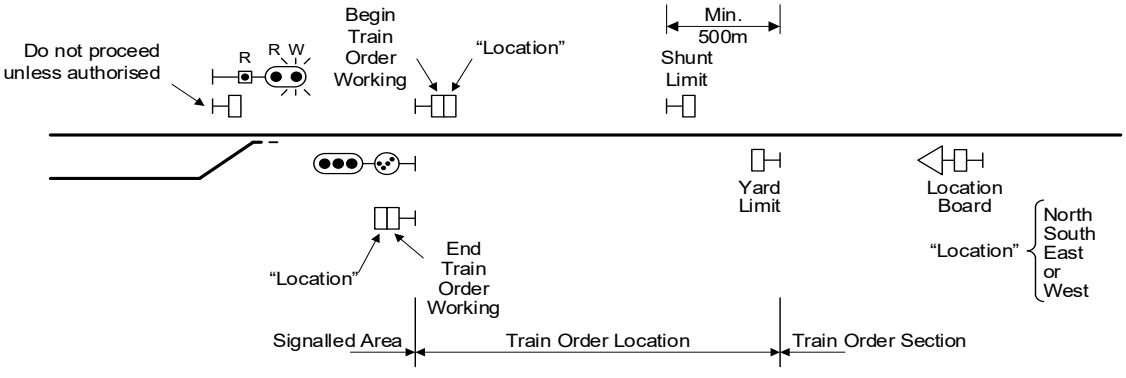

Figure 29: Example of TOW/signalled territory interface - shunting

4.9.4 Arrangement where a Dedicated Starting Signal is provided

This arrangement should be used when the shunting move is contained within the signalled location.

This arrangement shall provide a minimum of 500m separation between the home signal and starting indicator. A “DO NOT PROCEED UNLESS AUTHORISED” advisory sign should be provided adjacent to the starting indicator. Refer to Figure 30.

Where the separation cannot be achieved the Begin and End Train Order Working signs shall be positioned alongside the home signal and starting indicator. Refer to Figure 31.

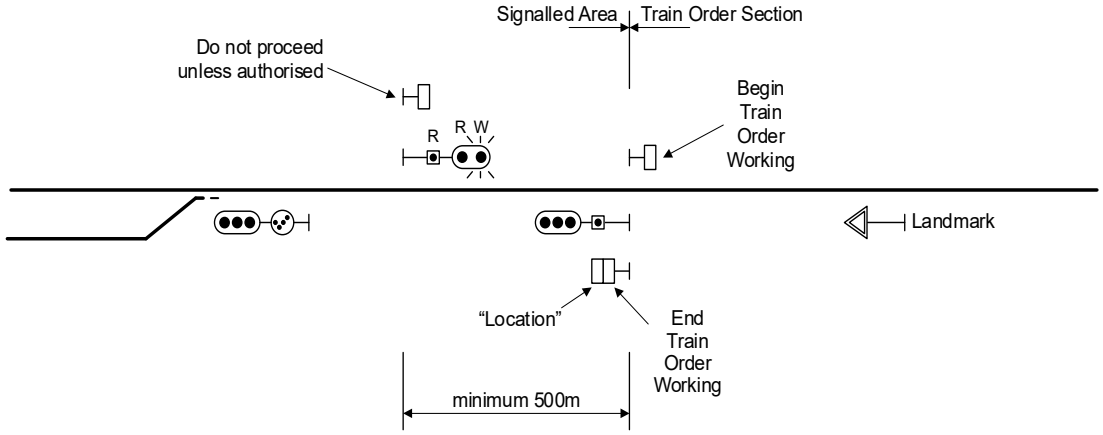

Figure 30: Example of TOW location adjacent to signalled area where a dedicated starting signal is provided

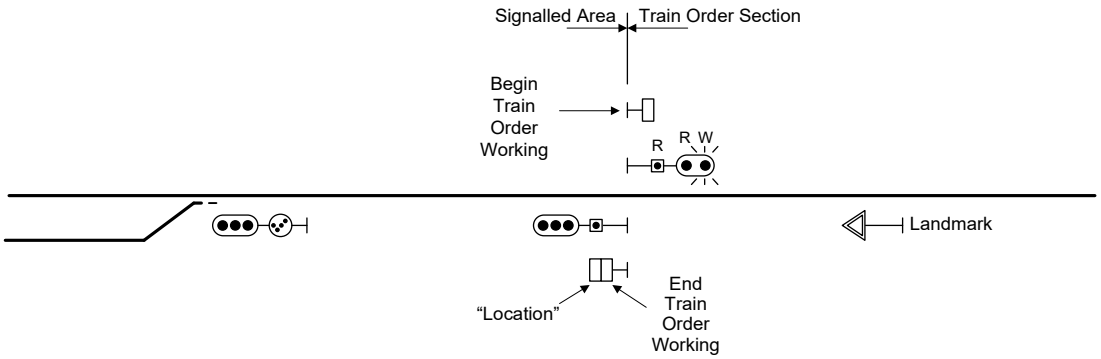

Figure 31: Example of TOW location adjacent to signalled area-alternative arrangement

4.9.5 Arrangement where a “Shunt Limit” Sign is provided

This alternative arrangement can be used when the shunting move is contained within the signalled location.

This arrangement shall provide a minimum 500m separation between the home signal and shunt limit sign. A “DO NOT PROCEED UNLESS AUTHORISED” advisory sign should be provided adjacent to the shunt limit sign. Refer to Figure 32 .

Where the separation cannot be achieved, the Begin and End Train Order Working signs shall be positioned alongside the home signal and shunt limit sign. Refer to Figure 33 .

A shunting signal should be used for movements up to the Shunt Limit sign.

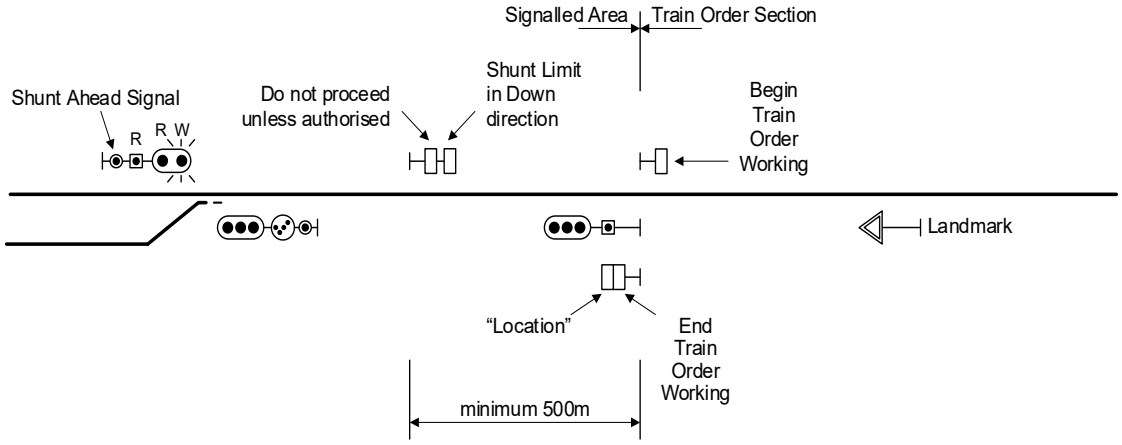

Figure 32: Example of TOW location adjacent to signalled area where a shunt limit sign is provided

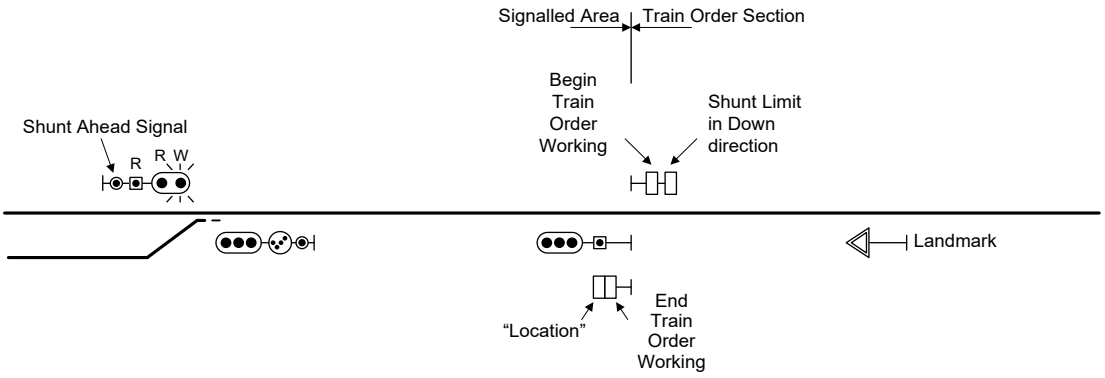

Figure 33: Example of TOW location adjacent to signalled area – alternative arrangement

4.10 Arrangements where the Line Terminates

4.10.1 Introduction

This section provides infrastructure arrangements where the line terminates.

4.10.2 Arrangement where a Train Order Working Location is adjacent to a Non-Interlocked Area

4.10.2.1 Arrangement where rail traffic is not required to be held outside the non-interlocked area

A 'STOP' sign shall be mounted above the 'End Train Order Working' sign, and a landmark sign shall be positioned 2000m, or train service braking distance (whichever is the greater) from the End Train Order Working sign. Opposing the End Train Order Working sign, a Begin Train Order Working sign shall be positioned. Refer to Figure 34.

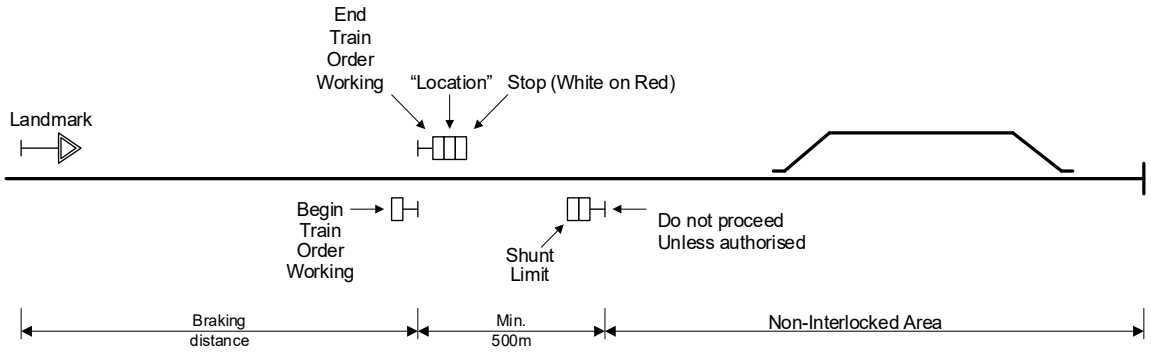

Figure 34: Example of the line terminating from TOW territory – adjacent to none-interlocked area

4.10.2.2 Arrangement where rail traffic is required to be held outside the non-interlocked area

Where there is a regular need for rail traffic to be held outside the non-interlocked area a train order location may be established adjacent to the non-interlocked area.

Refer to Figure 35. A 'STOP' sign shall be mounted above the 'End Train Order Working' sign. Yard limit sign shall be positioned a minimum of 2000m from the Stop sign. A location sign shall be positioned 2000m, or train service braking distance (whichever is the greater) from the Yard Limit sign. Opposing the End Train Order Working sign, a Begin Train Order Working sign, and a Yard Limit sign shall be positioned.

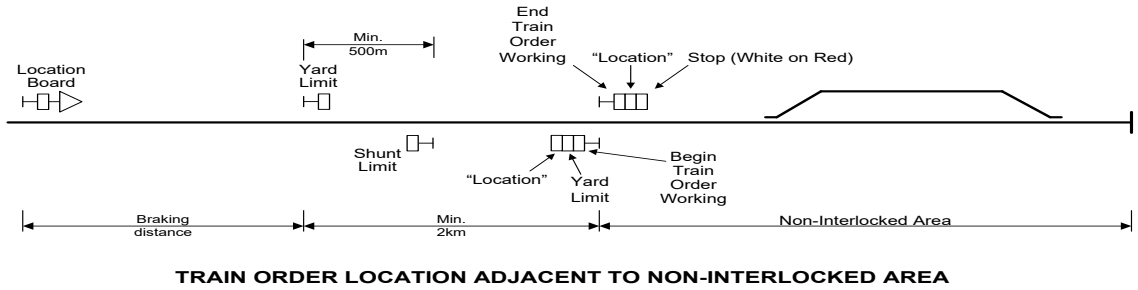

Figure 35: Example of the line terminating from TOW territory – adjacent to non-interlocked area – alternative arrangement

4.10.3 Arrangement where Line Terminates within a Train Order Working Location

'STOP' signs shall be located at the departure end of the TOW location. Refer to Figure 36.

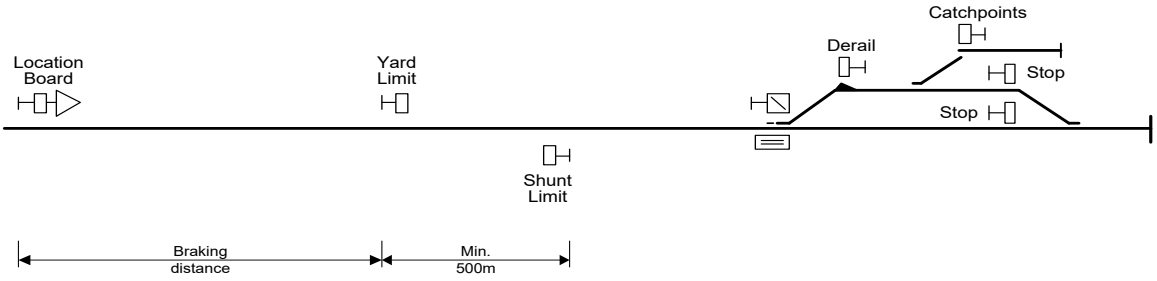

Figure 36: Example of arrangement where line terminates at a TOW location

4.11 Arrangements at a Network Control Boundary Interface

4.11.1 Introduction

This section provides infrastructure arrangements at the Network Control Boundary Interface within TOW territories.

4.11.2 Arrangements at the Network Control Boundary Interface

4.11.2.1 Arrangements at a Junction

Network Control Boundary Location signs shall be positioned “back to back” at the Network Control Boundary Interface.

The Network Control Boundary Interface shall be positioned at a minimum of 2000m from the Yard Limit sign of a TOW location at the junction.

See Figure 37. A “DO NOT PROCEED UNLESS AUTHORISED” advisory sign should be provided at the junction points.

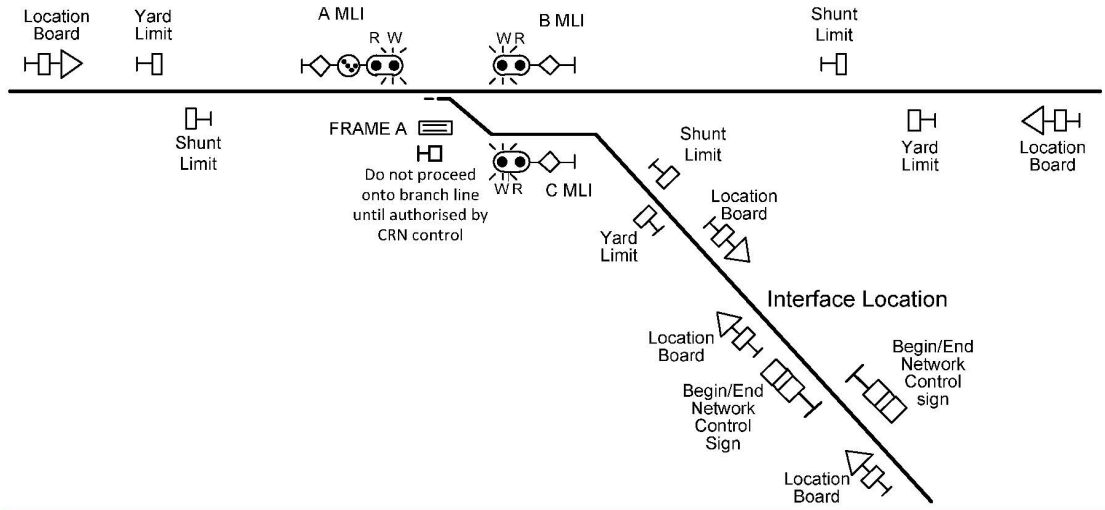

Figure 37: Example of a Network Control Boundary Interface at junction location

4.11.2.2 Arrangements on a Main Line

Network Control Boundary Location signs shall be positioned “back to back” at the Network Control Boundary Interface.

The Network Control Boundary Interface shall be positioned at a minimum of 2000m from the Yard Limit sign of a TOW location.

A “DO NOT PROCEED UNLESS AUTHORISED” advisory sign should be provided at the previous TOW locations Refer to Figure 38 on each side of the Network Control Boundary Interface.

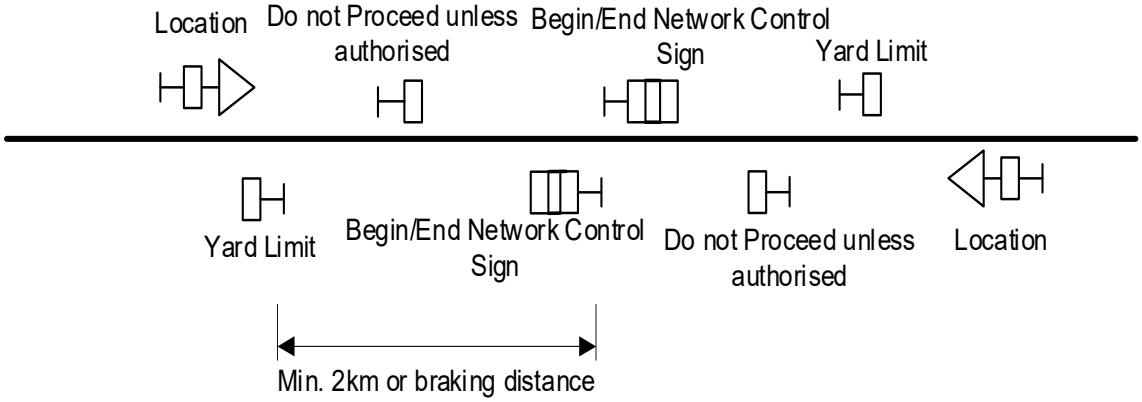

Figure 38: Example of Network Control Boundary Interface on a main line

5 Locations to be considered Alternative Safeworking Systems

5.1 Introduction

Consideration should be given to alternative Safeworking systems (e.g. Rail Vehicle Detection Signalling) instead of Train Order Working, where track complexity, layouts, and level crossing protection, combined with operational requirements, cannot be adequately protected, controlled, or managed with a Train Order Safeworking system.

5.2 Situations that may not be adequately protected, controlled, or managed by Train Order Working

a. Where rail traffic movements can be more effectively controlled by a Network Controller. This will usually be specified in the Operational Requirements.

b. Where multiple indicators or signals are required in the one running direction, and it is necessary to have another indicator or signal to indicate that the next indicator or signal is displaying a restrictive indication/aspect (e.g. stop or turnout).

c. Where shunting movements can occur on running lines by above rail operators not accredited for Train Order Working or rail traffic without a communication device.

d. Where multiple level crossings exist and protective indicators or signals may require a route cleared, without the route cleared throughout the interlocking, or for shunting purposes.

e. Where a particular section of the corridor has been identified as complex and is signalled in between two TOW sections, then these particular sections should be signalled to avoid a signalled section between two TOW sections.

f. Any combinations of the above.

Note:

For new works, Train Order Working is not the default safeworking system instead of Rail Vehicle Detection Signalling. TOW may be considered on a case-by-case basis based on the risk assessment and operational requirements & maintenance merits. As a minimum, a risk assessment shall be undertaken including representation from ARTC Operations, and a signal maintenance engineer, or a delegate. All identified risks due to additional complexity (e.g. additional points, level crossings, indicators) shall be agreed by the business unit and operations. All risks shall be accepted by the risk owners, and the final decision shall be documented.

Risk assessment and related documents shall be sent for information to standards@artc.com.au