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Level 2

Axle Counter System Design Principles and Generic Application Rules

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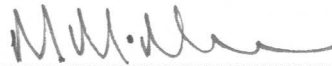


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Issue record

Issue	Date	Comments
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Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 5th December 2009.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 4 to continue to comply with the Issue of any relevant Network Rail Standards current when GRIP Stage 4 was reached and not to comply with requirements contained herein, unless the designated Standard Owner has stipulated otherwise in the accompanying Briefing Note.

Reference documentation

GC/RT5212	Requirements for Defining and Maintaining Clearances
GE/RT8000	Rule Book
GK/RT8217	Introduction and Use of Axle Counters – Managing the Risk
NR/SP/SIG/10067	VDU based Signalling Control System
NR/SP/SIG/50011	Methodology for Demonstration of Electrical Compatibility with Axle Counters
NR/L2/SIG/30009	Signalling Principles Handbook
NR/L2/SIG/30080	Axle Counter System – Operational and Safety Principles
NR/L3/SIG/30082	Axle Counter System Handbook
NR/L3/OPS/30083	Line Clear Arrangements Following Engineering Works – Enhanced Process for Vehicle Management
NR/L3/SIG/30084	Line Clear Arrangements Following Engineering Works – Engineering Examination
NR/GN/SIG/11600	Signalling and Operational Telecommunications Design: Technical Guidance
NR/SP/SIG/10075	Production of Level Crossing Ground Plans
NR/SP/SIG/11752	Train Detection

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1 Purpose

This standard details Network Rail's generic application rules for axle counter systems and the fundamental design principles to be adopted. This standard relates to the physical attributes that the system should have and technical application of various systems.

This is a high level standard to establish the generic system design principles required to safely manage the provision of axle counter systems for train detection.

2 Scope

This standard is applicable to all new axle counter installations and to alterations at existing axle counter installations.

The standard is based on multi-section axle counters, however the same principles may be applied to other configurations. The standard states the interlocking and MMI design principles irrespective of the technology of those systems or the axle counter type.

3 Definitions

A number of terms are defined for clarity in Appendix A. This meaning shall be assumed throughout the standard.

4 Introduction

This document is part of a suite of standards produced by Network Rail to establish the principles for design and implementation of axle counter systems and to provide axle counter application guidance for use on Network Rail managed infrastructure.

Figure 1 below shows the relationship of the documents that make up this new suite of axle counter standards. This provides an information hierarchy where further guidance or specific systems are described in separate documents, attempting to minimise duplication. It may therefore be necessary to consult more than one standard to obtain all information relevant to a particular topic.

It is recognised that axle counter systems manufactured by different suppliers are not the same and that they have different attributes which may influence the choice of axle counter system used for a particular application. This suite of standards is intended to be manufacturer neutral in stating requirements, desirable features and good practice for axle counter application on Network Rail's managed infrastructure. Where details or examples given in this standard are applicable to specific manufacturers system this does not preclude the use of axle counter systems, technologies and arrangements from other manufacturers provided that they satisfy the safety, operational and maintainability requirements specified by Network Rail.

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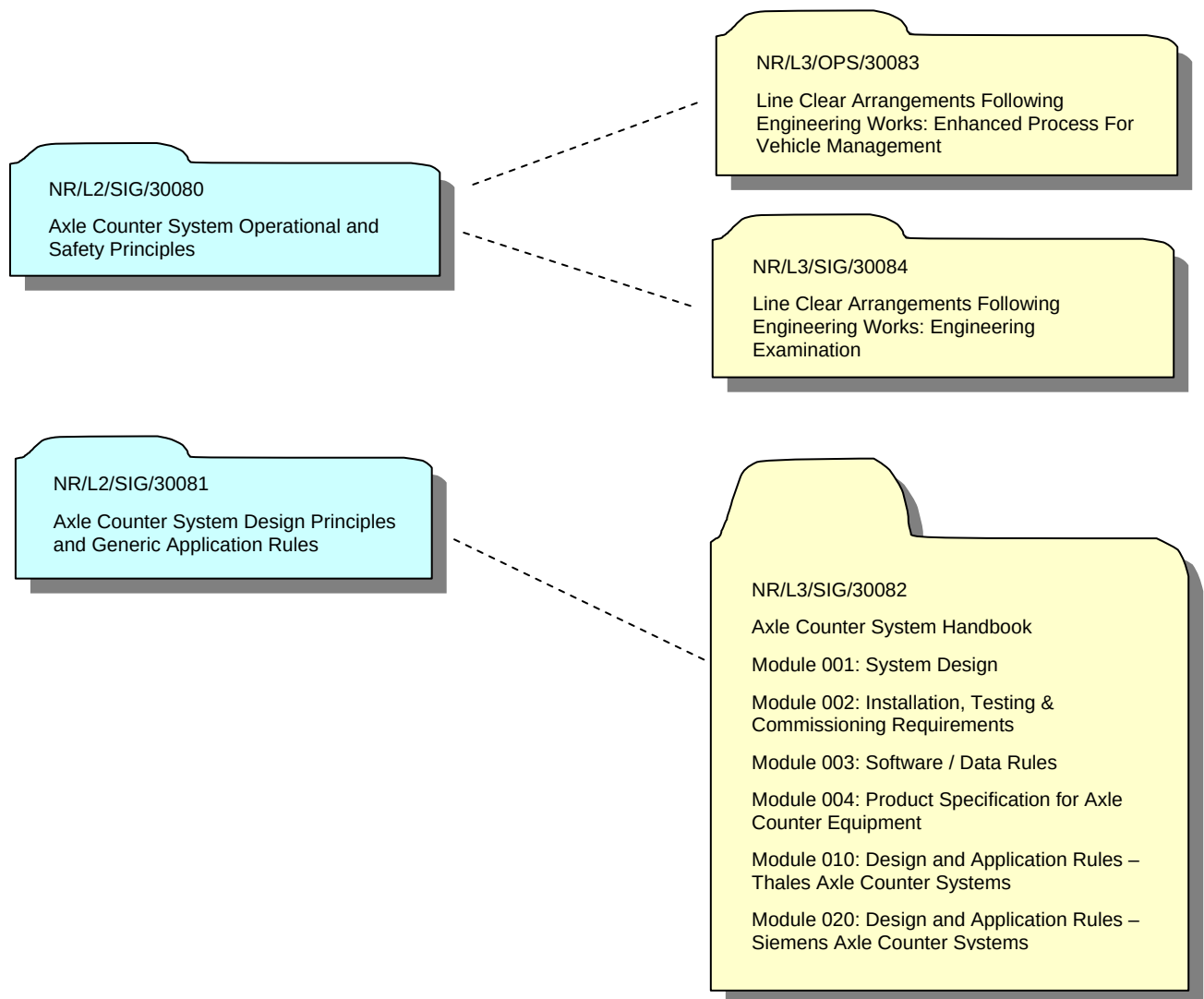


Figure 1 – Axle Counter Document Suite

5 Generic Application Rules – Engineering

5.1 Minimum & Maximum Axle Counter Section Lengths

The minimum length of an axle counter section shall be no less than 18.3m.

NOTE 1 The wheelbase limitation is the same as for track circuits as defined in NR/SP/SIG/11752. Particular care should be taken at level crossings and crossovers to confirm this requirement is not infringed. It may often be necessary to position a rail contact between the nose and toe of points at a crossover and, without the constraint of insulated rail joints, it is easier to position the rail contact closer to the toe.

NOTE 2 When considering provision of short axle counter sections, account should be taken of the time needed to process and transmit detection to confirm the sections operate in the correct sequence. This may vary depending on the type and combination of axle counter system, transmission and interlocking.

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5.1.1

There is no technical maximum limit to the length of an axle counter section, subject to:

- Meeting the signalling system requirements (operational, performance, reliability, maintainability, etc);
- Detection of vehicle presence by the interlocking within 3 seconds;
- The capability of the data transmission system;
- The effect of signal loss due to the cable characteristics and any use of isolating transformers;
- The distribution of power to the detection points through the cable network;
- The effect of induced voltage in ac electrified areas, especially with rail return system and regulations regarding touch potentials.

NOTE Where there is flexibility in signal positioning, advantage should be taken to optimise the design around these factors to enable a simpler and cost effective solution. The method of reset should be considered and there may be operational advantages in providing extra sections, e.g. to prevent a considerable distance (and time impact) when requiring to examine the line. The practical length of a section may be extended via use of local power supplies and a transmission system as long as it is still able to meet the requirements of this standard. These factors should be discussed and agreed at the design and operator consultation stage.

5.2 Axle Counter Section Identity

Each axle counter section shall be allocated an identity in accordance with standard conventions for naming train detection sections.

NOTE Axle counter section, detection point and evaluator naming should be undertaken on a project by project basis, avoiding repetition within a control area, and agreed with the Operators.

5.2.1

Axle counter sections with similar names shall not be used in close proximity on parallel lines, especially through crossovers and level crossings.

NOTE To mitigate against the risk of rail contacts being connected to the wrong control equipment or confused during conversation similar names should be avoided in close proximity, e.g. ECH on the Up line adjacent to EHC on the Down line.

5.2.2

Where the axle counter system is to operate over a transmission system each axle counter section shall require an address code unique within Network Rail's managed infrastructure.

NOTE It is considered essential that the identity code is unique (generally provided in data), as transmission links between evaluator and detection points may not be on closed transmission systems. Where a detection point is hardwired to an evaluator the requirement for a unique address code may be relaxed.

5.2.3

The unique address codes shall be managed by the Network Rail National Records Group (NRG).

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5.2.4

Where required, project designers shall request the next sequence of unique address codes from NRG.

5.2.5

Designs or operating documents shall only differentiate train detection types, by use of a T (track circuit) or X (axle counter) suffix, if mixed within a control area, and then only indicate the minority type.

NOTE 1 The aim should be to promote MMI clarity and to reduce data size (associated with the section name itself). If documents already indicate a track circuit, e.g. by showing a frequency, this is sufficient and there will be no need for a 'T' in the naming.

NOTE 2 At the fringes of a control area with axle counter train detection, there may be signal boxes that indicate some of these axle counter sections for information, typically train approaching/going away. These indications should be provided with an X suffix on the diagram or panel, unless axle counters are the predominant form of detection at the fringe box as well. It is acceptable to combine axle counter sections indicated from another signal box (the combined indication should have an X suffix).

5.3 Detection Point Identity

Each detection point shall be uniquely identified (see Figure 2).

5.3.1

Detection points shall be identified by the names of the sections either side, and in the axle counter reference direction, e.g. adjacent sections AA and AB share AA/AB detection point (see section 5.4).

NOTE Where more than one detection point would have the same identity then a suitable suffix (either numerical or based on point lie) should be used.

5.3.2

Where the detection point is at the boundary of an axle counter evaluator area, and does not share a common rail contact, then the identity of the other section shall be replaced with a '-', e.g. -/AB or AC/-.

5.3.3

The detection point at the end of an axle counter area, e.g. to/from a track circuited or non-tracked area, shall be given the name of the axle counter section.

NOTE If there is more than one such detection point on a section, the names should be suffixed by point conditions or signal numbers, e.g. AB(200R).

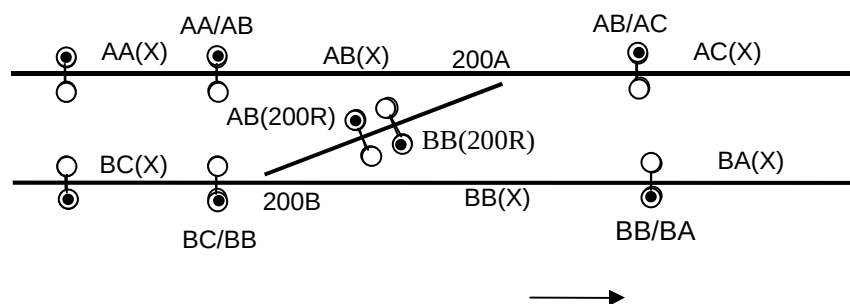


Figure 2 – Detection Point Identification

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5.3.4

The detection point identity shall be marked on the lineside unit case / lid.

5.4 Reference Direction For Counting

An axle counter reference direction shall be defined for each axle counter section.

5.4.1

The reference direction shall be the direction of increasing mileage.

NOTE The reference direction needs to be defined for the complete layout, independent of direction of travel of the trains and turnouts and crossovers encountered along the line. This enables the evaluator to establish the correct direction of any counted movement. If the direction of increasing mileage changes within a location or REB area, e.g. at a junction (see Figure 3) the preference is to retain the same reference direction for all detection points on the same line. Any change in reference direction should occur between locations/REBs.

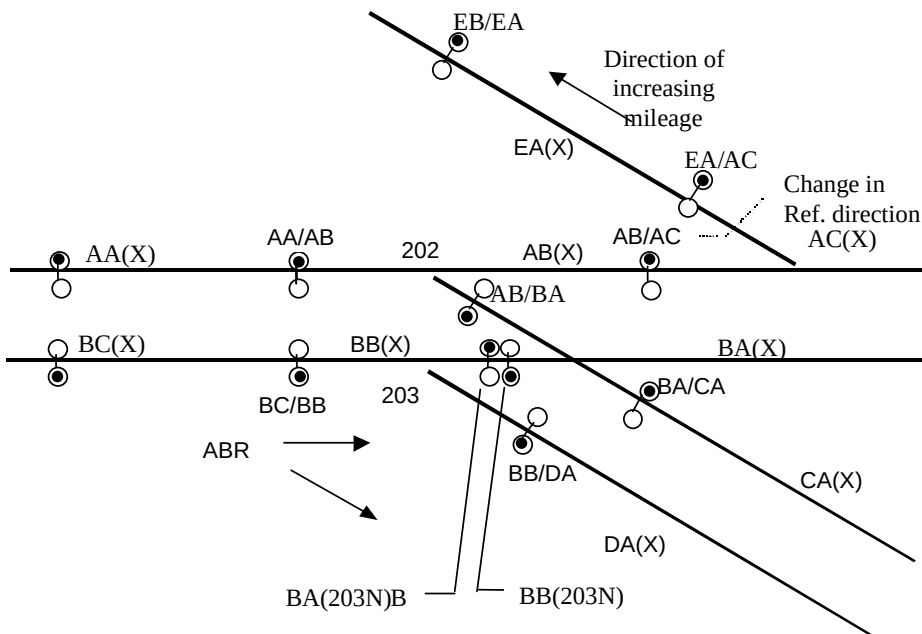


Figure 3 –Axle Counter Reference Direction Change

5.5 Location of Axle Counter Trackside Equipment

All non-rail mounted equipment shall be positioned in a position of safety wherever possible.

NOTE If it is not practicable to locate non-rail mounted equipment in a position of safety then alternate arrangements should be made to access the equipment safely.

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5.5.1

When choosing suitable positions for non-rail mounted equipment, the position shall not cause cables to run across any cable troughing route or to present a tripping hazard.

NOTE The positioning of equipment and cables should also take account of possible damage from track maintenance, access, etc and take suitable measures to minimise this risk.

5.5.2

Detection points shall be as far as practicable (but at least 30m) from any neutral section.

NOTE Proximity to neutral sections and other traction related equipment can cause higher levels of traction interference.

5.5.3

Rail-mounted equipment shall wherever practicable be fitted to the rail closest to the safe cess or the nearest position of safety unless otherwise justified.

NOTE This includes avoiding rails immediately adjacent to a conductor rail. Consideration should be given to works activities such as rail grinding, tamping, etc to minimise the risk of damage or the requirement for rail contact removal to facilitate works.

5.5.4

Where indicated on diagrams, the positioning of rail contacts shall be indicated using the symbols shown in Figure 4, including the use of a solid black circle within the symbol to indicate which rail the rail contacts are fitted to.

NOTE Figure 4 also indicates the transition from an axle counter area to a track circuit area.

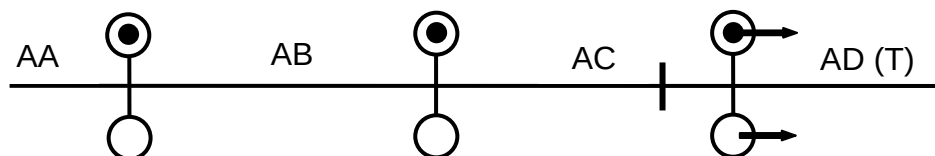


Figure 4 – Axle Counter Symbols

5.6 Site Surveys

A formal site survey shall be required to position rail contacts and associated detection point control equipment. Details of items to be considered are provided in Appendix B.

5.6.1

A Detection Point Siting Form shall be produced to document the requirements and functional constraints of each new or re-positioned detection point based on the site survey. An example form is shown in Appendix B.

5.6.2

Any lineside equipment that can not be positioned in accordance with the functional constraints specified on the Detection Point Siting Form shall be formally notified to the designer to confirm the proposed site position is acceptable.

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NOTE When designing axle counter data, it is important to know to which rail the rail contact will be fitted as not fitting it to the planned rail will effectively invert the normal direction of travel in some systems.

5.6.3

The site survey shall be made available to the designer to confirm all necessary changes are incorporated into the design.

NOTE This should be the basis of the update of the scheme and location area plans and the subsequent design.

5.7 Positioning of Rail Contacts

A rail contact shall be provided at all limits of an axle counter section where wheels can enter or leave the section with the exception of buffer stops, trap and catch points.

5.7.1

Rail contacts shall not be positioned where, due to the method of operation, trains are likely to stop with the first or last wheel stationary over a rail contact. Where the position cannot be changed the use of train stop markers or other signage shall be provided.

NOTE This is to reduce the potential for an axle counter disturbance due to minor wheel movements within the detection zone, e.g. whilst stopped at a station platform.

5.7.2

On lines electrified by conductor rail systems, rail contacts shall be positioned, where reasonably practicable, on the rail opposite the conductor rail.

NOTE There may be other restrictions on the placement of rail contacts relative to items of traction equipment and these should be detailed in the approval documents for the equipment.

5.7.3

The Track Engineer shall be consulted concerning any drilling restrictions, proposed positioning and any requirement to re-space sleepers.

NOTE There may also be positioning and fixing restrictions for specific axle counter systems, specified by their supplier, which should also be taken into account.

5.7.4

The nearest rail hole supporting a rail contact shall be a minimum of 1m from any weld or rail joint (insulated or otherwise) unless otherwise agreed with the Track Engineer.

5.7.5

Insulation shall be required between rail and sleeper, on three sleepers either side of rail contacts.

NOTE This avoids potential interference from variable magnetic short circuit windings.

5.7.6 Positioning to Confirm Correct Operating Sequence

The boundary between any two axle counter sections (or an axle counter section and any other form of train detection) shall be designed so that when a train traverses the boundary there is no loss of train detection and the receiving section

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indicates occupied within the interlocking before the sending section is allowed to indicate clear (in any direction of travel).

NOTE Where rail contacts are not shared, this should be achieved by physically overlapping the rail contacts. The last rail contact prior to a track circuited area should always be positioned within the track circuit area. Evaluator boundaries and junctions should be particularly considered. The overlap distance should be sufficient to make sure no loss of detection or sequence failure, otherwise a timing allowance or other controls for correct sequential operation should be made in the interlocking logic.

5.7.6.1

A timing assessment shall be carried out, based on the current line speed, to confirm no loss of train detection occurs.

NOTE The assessment should take account of system and interlocking delays from the particularly configuration used.

5.7.7 Positioning at Level Crossings

Rail contacts shall be positioned at least 4m clear of the edge of the surface at level crossings.

NOTE The 4m requirement is to make sure that the equipment is clear of any trespass guards and less accessible to crossing users.

5.7.8 Positioning at Points and Crossings

In areas of points and crossings, rail contacts shall (in conjunction with interlocking controls) be positioned so as to maintain the critical dimensions required for passing clearances, fouling points and clearance points. The positioning of rail contacts to achieve this shall conform to Railway Group Standards including GC/RT5212.

5.7.8.1

Rail contacts shall be positioned further from the crossing nose or point of convergence than the fouling point unless interlocking controls exist to manage the risks associated with a foul track section.

NOTE Rail contacts should be fitted between a running rail and a check or wing rail. In positioning the rail contact, consideration should be given to whether disruption can be limited to one line should the rail contact need to be removed for work on one line.

5.7.8.2

The position of rail contacts near points and crossings shall take into account the optimum release of track locking over the points.

5.7.8.3

The preferred position of rail contacts (to simplify aspect restriction release conditions and to minimise delay to traffic) shall be as follows:

- At a turnout the rail contact on each line shall be within 10m of the clearance point;
- At a crossover the rail contact shall be within 10m of the toes of the points in the parallel line, measured along the track (subject to the maximum distance between the parallel lines being 4m).

NOTE Where these dimensions can be achieved they should enable the driver of a train passing through the reset axle counter section on any possible path in either direction (signalled or otherwise) to observe the limits of the train detection section and identify any potential obstructions in a single

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pass in all weathers or darkness. This can therefore be used to release aspect restriction (see also section 6.7). Where not achieved (or visibility constraints apply) additional axle counter sections may also be considered. Aspect restriction only applies to main aspects. Figure 5 provides a number of examples.

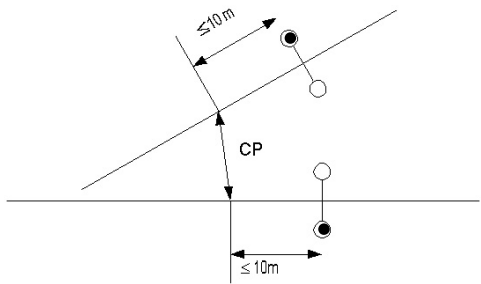


Figure 5a)

At a turnout the rail contacts on both lines should be within 10m of the clearance point

NB This allows aspect restriction to be removed by a single train, which could be in either direction.

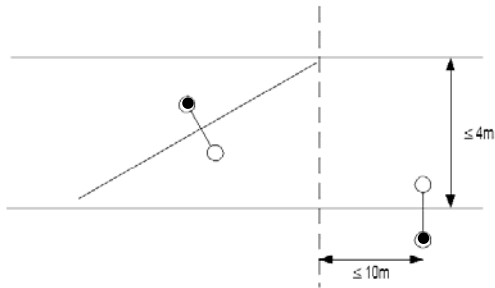


Figure 5b)

At a crossover the rail contacts should be within 10m of the toes of the points in the parallel line. 10m is measured along the track.

The maximum distance between the parallel lines should be 4m.

NB A train passing over the crossover reverse or along the straight route can be allowed to remove the aspect restriction.

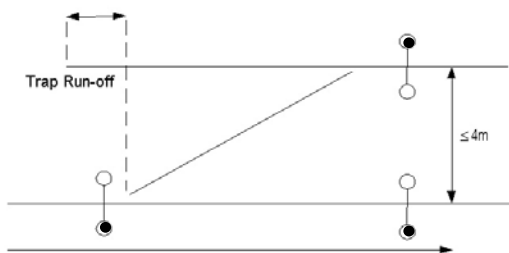


Figure 5c)

If one end of a crossover is a set of traps, the requirements for positioning the rail contacts are the same as figure 5b.

NB A train along the straight route can remove the aspect restriction, subject to the driver being instructed to examine the trap run-off.

The maximum distance between the parallel lines should be 4m.

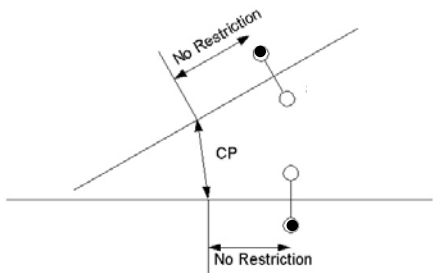


Figure 5d)

If all routes of the section are shunt class only, then the release conditions for the aspect restriction need not be considered in the positioning of the rail contacts.