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Common Signal Design Principles S1 - Signalling Locking and Train Dynamics

ESD-05-01

Applicability

ARTC Network Wide

Publication Requirement

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Primary Source

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3.0	13 Oct 15	Standards	Stakeholders	Manager Standards	Operational Safety & Environment Review Committee 13/10/2014 GM Technical Standards 30/11/2015

Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
3.0	21 Oct 14	6.2.7 Various	New Clause 6.2.7 Provision of Overlaps for Modified Simultaneous Entry at a Crossing Loop (approved by OSERC 13/10/2014). Further minor editorial amendments throughout for consistent terminology and
	26 Jun 15	6.2.6	removal of superseded reference documents. Clause 6.2.6 previously
	13 Oct 15	Various	applicable to NSW only now extended to network wide applicability. Rebranded.

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1 Introduction

1.1 Purpose

The purpose of this Standard is to address:

- The requirements for the provision of route holding as a means of maintaining locking by the occupation of track circuits once a train has entered a route and the signal has been replaced to stop and the route normalised
- The requirements for the provision of Interlocking between signals (routes), points and ground frames
- The requirements for the provision of approach locking on signals and the methods and conditions under which it is applied and released
- The requirements for the provision of time releases for various signalling functions and discusses the methods of determining time release expiry periods
- The concepts and definitions relating to certain types of points
- The concept of an overlap to provide a margin of safety between following trains and provides definition for of the terms associated with overlaps
- The concept of headway and provides further definitions and concepts for the various factors affecting headway
- The concepts and definitions of braking distance and its effect on the requirements and design of a signalling system.

1.2 Document Owner

The Manager Standards is the document owner and is the initial point of contact for all queries relating to this Standard.

1.3 Reference Documents

The following documents were considered in developing the ARTC common Signal Design Principles:

Reference ARTC Documents:

- SCP 01 Signalling Control Systems
- SDS 03 Braking Distance
- SDS 04 Overlaps

Reference QR Principles:

- S.07.4211.27 Regional RCS

Reference Victoria Specification and Guideline:

- ENG-SE-SPE-0001 Signal Design and Documentation

Reference WA Principles:

- WAGR Code of Practice 8190-600-004 Signal Design Principles – Urban

2 Route Locking

2.1 Designation of Class and Direction of Routes

2.1.1 Introduction

This Principle addresses the requirements for designating the class and/or direction of routes as applicable to running signals, running signals fitted with subsidiary and shunting signals in colour light territory. Running Signal or Route proves track section occupancy and points etc. Subsidiary Signal or Route proves the points position and not track section occupancy.

Signal Indications, meaning and application for both speed and route signalling are detailed in the Code of Practice for the Defined Interstate Rail Network, in volume 3.1, Operations and Safeworking – Rules, Tables 3.1 to 3.3.

2.1.2 Class of Route

2.1.2.1 Running (Main) Routes

Main routes are characterised as being intended to be used for a running move where the train speed is dictated by the track geometry and speed boards only, unless there are operational requirements for speed restrictions.

Main routes commence at a main signal and end at another main signal, a stop board acting as a main signal or a buffer stop.

Routes classified as main routes shall be designated (M) as a prefix after the signal number or ID. Refer to figure 1.

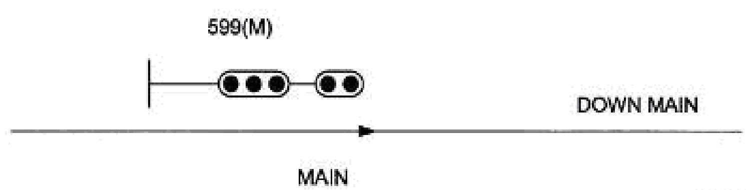


Figure 1 – Main Route

2.1.2.2 Subsidiary (Shunt) Routes

Subsidiary (shunt) routes are characterised by being intended to be used for moves taken at low speeds, with the train driver being responsible for ensuring that the train can be stopped clear of any obstruction. The proceed aspect on this signal does not prove that the track sections within the subsidiary route are unoccupied.

Subsidiary routes commence at a subsidiary signal beneath a main stop signal and end at another shunt signal, a main signal, a buffer stop, a stop board, a limit of shunt (LOS) board or in a siding or yard.

Shunt routes commence at a shunting signal or from a ground frame and end at another shunt signal, a main signal, a buffer stop, a stop board, a limit of shunt (LOS) board or in a siding or yard.

Routes classified as subsidiary or shunt routes shall be designated (S or LS) as a prefix after the signal number or ID. Refer to figures 2A & 2B.

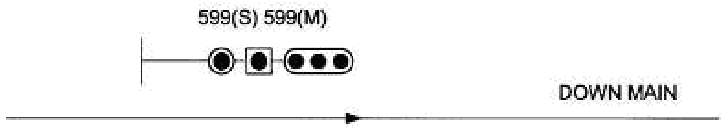


Figure 2A – Main with a Subsidiary Route

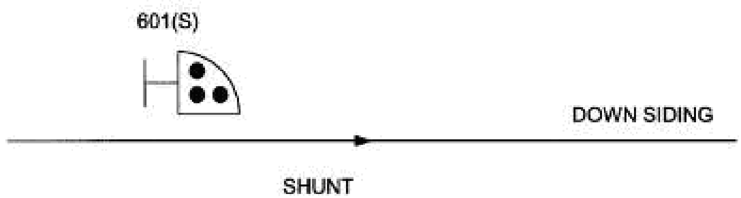


Figure 2B – Shunt Route

2.1.2.3 Direction of Route (Route Signalling Only)

If a route is associated with a signal which controls diverging movements then the route applicable to each possible divergence shall be allocated a route direction designation in addition to the class designation.

The route direction designation shall be a unique alphabetic character. The alphabetic characters shall be allocated such that the most left-hand diverging route is designated A.

If there is a divergence ahead of a signal to which no signalled move exists then a reserved route direction shall be allocated for future use.

If the direction of a main and subsidiary class of route is coincidental they shall be allocated the same route designation character.

To identify a particular diverging route the route designation character shall appear as second suffix to the signal number and class of route. Refer to figure 3.

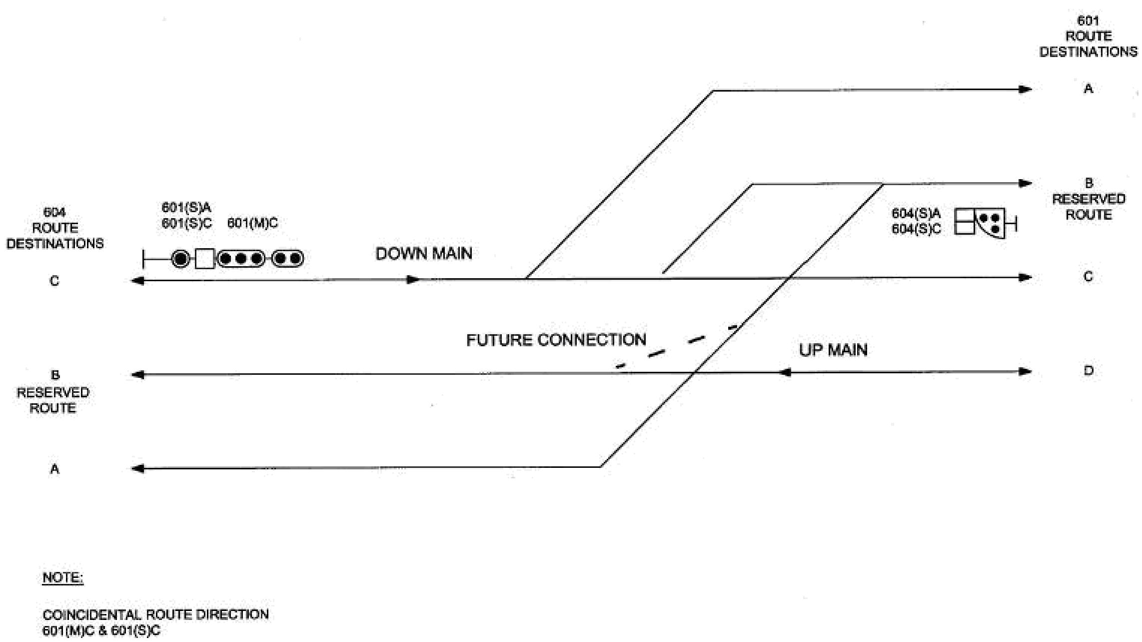


Figure 3 – Route Direction

2.1.3 Speed Signalling

In speed signalling, the train speed is dictated by the track geometry and any speed restriction enforced. The normal and medium speeds are displayed on the signal by its aspects and are dictated by the characteristic of a particular route. If the route is generally set for the straight line and required a normal speed then the three aspect signalling system will display either Green or Yellow aspect on the top arm “A”. If the movement warranted for a “Clear Normal Speed” then the signal aspect will display a Green on the on the top arm “A” and a Red aspect on the middle arm “B”. If the movement is for a “Normal Speed Warning” then it will display Yellow aspect on the top arm “A” and the Red aspect on the Middle arm “B”.

However, if the train movement is on to a crossing loop, generally a turnout, then the three aspect signalling system will display either red or Yellow on the middle arm “B”. If the movement is warranted for a “Clear Medium Speed” then the signal aspect will show a Red aspect on the top arm “A” and a green aspect on the middle arm “B”. If the movement is for a “Medium Speed Warning”, it will display a Red aspect on the top arm “A” and a Yellow aspect on the middle arm “B”. When required for reduce to medium speed movement, then the top arm “A” will display a Yellow aspect along with the middle arm “B” displaying Green aspect.

A low speed “C” light displays a smaller version of yellow light below “A” and “B” arm to indicate to proceed with caution and prepare to stop short of obstruction. The low speed is also used for simultaneous entry at crossing loops.

Note: See NCOP Volume 3.1, tables 3.1 to 3.3 for a full description of Signal Indications, meaning and application

2.2 General Locking Arrangements within Routes and Overlaps

2.2.1 Purpose

Locking is provided between signals (routes), points, ground frames and level crossings to ensure that a signal is only cleared for a train to proceed when conflicting signals, points and level crossings are locked in position so that the passage of the train is not endangered. This covers both the respective signal section and the overlap for the route.

Locking is maintained until the train has passed by the various signals, points and level crossings within the route and it is safe to release all or parts of the locking without endangering the passage of the train.

Locking is always extended and enforced by the addition of approach locking and where applicable route holding.

2.2.2 Requirements - General Locking within a Route and an Overlap

If a route from a signal conflicts with another route on the same signal or leads over one or more sets of points or ground frames or reads up to one or more opposing signals (routes) then it shall;

i. lock normal any conflicting routes leading away from the same signal;

ii. lock normal any opposing signal routes which lead into the route or its overlap;

iii. lock normal or reverse as required any sets of points in line with the direction of the route together with any points providing trap or flank protection to the route or its overlap;

iv. lock any ground frames normal in the route or its overlap;

v. lock any trailing points in its overlap in the appropriate direction for which the overlap is set, in South Australia trailing or facing points in the overlap are not locked in legacy Interlockings;

vi. lock normal or reverse any facing points in its overlap only if other locking conditions within or leading into the overlap make this necessary. Converse locking shall always be applied except in special cases;

2.3 Approach Locking

2.3.1 Purpose

Approach locking is provided to prevent an operator or an auto-normalisation call from normalising a route ahead of an approaching train which could allow a change to a route that might endanger the passage of the train.

Approach locking is normally applied to any signal routes which are interlocked. The approach locking becomes effective when the signal has been called to clear and all conditions for clearance are proved available

If a controlled signal has one or more routes which directly or indirectly interlock with other routes on the same or on other signals or with points or ground frames or level crossings then the signal shall be provided with approach locking.

2.3.2 Running Signals

The approach locking shall become effective if a proceed aspect has been displayed in the approached locked signal and the driver of an approaching train has sighted a signal showing a proceed aspect which would be altered by the replacement of the approach locked signal back to stop.

Once initiated the approach locking shall be maintained by the occupation of the track circuits over the appropriate approach locking distance in rear of the signal which is approach locked.

If a running signal is situated such that the number of aspects which can be displayed in rear are restricted due to physical or operational constraints of the system then the extent of the approach locking may be reduced accordingly.

If a running signal is situated such that no track circuit is provided in rear then it shall be approach locked immediately it displays a proceed aspect.

2.3.3 Subsidiary Shunt Aspects or Low Speed Aspects for Speed Signalling

The approach locking shall become effective if a proceed aspect has been displayed in the signal to be approached locked and an approaching train has passed the running signal immediately in rear and is within sighting distance of the signal and is within 600m of the signal or when the signal is cleared.

The approach locking once initiated shall be maintained by the occupation of the track circuits over the appropriate approach locking distance in rear of the signal which is approach locked. The approach locking point may commence 600m or sighting distance in rear of the approach locked signal or from the first signal in rear as the case may be.

2.3.4 Ground Shunting Signals

The approach locking shall become effective if a proceed aspect has been displayed in the signal to be approach locked and an approaching train has passed the signal in rear and is within sighting distance of the signal and is within a distance of 300m of the signal to be approach locked.

If a shunting signal is situated such that no track circuit is provided in rear then it shall be approach locked immediately it displays a proceed aspect.

2.3.5 Release of Approach Locking

Approach locking shall be released by the signal at stop and the passage of the train past the signal which is approach locked or after the expiry of a time period to allow for the train to be nearly at or have come to a stand at the approach locked signal, or the train being otherwise proved to have come to a stand. Where there is no train within the approach area, then the approach locking may be released upon signal cancellation.

2.3.6 Running Signal

The approach locking shall be released by the normal passage of the train over the first and second track circuits in sequence immediately past the approach locked signal and in the direction for which the route is set, or following a time release, which shall commence timing immediately the approach locked signal has been replaced to stop.

The standard time releases for approach locking are 240 seconds for running and subsidiary signals, or 120 seconds if the start of the breaking point is not fully track circuited and 30 seconds for ground shunt signals. Where the subsidiary signal has a separate approach lock to the main signal than the time release for the approach locking on the subsidiary signal may be 60 seconds.

Other times may apply at specific locations and consideration shall be given to the distance between signals when determining the time release period. As this distance increases, it is necessary to increase the approach locking time release period to reasonably ensure the train has come to a stand. This is to be applied where the proceeding signal is greater than the train braking distance.

Where a crossing loop is greater than 1500m, then a minimum time release period of 180 seconds shall be applied.

2.3.7 Subsidiary Shunt Aspects or Low Speed Aspects for Speed Signalling

The approach locking shall be released by the normal passage of the train over the first track circuit immediately past the approach locked signal, or following the expiry of a time release which shall commence timing immediately the approach locked signal has been replaced to stop.

The time release expiry period shall be 60 seconds. The subsidiary shunt aspect time release period may be equal to that of the main aspect under particular operating conditions.

2.3.8 Ground Shunting Signals

The approach locking shall be released by the normal passage of the train over the first track circuit immediately in advance of the approach locked signal or following the expiry of a time release which shall commence timing immediately the approach locked signal has been replaced to stop.

The time release expiry period shall be 60 seconds.

In freight yards, ground shunt signals may have a time releases of 30 seconds if there is an approach track circuit.

2.3.9 Release of Approach Locking with Simplified Auto normalisation

Where automatic normalising of the signal is provided by occupancy of the A track circuit alone (e.g. One Control Switch (OCS) type systems), the track occupied release of approach locking is not to be provided for main running aspects.

Where there is a need for a track occupied release (e.g. on certain subsidiary signals), selection shall be incorporated to ensure that the track occupied release is not effective for main running aspects.

2.3.10 Signals Stepping from Shunt to Main Aspect

It is permissible for signals to step up directly from a shunt aspect to a main aspect without first releasing approach locking. However, it is not permissible for a signal to step down from a main to a shunt aspect where less restrictive locking is applied without release of the approach locking.

2.4 Route Holding (Route Locking)

2.4.1 Purpose

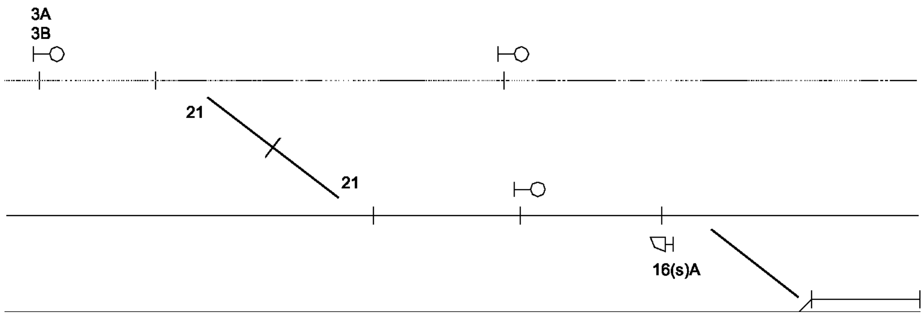
Route holding is provided to maintain the effect of route to route or route to points or similar locking by the occupation of track circuits between the functions concerned.

The route holding becomes effective once a train has entered the route and the initiating signal replaced to stop and the route normalised.

In some circumstances a time release is required to free route holding.

2.4.2 Requirements - Holding of Locking Between Opposing Routes

If opposing routes are situated such that the occupation of an intervening track circuit is in itself insufficient to maintain the aspects of opposing signals at stop, then this shall be enforced by the provision of route holding between the signals concerned. This will be required between main and main signals and between main and shunt signals, (this may be achieved via points – see figure 4).



"16(s)A sets locks and detects 21 NORMAL
3B sets locks and detects 21 REVERSE"

Figure 4 – Route Holding

3B to route hold and prevent 16(s)A from clearing as 16(s)A could set lock and detect 21 points normal after train on 3B route has cleared 21 points

Generally no route holding is applied between shunt and shunt signals, however, in special circumstances route holding may be applied.

For conflicting routes, route holding is not required where both routes cannot be set together by virtue of different points lie requirements.

2.4.3 Requirements - Holding of Route to Point Locking

If a set of points is located within the route section of a signal then the points shall be route held by the occupation of any one of the intervening track circuits within the signal route section between the signal and the set of points concerned.

If a set of points is located within the route overlap of a signal then the points shall be route held by the occupation of any one of the intervening track circuits within the signal route section between the signal and the set of points concerned, this does not apply for South Australian jurisdictions.

2.4.4 Requirements - Releasing of Route Holding

If permitted route holding shall be released after the expiry of a time release. Instances where a time release may be permissible are:

a) if train has come to a stand and it is required that an opposing signal be cleared

b) if a train has come to a stand at a signal and it is required that a set of points in the overlap be moved to the opposite position to facilitate the same or some other train movement

c) if a train has come to a stand and it is required to operate a releasing switch which is in the route.

In cases where track geography may result in a second train maintaining the route holding initiated by a first train, tracks shall be conditioned by points set in rear of the first train for the second train. Selection of signal routes shall be by points set.

Timing out of a route holding on overlap locking shall be performed on the last in-route track circuit. Where train movements may not always travel to the last in-route track circuit then time out shall be on aggregation of suitable tracks at the end of the route. Timing out of route holding locking on opposing shunt moves must be based on the destination track/s occupied for time for the original move. The time release must be based on Table 3: Route Holding Times.

The Time Releasing shall be determined by calculating the time taken for a train running at a consistent speed to pass over the timing track circuit. If the timing track circuit is 200m or less then this speed shall be taken as 15kph. If the length of the timing track circuit is greater than 200m then this speed shall be taken as 25kph. The time calculated by this method shall then be rounded up to the next 15 seconds.

Where the stop signal ahead is situated some longer distance back from the potential fouling point then consideration may be given to a commensurate increase in the average speed used for calculating the time release period. This calculated time shall be shown in the Control Tables up to a maximum of 35kph.

Releasing arrangements are to take into account the method of operation of the interlocking and shunting arrangements. For main line movements timing shall require berth track occupancy, however, for locations where ground frames are provided, the timing track should be local to the ground frame and extend approximately 100m either side.

Consideration should be given to having a time release for the full length of the route in addition to a time release for a final track circuit in the route.

Long timing over a number of track circuits (e.g. in a loop) may be necessary to meet operational needs.

3 Point Locking

3.1 General Point Locking Requirements

a) Points shall not be free to move until the tracks that directly or indirectly lock point movements, have been continuously energised for 1 second minimum.

b) Pre-selection of signalling routes over points shall not be permitted. Points selection circuits shall be designed to be non-storage regardless of type of operation. With Train Control systems pre-storage of route requests is permissible where a request function is part of the route request.

c) Points motors/valves (excluding E.P. and clamplocks) shall be controlled by normal and reverse contactors of BRB 966-F4 or QBCA1 or equivalent type with heavy duty contacts.

d) Contacts of point 'Isolating Relays' where applicable shall be in each point motor circuit, to control the point motor power supply. These shall only be energised to drive the points. The circuit function shall include the contact of the local track relay in preference to a repeat relay. The isolating relay shall double switch the point motor circuit.

e) Points contactors and IR relays are to be mounted adjacent to each other in the nearest location case, walk-in or relay room.

f) Back proving of both 'A' and 'D' contact stacks of the BRB 966-F4 or QBCA1 or equivalent relay shall be carried out.

g) The emergency on site operation of point machines will be made possible by the use of an emergency crank handle or manual lever.

h) Where applicable, when the points crank handle is removed from the Annett lock, the power supply to the point motor will be cut off and all signals interlocked with the points held at stop. This is achieved by cutting the detector relays and isolating relay circuits.

i) There shall be a lever to select motor or manual operation in the cases of dual control point machines. This lever shall be normally locked in the motor position with a padlock which is released by the nominated operation key, see network rules. The lever in the manual position shall isolate the motor and detection circuit.

j) A timing device shall be provided for all points to cut the feed to the point motor if its running time exceeds 300% of its normal running time. This timing device shall be re-set if the point control is operated to return the points to the other position.

k) Where magnetic contactors are utilised in the machine, checking of the opposing lock relay should be performed in the detector circuit. In this case the ESML/EOL contacts should cut both the detector circuit and the isolating relay.

l) Facing points in the overlap are generally not locked.

Release of Point locking is achieved by one of the following:

a) Timing out of the approach locking with a train on the approach tracks, or

b) Occupation of the last in-route track for a time as specified in Table 3: Route Holding Times, or

c) Occupation of group track circuits within the route as specified in the control tables, or

d) Passage of the train through the route (i.e., train has proceeded past the next signal), or

e) Cancellation of the signal, providing the approach locking is released.

3.2 In-Route Points

When the points track is the first in-route track, the points are locked by the signal called and maintained by either the signal's approach locking or the points track occupied. Where the points are not situated in the first in-route track, route holding is required to lock the points in the required lie. It shall be initiated by the signal called, and held by either the signal's approach locking or the occupation of tracks between the signal and the points track.

3.3 Self Normalising Points for Traps and Catch Points

Self normalisation may be provided for trap and catch points on sidings which protect the main line. Where self normalisation is specified in the signalling arrangement, the points shall be set to normal when the points have been continuously free to move for a period not less than 45 seconds. The timing and points call functions are implemented in the control centre.

3.4 Self Restoring Points for Crossing Loops

Self restoring points may be provided for crossing loops. The points shall restore to normal after the passage of the train and when the points have been continuously free to move for a period not less than 3 seconds. The timing of the points call function is implemented in the interlocking equipment.

3.5 Yard Entrance/Exit

Shunting yard entry/exit points protecting main routes past the yard are to be locked by those main routes to protect main route and overlaps where there is the possibility of a shunt coming loose within the yard and travelling in an opposing or flank direction towards that route or overlap where the distance from the yard entrance/exit to the point of conflict is less than 250m, or as otherwise determined by the Signal Design Authority.

3.6 Points Sequencing

Sequencing of the motoring points machines may be used where there is insufficient power capacity available through cabling or back up power supplies. Detection of the initial points or time out of the cut-out timer to ensure the points are not motoring is required to before subsequent points can be motored.

3.7 Derailment at Catch Points

Where vehicles that have been derailed by catch points are likely to be foul (as defined in S.07.42111.20 Bonding and Track Clearance Points) of a main running line, a means (e.g. a circuit interrupter) shall be provided to prevent the clearing of signals along the main running line when vehicles have been derailed by the catch points.

3.8 Detection of Points

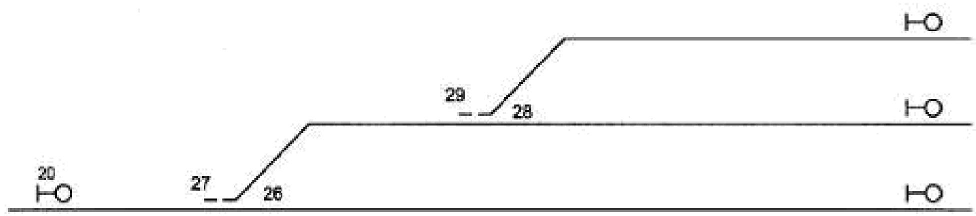
3.8.1 Introduction

This Principle addresses the requirements for the electrical detection of mechanically, power or ground frame operated points in colour light signal aspects.

Facing point locks shall be provided on facing points on running lines for all signalled facing movements for trains conveying passengers. On electro-pneumatic (EP) points, a plunger lock shall also be provided in these circumstances. Moreover, facing point locks are to be provided for all authorised running movements over facing points including interlocked emergency crossovers.

3.8.2 Detection of Mechanically Operated Points in the Route Section

If a set of mechanically operated facing points is situated within the route of a signal, then the correct position of the open switch, closed switch and facing point lock shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to figure 5.

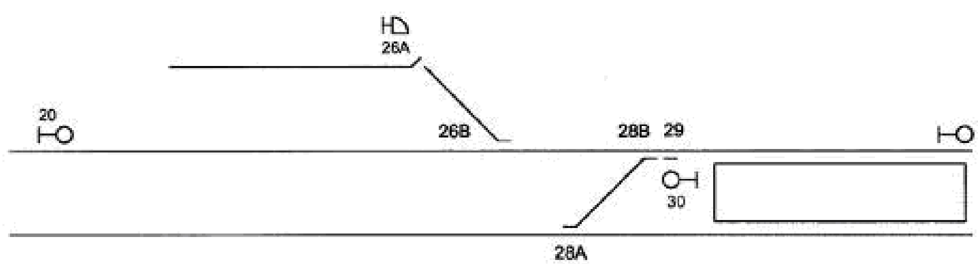


SIGNAL	DETECTS	
	POINTS	FPL'S
20	26N	27R
	26R 28N	27R 29R
	26R 28R	27R 29R

FPL OUT BOTH WAYS

Figure 5 – Detection of Facing Points and FPL's in Routes

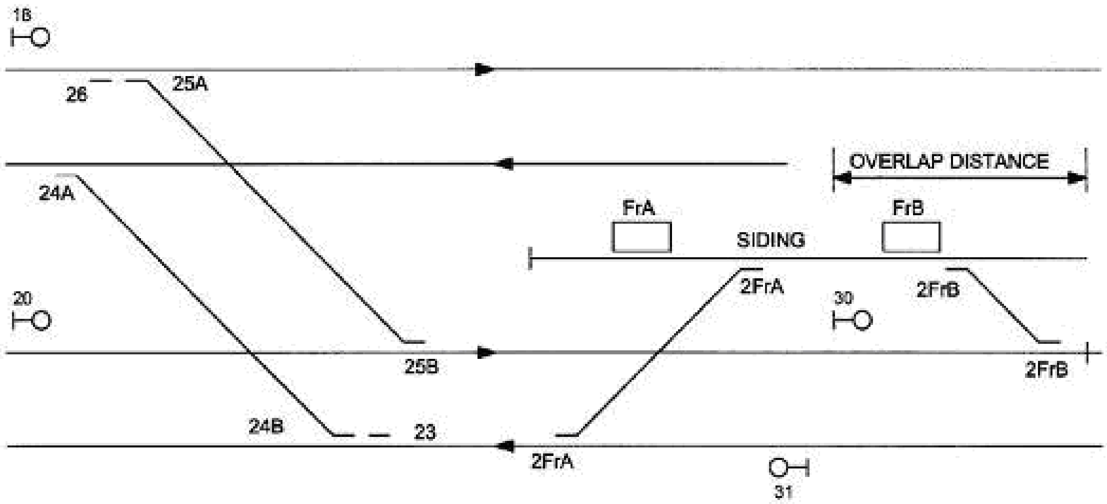
If a set of mechanically operated trailing points is situated within a route, then the correct position of the open switch and closed switch will not generally be required to be detected in the signal aspect. Refer to figure 6.



SIGNAL	DETECTS	
	POINTS	FPL'S
20	26AN	NIL
30	28BR 26AN	29R

Figure 6 – Detection of Trailing Points in Routes and as a Trapping Protection

If the end of a set of mechanically operated points is situated such that it provides trapping/flank protection to the route then it may be desirable for the correct position of the closed switch and the open switch, or the open switch in the case of single switch catch points, to be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to figure 7.



<table>
<tr><th rowspan="3">SIGNAL</th><th colspan="3">DETECTS</th></tr>
<tr><th colspan="2">IN ROUTE OR OVERLAP</th><th>AS TRAPPING PROTECTION TO ROUTE OR O/L</th></tr>
<tr><th>POINTS</th><th>FPL'S</th><th>POINTS</th></tr>
<tr><td rowspan="2">18</td><td>25AN</td><td>26R</td><td></td></tr>
<tr><td>25AR</td><td>26R</td><td>2FrAN (SIDING END), 2FrBN (SIDING END)</td></tr>
<tr><td>20</td><td></td><td></td><td>24BN, 2FrAN (SIDING END),
2FrBN (SIDING END)</td></tr>
<tr><td>30</td><td></td><td></td><td>2FrBN (SIDING END)</td></tr>
<tr><td rowspan="2">31</td><td>24BR</td><td>23R</td><td>2FrAN (SIDING END)</td></tr>
<tr><td>24BN</td><td>23R</td><td>2FrAN (SIDING END)</td></tr>
</table>

Figure 7 – Detection of Multiple Ended Points in Routes and as a Trapping Protection

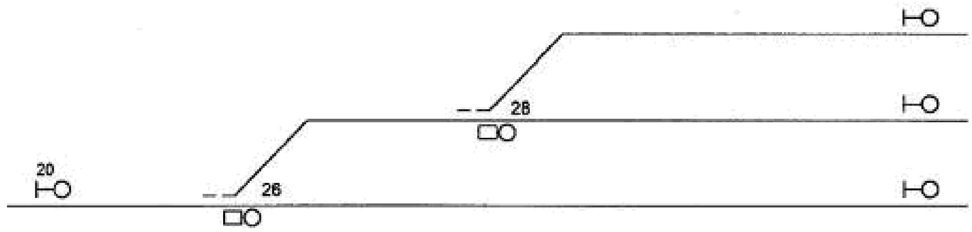
3.8.3 Detection of Mechanical Points in the Route Overlap

If a set of mechanically operated facing points is situated beyond the exit for the route for a signal, but within the overlap distance applicable to the signal, and is protecting an alternative overlap which is unavailable, or not permitted, then it is desirable that the correct position of the open switch and closed switch be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect or, if it is not practical to include the points switch detection then at least the points lever shall be proved to be in the correct position and electrically lever locked, where applicable.

If a set of mechanically operated facing or trailing points is situated outside the route of a signal but offers trapping/flank protection to the route then it may be desirable to detect the appropriate position of the points subject to operating considerations. Refer to figure 6.

3.8.4 Detection of Power Operated Points in the Route Section

If a set of power operated facing points is situated within the route of a signal then the correct position of the open switch, closed switch and facing point lock (and plunger lock where used on EP points) shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to figure 8.

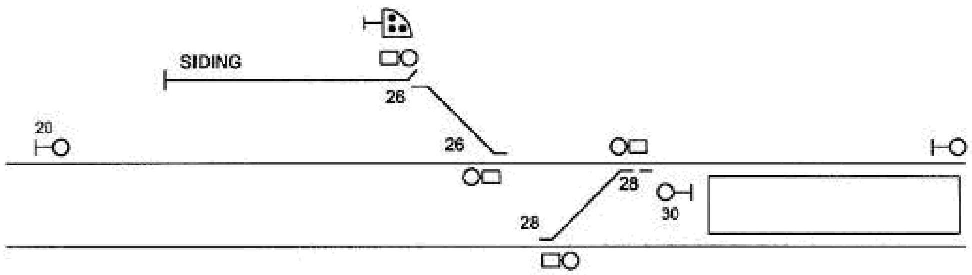


SIGNAL	DETECTS POINTS
20	26N 26R 28N 26R 28R

Figure 8 – Detection of Facing Points in Routes

If a set of power operated trailing points is situated within the route of a signal then the correct position of the open switch, closed switch and facing point lock, if provided, shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to figure 9.

If the end of a set of power operated points is situated such that it provides trapping/flank protection to the route then the correct position of the open switch, closed switch and facing point lock, if provided, or the open switch in the case of a single switched catch point, shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to figure 9.

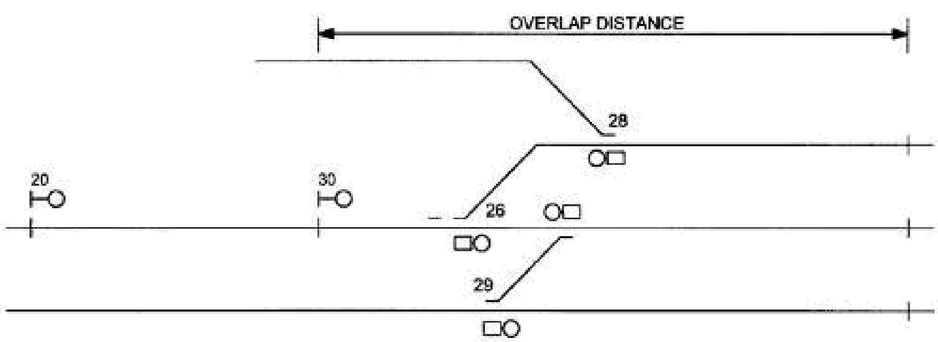


SIGNAL	DETECTS POINTS
20	26N 28N
30	26N 28R

Figure 9 – Detection of Trailing Points in Routes and as a Trapping Protection

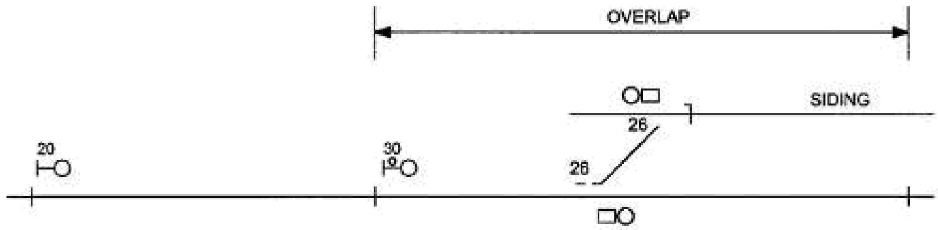
3.8.5 Detection of Power Operated Points in the Route Overlap

If a set of power operated facing points is situated beyond the exit of a route for a signal but within the overlap distance applicable to the signal and is protecting an alternative overlap which is unavailable, or not permitted, then the correct position of the open switch, closed switch and facing point lock shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to figures 10 & 11.



SIGNAL	DETECTS POINTS
20	29N W 26N 28N W 26R 26N W 28R 26R W 29R

Figure 10 – Detection of Point in an Overlap



SIGNAL	DETECTS POINTS
20	26N

NOTE: NO OVERLAP IS PERMITTED INTO THE SIDING

DETECTION OF FACING POINTS IN A FIXED OVERLAP

Figure 11 – Detection of Point in an Overlap

If a set of power operated trailing points is situated beyond the exit of a route for a signal but within the overlap distance applicable to the signal, the actual field position of the points switches in the line of the overlap will not require to be detected in the signal. However if the points can be manually operated in emergencies then operation of the emergency facility provided (e.g. ESML, EOL) shall reliably and fail-safely replace and retain at stop all signals which interlock with the trailing points; it is normal practice to include the emergency facility lock contacts in the points detection circuit.

If an end of a set of power operated points is situated such that it provides trapping/flank protection to an overlap then the correct position of the open switch, closed switch and facing point lock, if provided, or open switch in the case of a single switch catch point, shall be detected before the signal is permitted to clear over that line of overlap and shall remain detected continuously thereafter to maintain a clear aspect. Refer to figures 9 & 11.

3.8.6 Multiple Ended Points

If a set of points comprises two or more point ends, then the correct positions of the open switch, closed switch and facing point lock, if provided, at each end shall be detected as prescribed before a signal is permitted to clear and continuously thereafter to maintain a clear aspect. Normal practice shall be to include the detection of all ends of the same set of points in a common circuit.

3.8.7 Detection of Ground Frame Operated Points

In relation to ground frame operated facing points in the route section and point ends providing trapping/flank protection to the route section or route overlap, the correct position of the open switch, closed switch and facing point lock, if provided, or the open switch in the case of a single switched catchpoint, shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect.

3.9 Track Circuit Locking of Points

3.9.1 Purpose

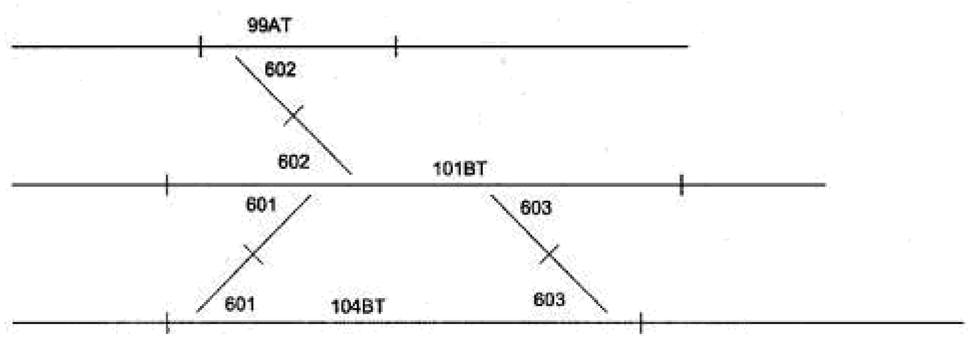
Track locking is provided over points to ensure they are held in position for the passage of a train once the direct route to point locking has been normalised and the train is between the points and the signal leading over them.

3.9.2 Requirements - Track Circuit Locking of Points Controls

All sets of power operated points shall be locked in both the normal and reverse positions by the occupation of the track circuit or circuits immediately over the points. Refer to figure 12.

The limits of this track circuit or track circuits over the points shall extend at least as far as the clearance point in accordance with S3 – 5.2 Track Circuit Limits and Clearance Points.

If the track layout and train movement do not permit the track locking to be extended then route holding as described in ESD-05-01 – 2.4 Route Holding (Route Locking) shall be provided.



POINTS N°	LOCKED NORMAL & REVERSE BY TRACK CIRCUITS OCCUPIED
601	101BT 104BT
602	99AT 101BT
603	101BT 104BT

Figure 12 – Detection of Point in an Overlap

3.9.3 Electrically Operated Points

The motor circuit of electrically operated facing points shall be directly controlled by a contact of the track circuit function immediately over the points (see 3.9.2) and route locked by all routes leading up to the points. The track circuit function is input via an isolating relay except where trailable point machines are installed in yards. Approach stick relays of facing signals are also included in the isolating relays.

A feature shall be included such that the occupation of the track circuits concerned does not preclude the completion of a point movement once it has commenced.

3.9.3.1 Pneumatically Operated Claw Locks

Operation of the cut-off valve (LWR) shall be controlled by a contact of the track circuit immediately over the points and if facing points any other track circuits between the points concerned and the signal or signals reading over the points.

3.9.4 Control Tables

The requirements for the direct track locking of point operating mechanisms shall be in accordance with the Control Tables concerned.

Track circuits over points shall be high voltage impulse type. However, other track circuit types may be used where it is demonstrated that there are no issues with the reliability of operation.

4 Headway

4.1 Headway Concepts and Definitions

The headway on any section of railway line is a measure of the capacity to pass trains through the section.

Headway is defined as the time interval between successive trains running at the line speed on clear signal aspects.

Headway is expressed in minutes and perhaps seconds rather than the number of trains passing over a line during each hourly interval.

The spacing of signals on a section of line may not achieve a consistent headway due to other factors. The headway for the section of line is then based on the worst case headway of the individual signals.

Headway may be stated for trains of a specific type or performance.

4.2 Signal Spacing

As headway considerations become critical to the performance of train services then it is necessary to provide a system of evenly time-spaced signals having regard to the effect of line speed, braking and gradient. Other operating factors such as station dwell time, freight train acceleration/deceleration and actual performance on the track (gradient and curves) will also affect headway considerations. Train simulation may be required to determine these effects.

Signal spacing is defined as the distance between two signals. It is often evaluated for successive signals provided to achieve a particular headway for a line.

4.3 Sighting Point & Distance

Adequate signal sighting point is essential if the drivers of trains are to be allowed to take the maximum advantage of the signal aspects ahead of them. Poor sighting can have a detrimental effect on headways in practice.

The sighting point is the point in rear of a signal at which the driver of a train is first able to view the signal.

The sighting distance is the distance between the sighting point and the signal to which it applies. The distance between the sighting point and the signal is provided to allow the driver to firstly observe the signal and then to be in a position to respond to the aspect displayed. The time permitted for sighting a signal shall normally be a minimum of 8 seconds. In exceptional situations this may be reduced to an absolute minimum of 6 seconds. For further details see ESC-04-01 Signal Sighting and Position.

The actual Sighting Distance may vary depending upon the approach speed of the train. When the line speed or train approach speed is increased, the Signal Sighting distance shall be reviewed.

The Signal Sighting Distance shall not be considered as part of the train braking distance when determining the spacing of signals.

4.4 Distance between Running Signals

4.4.1 Minimum Distance between Running Signal Aspects

The Braking Distance of trains is a crucial factor in determining the position of signals and aspects to be displayed. Braking Distances and permitted line speeds will vary between different classes of trains. For a section of track the signal design shall account for all classes of trains but may be determined by the limiting performance of the line speed and braking distance of one of the classes of trains. This must take into account the track infrastructure factors of line speed, gradient and curvature.

The “longest braking distance” shall be the service braking distance of the train that takes the longest distance to stop or nominate target speed from its maximum allowable and attainable speed at that particular brake application location. Where the attainable speed is significantly below the line speed then this should only be used if there are other controls or mitigations to ensure that future trains do not exceed this design speed.

The minimum distance between a signal showing a first warning aspect and the stop signal to which it applies shall not be less than the respective “longest braking distance”. This distance shall be determined in accordance with ESD-05-01 – 5.2 Braking Distance in Signalling Systems

The minimum distance between a signal showing the first warning aspect and a points turnout to which it applies shall not be less than the “longest braking distance” to reduce to the restricted speed required for the points turnout.

The minimum distance between a signal showing the first warning aspect and a subsidiary signal showing a proceed aspect shall be the “longest braking distance” to reduce to the restricted speed required by the subsidiary signal proceed aspect where such restricted speed is applicable.

4.4.2 Maximum Distance between 3 Aspect Running Signals

The distance between 3 aspect running signals shall generally be limited to 4,000m and exceptionally to an absolute limit of 4,500m.

If the distance between two successive running signals is greater than 4km and more than 2 times the service braking distance then the sighting distance of the second signal shall be greater than the minimum sighting distance shall be in accordance with ESC-04-01 Signals Sighting and Position and SDS 01 Signals – 1.12 Positioning and Sighting of Signals. The overlap distance for the first signal beyond the second signal should be greater than the normal minimum overlap distance shall be in accordance with ESD-05-01 – 6.2 Overlaps for Colour Light Running Signals, such that the sighting distance and the overlap distance together are greater than their combined minimum distances to an extent commensurate with the greater distance between the signals. This only applies to double track with automatic and control signals.

5 Braking Distance Concepts and Definitions

5.1 Definitions

5.1.1 Braking Distance – Concept

Braking Distances for trains can be relatively long due to their significant mass, speed, braking characteristics, and the track gradients.

Consequently the Braking Distances become a critical consideration when determining the position of the first warning aspect with respect to the stop signal to which it applies, and especially so when trains with different Braking Distances operate over the same line.

5.1.2 Braking Distance – Definition

Braking Distance is the distance travelled by a train between the point at which the driver initiates a brake application and the point at which the train eventually comes to rest.

5.1.3 Service Braking Distance – Definition

Service Braking Distance is fundamental in determining the minimum distance between the first warning aspect given to a driver and the stop signal to which it applies.

5.1.4 Emergency Braking Distance – Definition

Emergency Braking Distance is the braking distance for a train when it has been subjected to an "emergency" brake application.

Emergency Braking Distance may be used in determining the minimum overlap distance to be provided beyond a stop signal.

Notes: The Emergency Brake can be initiated independently of the Service Brake for example by release of the "dead mans lever" or by a train stop mechanism where provided.

Emergency Braking Distance is not necessarily less than the Service Braking Distance and is greater for some types of trains.

5.2 Braking Distance in Signalling Systems

5.2.1 Determination of Braking Distance

The Braking Distance for each type of train running on a particular line may be obtained from theoretical calculation or from dynamic tests performed on the trains themselves or result from a mixture of both sources of information.

The approved Brake Tables shall be used to determine signal design requirements.

Either way, many factors influencing this predetermined Braking Distance. The Brake Tables have included consideration of:

- the speed of the train when the brake application was initiated
- the fundamental rate of braking which can be achieved
- the effects of the braking system reaction time
- the number of brakes which may be cut out
- the acceptable amount of wear and tear on braking performance
- the effect of rising or falling gradients
- % contingency.

From the above two sets of Braking Tables can be produced for each type of train, one for Service Braking and one for Emergency Braking.

5.2.2 Service Braking (SB) Curves

The Service Braking curves to be used in conjunction with this Principle shall be the curves nominated in the standard ESD-32-01 Signalling Rollingstock Interface.

When designing a signalling system, the signal spacing shall be determined so as to enable the longest braking distance train, travelling at its maximum allowable and attainable speed, applying service braking at the warning signal to come to a stand at the signal. The sighting distance of the warning signal shall not be included in the determination of the minimum signal spacing for braking when designing the system.

5.2.3 Determination of Longest Braking Distance

The longest (service) braking distance required in any particular section of a running line shall be determined from the appropriate Service Braking Tables have regard to:

- the types of trains running over the particular section of line
- the maximum speed permitted (line speed) for each type of train. Note that it is the line speed approaching the first warning signal rather than the line speed between the warning signal and the stop signal which is most relevant.
- the service speed of each type of train in the particular section of line. (For example, some types of freight train are limited to a maximum speed irrespective of line speed and in some situations trains may not be able to always attain line speed)
- the gradient on the particular section of line, in particular the gradient approaching the warning signal and between the warning signal and the stop signal. Where there is a change in gradient, then the braking distance shall be calculated by incrementally determining the speed reduction for each section of gradient. Where there is a long train then the point of the centre of mass of the train shall be used to determine the gradient applicable for calculations.
- the present speed restriction, if any, applicable to the particular section of line.

Care must be exercised in accurately identifying the “worst” braked trains running over the particular section of line for the purpose of determining the longest (service) braking distance correctly.

Subsequent to power failure affecting the area controlled by an interlocking or the interlocking itself, the track circuit release of approach locking shall be suppressed for a time which is not less than the longest approach locking time release for the interlocking.

6 Overlaps Concepts and Definitions

6.1 Overlap – Definition

An overlap is the section of track immediately in advance of a stop signal which must be unoccupied and free before the stop signal next in rear is permitted to show a proceed indication.

The overlap distance is the length of the section of track which forms the overlap and is measured from the Stop signal to a predetermined clearing point in advance.

Where provided, the purpose of an overlap is to ensure a margin of safety beyond a stop signal by establishing a predetermined separation distance between two trains. This is to allow for slippery rails or a misjudgement of the final brake application by a driver intending to stop at a signal. The margin of safety is a predetermined separation distance between two trains and may be prescribed under these Principles:

- Historical precedents and experimental data
- Maximum Line Speed
- Permanent Speed Restrictions
- Service Speed
- Service Braking Tables
- Emergency Braking Tables
- Impact of gradient
- Emergency Brake Tripping System
- Automatic Train Protection System
- Provision of conditional caution aspect clearance of signals.

When there is enforcement of train braking, then the overall distance is determined dynamically using the relevant train braking tables.

Opposing moving trains cannot share a common overlap except as detailed below in 6.2.4.

It is not ARTC policy to provide enforcement of train braking by automatic train protection systems e.g. train stops. However, where these are provided as legacy systems or otherwise and trains are correspondingly fitted, then the overlap distance is the emergency braking distance for the fitted trains.

6.2 Overlaps for Colour Light Running Signals

6.2.1 Provision of an Overlap

If a running signal is capable of showing an unconditional warning aspect then an overlap shall be provided immediately beyond the stop signal to which the warning aspect applies.

6.2.2 Overlap Distance

The nominal length of the overlap to be provided shall not be less than the minimum distances shown below:

- Low speed subsidiary for route signalling or conditional cleared running signals, 100m
- Running signals, 200m
- Running signals with a line speed greater than 80kph, 300m.

If the train density is such that the headway is less than 10 minutes, then the overlap distance is increased by 100m.

6.2.3 Variations to Overlap Distances

If the grade on a particular section of line is greater than 1 in 100 falling, then the overlap distance shall be increased for that speed range by not less than 100m.

If a block joint already exists or is to be provided for other purposes and could also be used as an overlap block joint without adversely affecting the line headway then the overlap distance may be increased to avoid the provision of a separate overlap track circuit.

If the line headway is adversely affected by the nominal overlap distance then a reduction in the overlap distance should be considered based on the appropriate factors presented under ESD-05-01 – 6 Overlap Concept and Definition.

Where train speeds are permanently restricted due to them departing yards or negotiating turnouts or junctions, then the overlaps beyond the signal may be reduced to 90m where the speed approaching the signal is restricted to 15kph and to 150m where the speed is restricted to 25kph, or reduced to the longest braking distance, if less.

If a running signal is more than 4km and more than 2 times service braking distance from the next signal, then the overlap distance for that running signal beyond the next signal shall be commensurably greater than the normal minimum overlap distance.

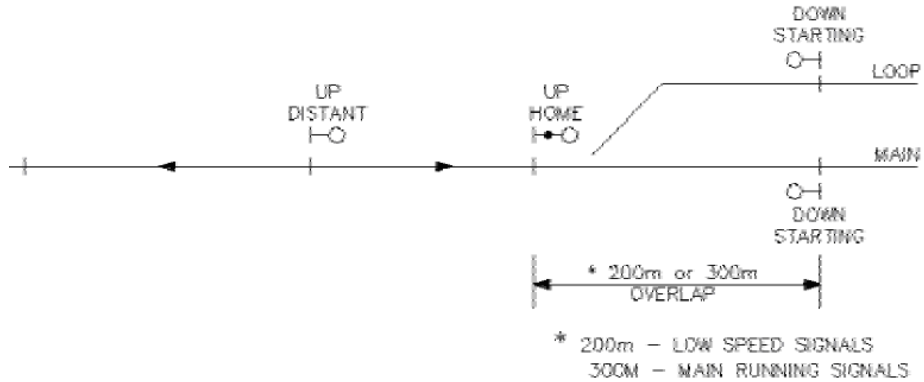
If a line is freight only then, consideration may be given to the reduction in the length of overlaps, based on a Risk Assessment for the operation of the line.

This Principle addresses the requirements for the provision of overlaps on single lines and in crossing loops in CTC colour light territory.

6.2.4 Provision of an Overlap on a Single Line in CTC Territory

An overlap shall be provided at the exit from a single line block section immediately in advance of the home signal.

This overlap shall extend from the home signal as far as the opposing main and loop starting signals controlling the entrance to the single line block section and shall incorporate loop and flank protection. Refer to figure 13.



* OR MEDIUM SPEED, FOR SPEED SIGNALS IN SPEED SIGNALLING AREAS

Figure 13 –Overlaps on Single Lines in CTC Territory

If for operational reasons an outer home signal is provided at the exit from a single line block section together with an opposing starting signal on the single line then an overlap shall be provided immediately in advance of the outer home signal.

This overlap shall extend from the outer home signal towards the opposing starting signal on the single line. Refer to figure 14.

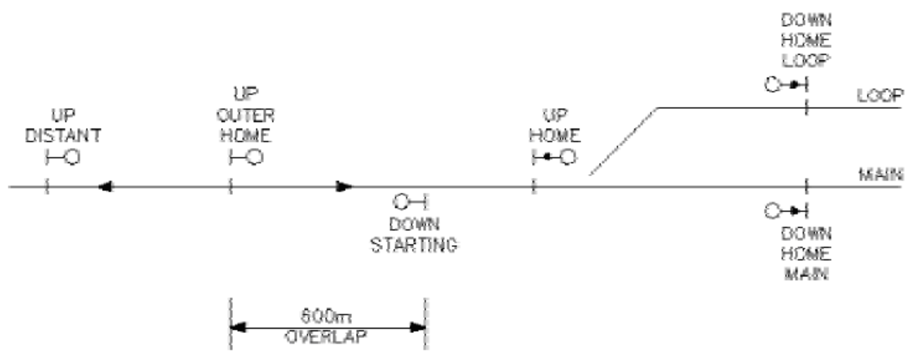


Figure 14 –Overlaps on Single Lines in CTC Territory

If a home signal only is provided then a nominal overlap of 200m shall be provided for the single line block section extending over the loop end.

If main running signals are provided for loop entry, this distance shall be 300m. Refer to figure 13.

If an outer home signal is provided then a nominal overlap of 300m shall be provided for the single line block section and this shall abut a 100m overlap provided immediately in advance of the opposing starting signal. Refer to figure 14.

If the train density is such that the headway is less than 10 minutes, then the overlap distance is increased by 100m. If the grade approaching the home signal or within the overlap is greater than 1 in 100 falling, then the overlap distance shall be increased by 100m.

If a block joint which already exists or is to be provided for other purposes could also be used as an overlap block joint without adversely affecting the line headway then the overlap distance may be increased to avoid the provision of a separate overlap track circuit.

6.2.5 Provision of Overlaps at a Crossing Loop

The home signal shall be provided with an overlap immediately in advance of the main and loop starting signals into the single line block section in advance.

This overlap shall extend from the main or loop starting signal into the single line block section in advance as far as the opposing home signal. Refer to figure 15.

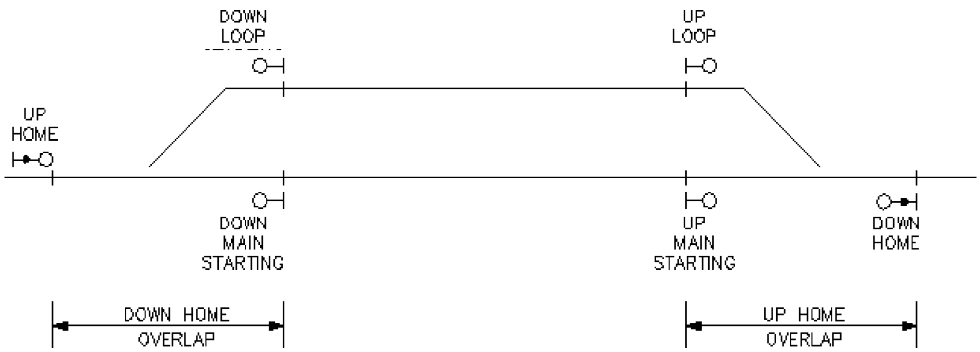


Figure 15 –Overlaps on Crossing Loops in CTC Territory

If an outer home signal is provided then an overlap shall be provided for the caution aspect.

This overlap shall extend from the home signal to the main or loop signals leading into the single line block section in advance. Refer to figure 16a.

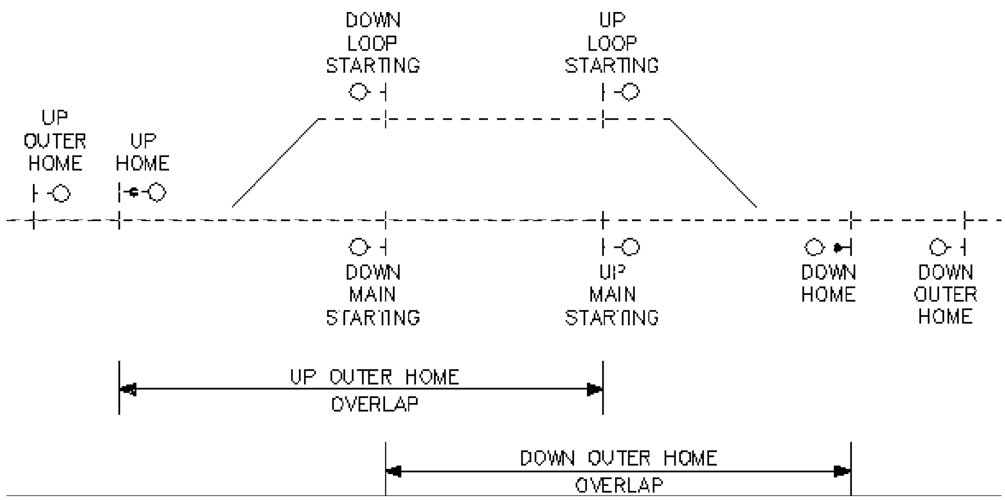


Figure 16a –Overlaps on Crossing Loops in CTC Territory

At CTC loops using a low speed subsidiary for entry, the distance between the loop and main starting signals and the home signal shall be 200m. Where main running aspects are used for entry, this distance shall be 300m. The points shall be set to deflect any conflicting movement.

The nominal overlap distance for an outer home signal shall not be less than that required under ESD-05-01 - 6.2.2 Overlap Distances and not greater than the distance to the main and loop signals leading into the section in advance.

6.2.6 Provision of Overlaps for Simultaneous Entry at a Crossing Loop

The home signal shall be provided with an overlap immediately in advance of the main and loop starting signals. As detailed above, the overlap for a CTC crossing loop is 300m with a running aspect. This overlap in the above examples extends into the single line section. The following configuration has the 300m overlap entirely within the crossing loop and clear of the clearance point for the other path through the crossing loop. This will allow for the clearing of both home signals for simultaneous entry to the loop line and the main line. The aspect sequence is to be appropriate for the path to the stop signal with a 300m overlap. The points shall be set to direct any conflicting movement to an alternate path.

The nominal overlap distance for an outer home signal shall not be less than that required under ESD-05-01 - 6.2.2 Overlap Distances and not greater than the distance to the main and loop signals leading into the section in advance.

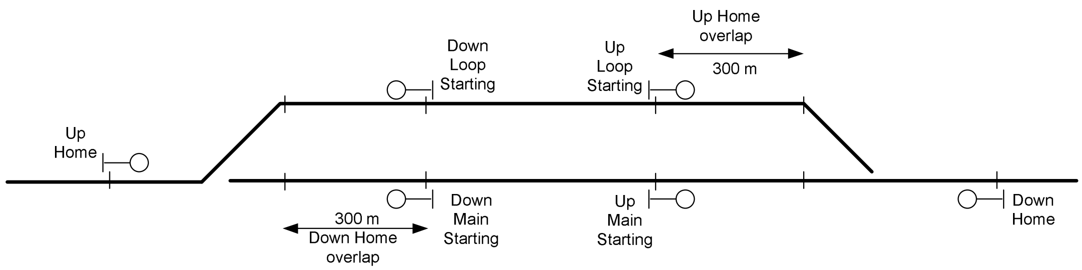


Figure 16b –Overlaps on Crossing Loops for Simultaneous Entry

The train may stand at the Starting signal with the rear of the train extending to the clearance point. This is the rear of the train extends beyond the starting signal at the other end of the loop. The standing room for the train should allow for the locomotive to have a sighting distance on the approach to the signal and the rear to be inside the clearance point with an allowance for sag of the train.

6.2.7 Provision of Overlaps for Modified Simultaneous Entry at a Crossing Loop

The home signal shall be provided with an overlap immediately in advance of the 2nd home signal and loop starting signals. The overlap for a CTC crossing loop is 300m with a running aspect. The overlap example in section 6.2.5 extends into the single line section; the overlap example in section 6.2.6 extends from the starting signal to the clearance point and is wholly within the crossing loop. The Modified Simultaneous Entry configuration of the 300m overlap is entirely within the crossing loop and clear of the clearance point for the other path through the crossing loop.

Modified Simultaneous Entry configuration will provide the 300m non-shared overlap within the crossing loop by placing a home signal 300m from the clearance point and 200m on the approach side of the crossing loop starting signals.

The home Signal placed 200m on the approach side of the staring signal will be known as either the Down 2nd Home Loop, Down 2nd Home Main, Up 2nd Home Loop or Up 2nd Home Main depending upon which line the signal is positioned.

The 2nd Home Signal will be fitted with a low speed signal that will be conditionally cleared after a timing sequence that provides assurance that the approaching train has reduced speed to 25kph or lower.

The timing sequence will be an overlay timing track circuit 100m in length located at 250m on the approach side on the 2nd Home Signal.

A sign worded “Begin 25kph timing” will located at the commencement of the timing sequence track circuit (250m on the approach side of the 2nd Home Signal)

When the timing sequence has completed and the train is proved to have reduced speed to 25kph or lower, and the 100m overlap is vacant, the 2nd Home Signal will display a low speed signal.

The overlap for the low speed signal will extend from the starting signal to the clearance point.

The 2nd Home Signal will only display a clear indication (green), stop and Low Speed; a clear indication will only be displayed when the starting signal is displaying a clear indication.

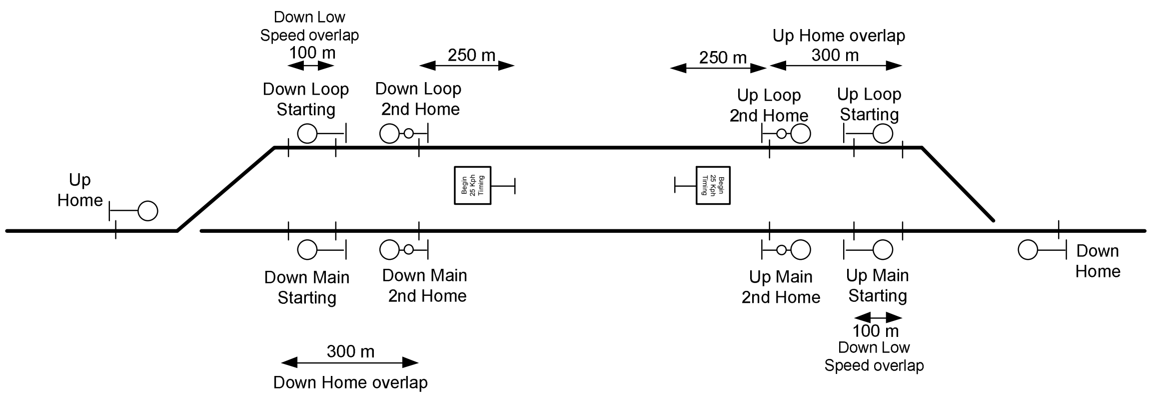


Figure 16c –Overlaps on Crossing Loops for Modified Simultaneous Entry

This configuration will allow for the clearing of opposing home signals for simultaneous entry to the loop line and the main line. The aspect sequence is to be appropriate for the path to the stop signal with a 300m overlap. The points at the other end of the loop shall be set to direct any conflicting movement to an alternate path.

The nominal overlap distance for an outer home signal shall not be less than that required under Section 6.2.2 Overlap Distance and not greater than the distance to the main and loop signals leading into the section in advance.

The train may stand at the Starting signal with the rear of the train extending to the clearance point. This is the rear of the train extends beyond the starting signal at the other end of the loop. The standing room for the train should allow for the locomotive to have a sighting distance on the approach to the signal and the rear to be inside the clearance point with an allowance for sag of the train.

6.3 Overlaps in ETS and OTS Territory where Colour Light Running Signals are Provided

6.3.1 Provision of an Overlap

An overlap shall be provided at the exit from the single line section immediately in advance of the home signal.

This overlap shall extend from the home signal to the opposing starting signal or signals controlling the entrance to the single line section or approved clearing point as required. Refer to figure 17.

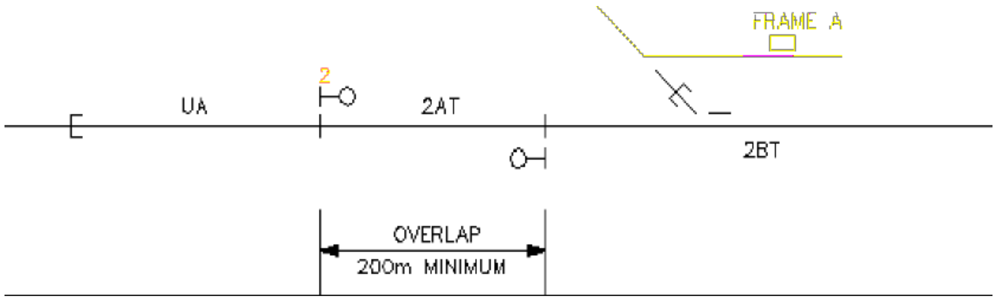


Figure 17 –Overlaps in ETS or OTS Territory

The length of the overlap shall be 200m minimum.

6.4 Overlaps in Train Order Working Areas

This Principle addresses the requirements for the provision of overlaps on single lines operated under train order working.

6.4.1 Provision of an Overlap at Train Order Working Locations

An overlap shall be provided between train movements approaching a location and shunting movements at that location. The minimum length of the overlap shall be 500m.

This overlap shall extend from the Yard Limit Board to the opposing Shunt Limit Board.

If a full overlap is not available, a reduced overlap may be used provided the speed of approaching trains is reduced to be commensurate with the safety margin provided by the reduced overlap distance.

At locations where Shunt Limit boards are not provided and shunting is taking place, then train authorities must not be issued for a train to approach the location.

At adjacent train authority working locations, a 500m minimum overlap shall be provided between the Yard Limit Board and the opposing Shunt Limit Board in each location, where sufficient distance exists. Where insufficient distance exists, this overlap may be reduced to a minimum of 100m. However, if a reduced distance is applied, movements must not be authorised concurrently approaching the location and shunting at the location.

6.4.2 Provision of an Overlap between Train Order Working and Signalled areas

An overlap shall be provided at the exit from a single line section controlled by train order working, immediately in advance of the home signal.

This overlap shall extend from the home signal to the opposing starting signal or signals controlling the entrance to the single line section or approved clearing point as required.

The minimum length of the overlap shall be 500m.

6.5 Conditional Overlaps

6.5.1 Provision of a Conditional Overlap

If it is necessary for specific operational purposes or for general headway reasons for trains to be brought closer together than is permitted by the requirements for a full overlap as described in ESD-05-01 – 6.2 Overlaps for Colour Light Running Signals, then a conditional overlap may be provided enabling a running signal to show a conditional caution aspect.

6.5.2 Requirements for a Conditional Overlap Permitting the Display of a Conditional Caution Aspect

If a full overlap is not available, but an overlap of reduced distance is known to be clear and the train ahead occupying part of the full overlap distance is stationary or signalled away in the correct direction of running, then the running signal requiring the full overlap shall be cleared after a suitable time delay has elapsed ensuring that the speed of the following train has been reduced to be commensurate with the safety margin provided by the reduced overlap distance. Refer to figure 18.

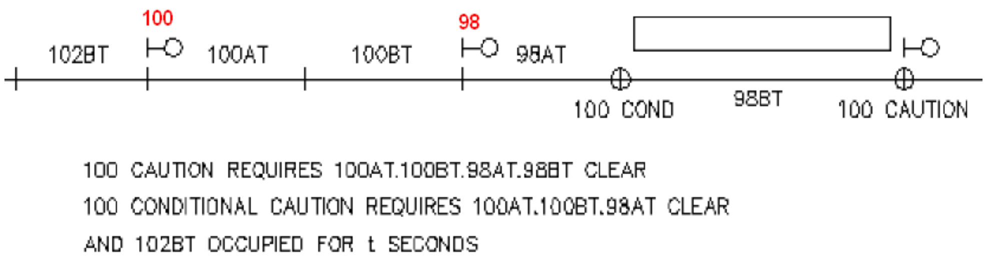


Figure 18 – Conditional Overlaps

6.6 Locking Opposing Routes Leading into or Situated within an Overlap

This Principle addresses the requirements for locking out opposing routes leading into or situated within an overlap by a particular route of the signal requiring the overlap.
Generally, opposing routes shall have non-conflicting overlaps.

6.6.1 Requirements for the Signal Requiring the Overlap

If a signal requires an overlap into which a route or overlap from an opposing signal leads or in which the route from an opposing signal is situated then the opposing route shall be normal and any associated track circuit holding released, if applicable, before the particular route of the signal requiring the overlap is permitted to set. Refer to figure 19.

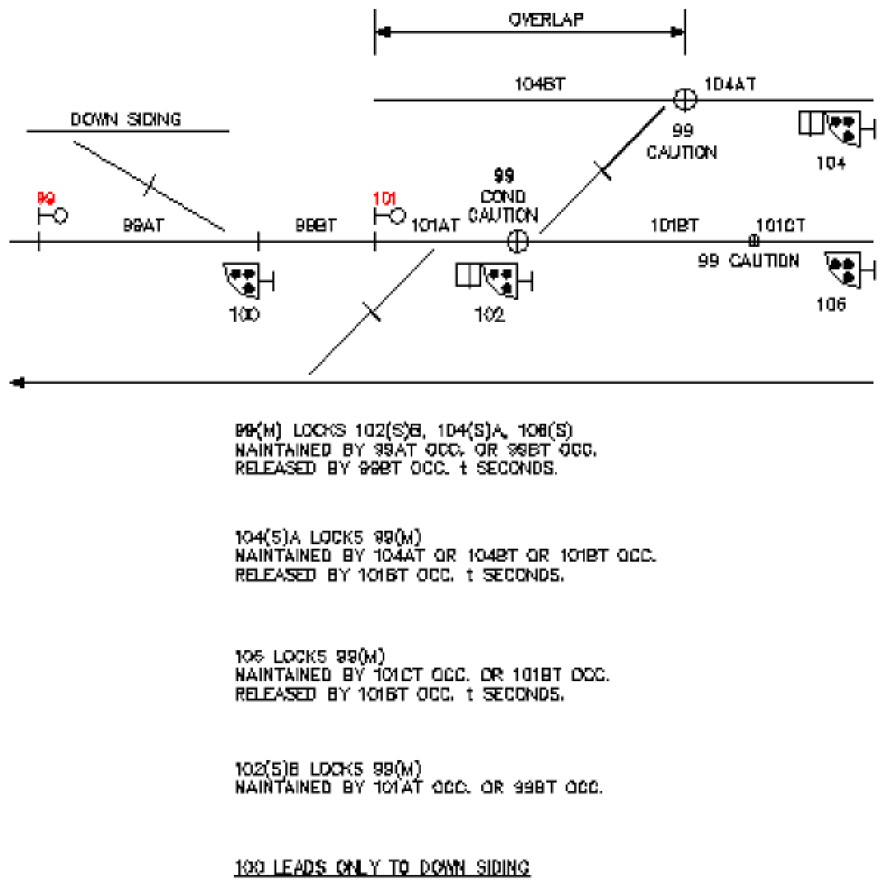


Figure 19 – Signal Requiring the Overlap

If it is required to set the particular route of the signal requiring the overlap, then the opposing routes leading into the overlap or situated within the overlap shall be locked normal until the particular route of the signal requiring the overlap is normalised and any associated track circuit holding released, if applicable. Refer to figure 19. The converse also applies.

6.6.2 Requirements for Opposing Signals

If it is required to set a route from an opposing signal leading into or situated within an overlap, then the particular route of the signal requiring the overlap shall be locked normal until the route from the opposing signal has been normalised and any associated track circuit holding released, if applicable.

6.7 Setting and Locking of Points within an Overlap

This Principle addresses the requirement for setting and locking of trailing and facing points when situated within an overlap and for trapping and flank protection to an overlap.

6.7.1 Trailing Points

If a set of trailing points situated within an overlap is available then it shall be set and locked in the appropriate position by the particular route of the signal requiring the overlap and remain locked until the particular route has been normalised, or if provided, an alternative overlap has been set.

If a train passes the signal requiring the overlap then the trailing points shall also become locked in position by track circuit occupancy until the train has come to a stand at the signal in advance and any time release provided has expired or the train has passed beyond the signal in advance and the trailing points have become directly locked by track circuit occupancy. Refer to figure 20.

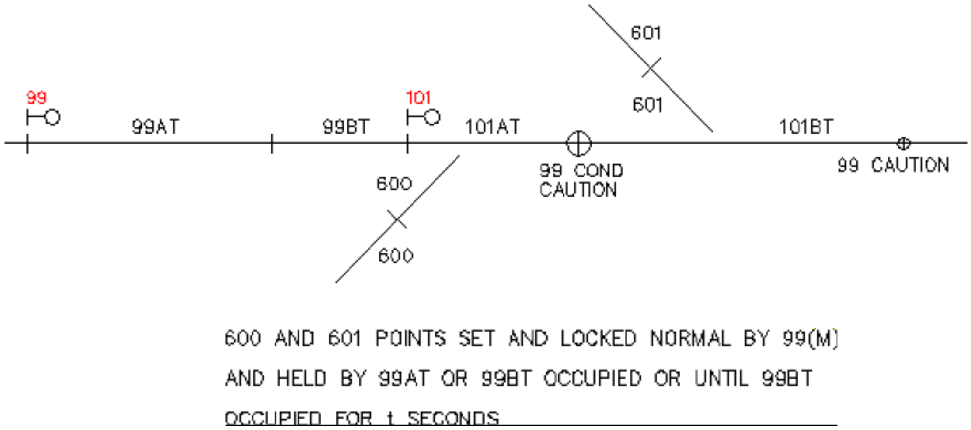


Figure 20 – Setting and Locking of Trailing Points within an Overlap

If alternative overlaps are provided then a set of trailing points shall be set and locked as described above subject to the particular lay of the overlap. Refer to figure 21.

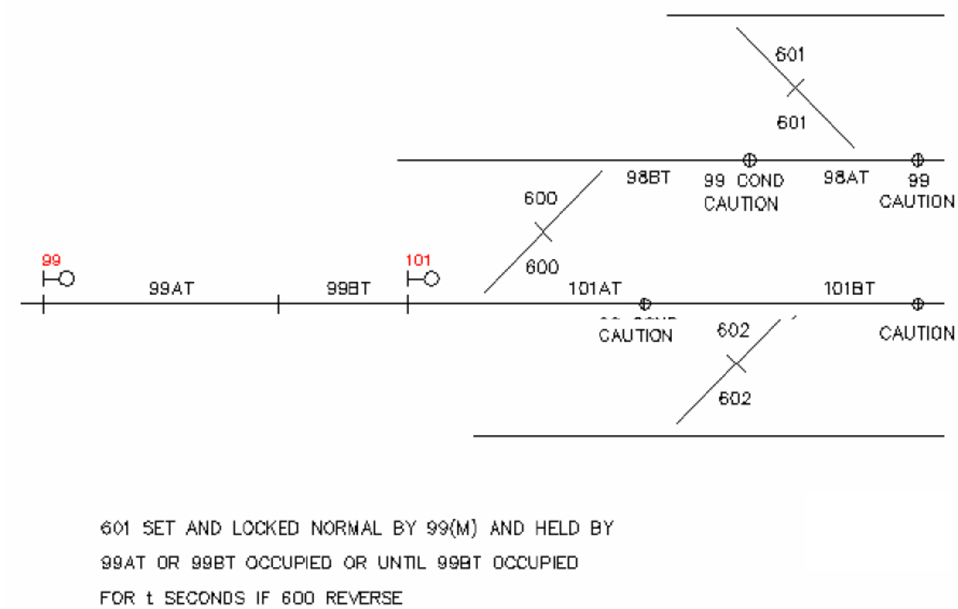


Figure 21 – Setting and Locking of Trailing Points within an Overlap

If a set of trailing points situated within an overlap is not available then the particular route of the signal requiring the overlap shall be inhibited from setting.

6.7.2 Facing Points

If a set of facing points is situated within an overlap and each of the alternative overlaps is available then no setting or locking of the facing points is required. Refer to figure 22.

If a set of facing points is situated within an overlap and one of the alternative overlaps is not permitted or is not available then the facing points shall be set and locked in the direction of the available overlap by the particular route of the signal requiring the overlap and remain locked until the particular route has been normalised or until an alternative overlap has become available. Refer to figure 22.

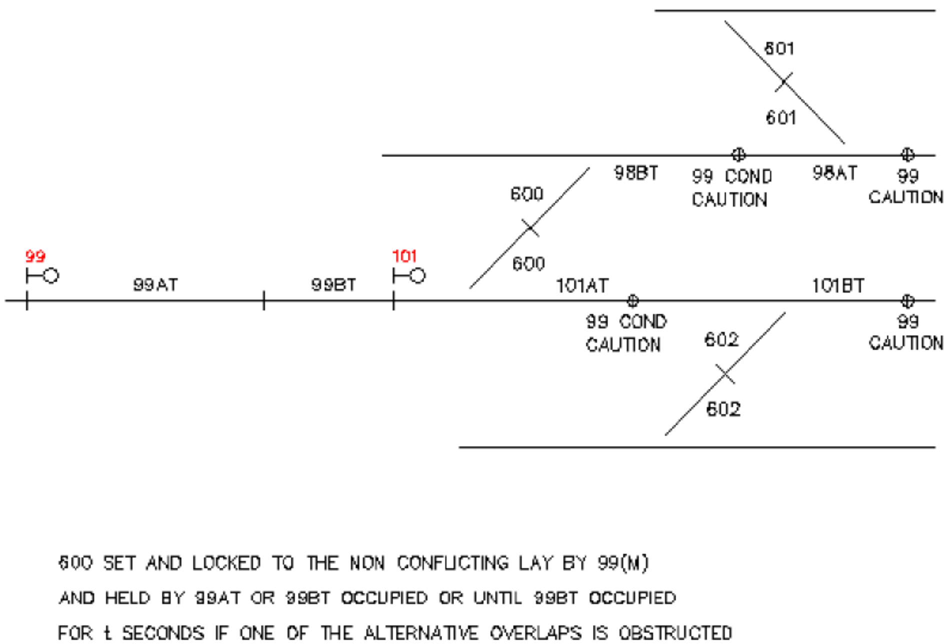


Figure 22 – Setting and Locking of Points within an Overlap

If a train passes the signal requiring the overlap then the facing points shall remain locked in position, if required, by track circuit occupancy until the train has come to a stand at the signal in advance and any time release provided has expired or the train has passed beyond the signal in advance and the facing points have become directly locked by track circuit occupancy.

If a set of facing points situated within an overlap is not available to be set then the particular route of the signal requiring the overlap shall be inhibited from setting.

6.7.3 Facing Points Providing Flank Protection

If a set of facing points which provides flank protection to an overlap is available then it shall be set and locked in the appropriate position by the particular route of the signal requiring the overlap and remain locked until the particular route has been normalised or if provided an alternative overlap has been set. Refer to figure 20.

If a train passes the signal requiring the overlap then the points shall also become locked in position by track circuit occupancy until the train has come to a stand at the signal in advance and any time release provided has expired or the train has passed beyond the signal in advance and the points have become directly locked by track circuit occupancy. Refer to figure 21.

If alternative overlaps are provided then a set of facing points providing flank protection shall be set and locked as described above subject to the particular lay of the overlap. Refer to figure 21.

If a set of facing points which provides flank protection to an overlap is not available then the particular route of the signal requiring the overlap shall be inhibited from setting.

6.8 Setting and Locking of Points within an Overlap at a Crossing Loop in CTC Territory

This Principle addresses the requirements for setting and locking points situated within the various overlaps required for subsidiary low speed, shunt, and outer home signals at a crossing loop in CTC territory.

6.8.1 Requirements for Home Signals

6.8.1.1 Where an Opposing Outer Home Signal is not provided

If the starting signal ahead is not clear and it is required to clear the low speed subsidiary signal fitted to the home signal for the main line then the particular route shall set and lock the trailing points in the overlap in the reverse position until the particular route is normalised. Refer to figure 22.

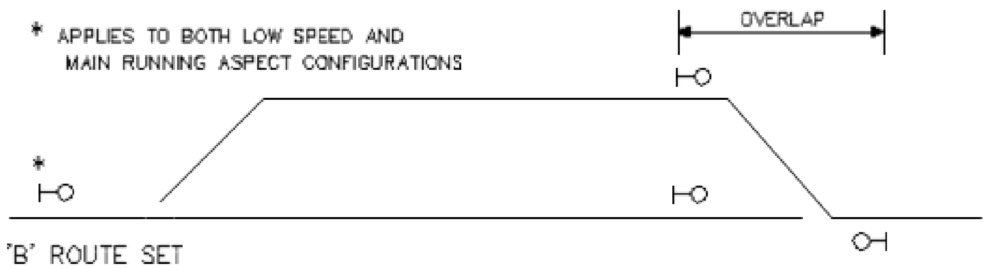


Figure 22 – Where an Opposing Outer Home Signal is not provided

This locking shall not be held by the occupation of track circuits.

The points shall be detected reverse the signal is permitted to clear and continuously thereafter.

If it is required to clear the home signal for the loop, then the particular route shall set and lock the trailing points in the overlap in the normal position until the particular route is normalised. Refer to figure 23.

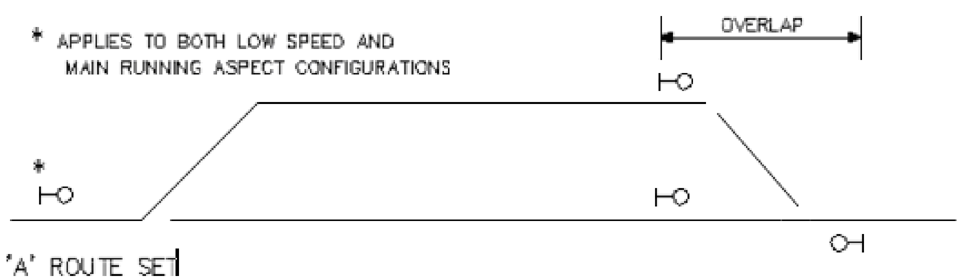


Figure 23 – Where an Opposing Outer Home Signal is not provided

This locking shall not be held by the occupation of track circuits.

The points shall be detected normal before the signal is permitted to clear and continuously thereafter.

6.8.1.2 Where an Opposing Outer Home Signal is provided

If it is required to clear the low speed subsidiary signal fitted to the home signal for the main line or the loop and an opposing outer home signal is provided then the particular route required shall set and lock the trailing points in accordance with the requirements of ESD-05-01 – 6.7.1. Refer to figures 24 and 25.

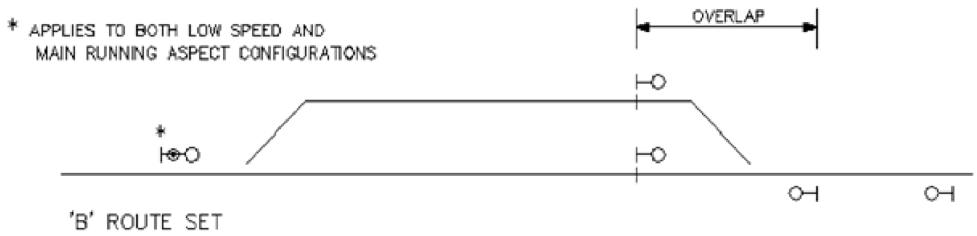


Figure 24 – Where an Opposing Outer Home Signal is provided

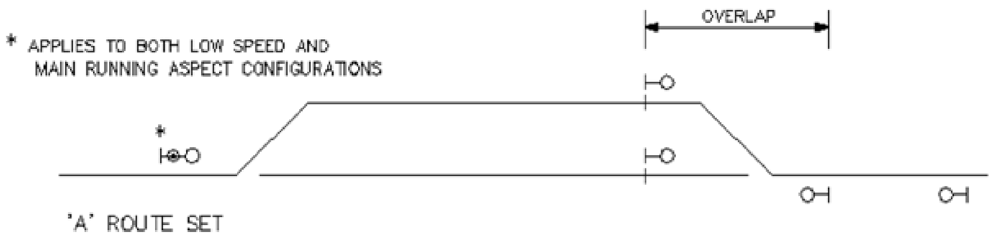


Figure 25 – Where an Opposing Outer Home Signal is provided

This locking shall be held by the occupation of track circuits or released by track circuit occupation for a predetermined time.

6.9 Overlaps for Low Speed Subsidiary Signals in Route Signalling Territories

This Principle addresses the requirements for the provision of a locking overlap for a movement made under the control of a low speed aspect on a running signal.

6.9.1 Requirement

A locking overlap coincidental with the caution overlap of the running signal with which the low speed signal is associated shall generally be provided.

Track circuits in the overlap shall be proved clear consistent with the low speed aspect to ensure that trains proceeding at low speed are afforded adequate protection.

Locking overlaps used with conditional low speed indications may be considered for reduction to meet special operations requirements on obtaining special approval.

6.10 Overlaps for Subsidiary, Ground Shunting or Low Speed Route Signalling

A nominal locking overlap of 100m on a running line shall be provided for a subsidiary shunting signal or ground shunting signal for power operated points. This applies for shunting speeds of 25kph or less or low speed in speed signalling areas of 25kph or less. Hand operated points shall be locked in accordance with the existing practice for the region.

6.11 Preferential Setting of Conditionally Locked Points in an Overlap

6.11.1 Purpose

Preferential setting of facing points in an overlap is provided to ensure that whenever possible an overlap is set in the direction of the most frequently used route ahead of an inner signal.

This reduces the probability of an overlap being set in the least used direction which may result in excessive or unnecessary overlap swinging if other routes, when setting, interact with the established overlap.

6.11.2 Requirement

If an overlap contains a set of facing points that lead over a set of trailing points which are situated beyond the facing points, and the lay of the facing points is towards the trailing points and this is the most used direction of traffic and the trailing points are available to be set (or are already set) for the overlap then they shall be set (if necessary) and locked as applicable for the overlap. Refer to figure 26.

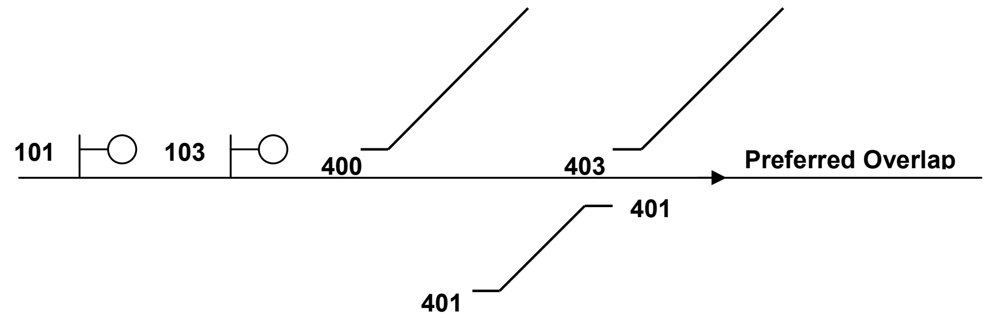


Figure 26 – Preferential Setting of Conditional Locked Points in an Overlap

This lay of overlap shall be the first preference.

If the trailing points are not available to be set for the overlap then the facing points shall be set and locked in the opposite lay towards the alternative overlap which shall be the least used direction of traffic. Refer to figure 27.

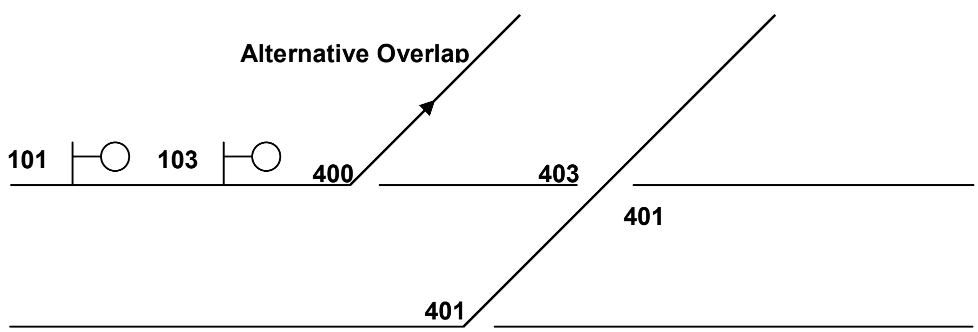


Figure 27 – Preferential Setting of Conditional Locked Points in an Overlap

This lay of overlap shall be the second preference.

Overlap track circuits shall not be proved clear in shunting signal aspects.

In yards, locking of ground frames in the overlap is not usually applied and locking in the overlap is usually via the signals, not the points, and is generally not maintained.

6.12 Automatic Overlap Setting by Track Circuit Operation

6.12.1 Introduction

This Principle addresses the requirements for the provision of automatic overlap setting due to the occupation of track circuits in the alternative overlap at the time a route is set.

6.12.2 Purpose

This form of automatic overlap setting is provided when an outer running signal has a choice of two or more overlaps beyond an inner signal and due to track circuit occupation one of the overlaps is not available. Under these conditions the facing points may be set towards the available overlap automatically when the route is setting.

6.12.3 Requirements

If a choice of overlap exists beyond an inner signal at the time of setting an outer signal and the overlap in the direction in which the facing points are set is unavailable due to the occupation of track circuits then the outer signal may set and lock the facing points in the direction of the available overlap. This shall be applied to set the points to the normal position or main line position only. Refer to figure 28.

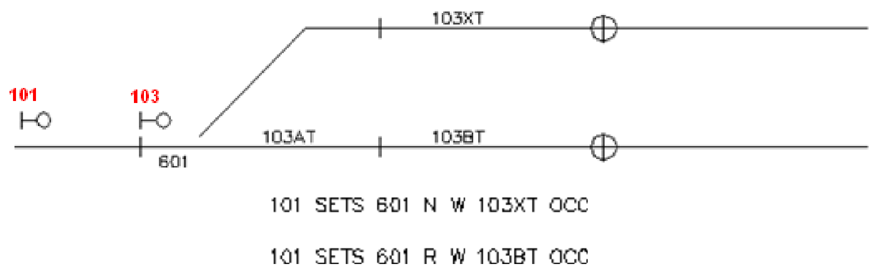


Figure 28 – Automatic Overlap Setting by Track Circuit

6.13 Overlap Swinging

6.13.1 Overlap Maintenance

This Principle addresses the requirements for the locking of facing points to ensure that a clear overlap is maintained while an alternative overlap is occupied and a route is set or a train is occupying the route leading up to the home signal at the points.

6.13.2 Purpose

This locking is provided when an outer running signal has a choice of two or more overlaps beyond an inner signal, and due to track circuit occupation, one (or more) of the overlaps is not available.

6.13.3 Requirements

If a choice of overlap exists beyond an inner signal, then the clearing of an outer signal will lock any facing points beyond the inner signal to prevent the operation of those points towards the obstructed overlap, dependant on overlap length.

The points shall remain locked whenever a train is approaching the inner signal, and the alternative overlap remains obstructed.

This locking may be released when the alternative overlap becomes clear, or the route has been cancelled and the approach locking released, or the train has been time released at a stand at the inner signal.

If multiple overlaps exist, care should be exercised to ensure that overlap maintenance is properly applied through the various combinations of conditions.

If only one set of facing points is involved and the alternate path is often used, then automatic overlap setting should be provided where there is the traffic density to warrant the extra complexity.

7 Block Sections

Only one train may occupy the block section between two interlockings at any time. Alternatively, the block may be split into more than one section by intermediate or controlled signals.

In order to set the block section so as to allow entry into the block, the following shall be proved:

a) All opposing signals are normal

b) Releases, which require the block section, are normal. Detection of the release is only required at time of initiation of the block feed.

c) Entry into the block section from any other section is not available (i.e. all other block relays false)

d) A block feed which would allow an opposing signal to set, is de-energised

e) No traffic is proceeding from the other end of the block

f) For main signals, all tracks, including all tracks up to the opposing starter signal at next interlocking clear. Tracks, beyond the overlap and the opposing signal which may be occupied by a train proceeding in the same direction are not required to be proven clear. Where a track circuit is included in the block section based on the lie of points (and is not a fouling track of the points), the points shall be directionally locked based on the condition of the track circuit.

g) For coded track circuits which have timer constraints for the passage of block occupancy information, then additional controls are required. The aspect for a starter signal shall prove the opposing block de-energised before providing a proceed aspect. Where coded track circuits abut standard track circuits within the section then provision shall be made for standard track circuit to have a time delay to pick up to compensate for the time delay within the coded track section. This will ensure that the block occupancy is maintained and occupied during the passage of a train.