

Engineering Standard

Signalling

CRN SD 004

SIGNALLING DESIGN PRINCIPLES - OVERLAPS

Version 1.2

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Document control

Revision	Date of Approval	Summary of change
5.0	July 2004	RIC Standard SC 00 13 01 04 Version 5.0 July 2004
1.0	May 2011	Conversion to CRN Signalling Standard CRN SD 004
1.1	April 2016	Review and Update
1.2	October 2018	Review and Update

Summary of changes from previous version

Section	Summary of change
4.6	Section Withdrawn – ETS and OTS sections
various	Update CTC to CTC / RVD
4.3.8.1	Alterations to the Table in this section
4.2	Normally will be the A track,
4.3	Remove 4.3

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4 Overlaps

4.1 Overlaps Concepts & Definitions: Principle 4.1

4.1.1 Introduction

This Principle addresses the concept of an overlap to provide a margin of safety between following trains and provides definition for of the terms associated with overlaps.

4.1.2 Overlap - Concept

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.

4.1.3 Overlap - Definition

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

4.1.4 Overlap Distance

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.

This predetermined clearing point may be prescribed under these Principles or measured dynamically resulting in sets of braking curves, or may be the result of a combination of both.

Factors which influence the predetermination of the clearing point may be

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

4.1.5 Overlap Track Circuit(s) - Definition

One or more track circuits which constitute the predetermined overlap distance. On plain line this will normally be at least the "A" track circuit beyond a stop signal.

4.2 Overlaps on Double Lines at Colour Light Running Signals not Equipped with Train Stops: Principle 4.2

4.2.1 Introduction

This Principle addresses the requirements for the provision of overlaps on double lines at running signals in colour light signalling territory which are not equipped with train stops.

4.2.2 Provision of an Overlap

If a running signal on a passenger line 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.

4.2.3 Overlap Distance

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

Speed Range Over a Particular Section of Line		Minimum Overlap Distance
0 – 59Kph	300m	(Or longest braking distance, if less).
60 – 79Kph	400m	(Or longest braking distance, if less).
80 and greater	500m	(Or longest braking distance, if less).

4.2.4 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 100 metres.

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 effecting 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 Principle 4.1.4.

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 90 metres where the speed approaching the signal is restricted to 15kph and to 150 metres where the speed is restricted to 25kph, or reduced to the longest braking distance, if less.

If a running signal is more than 1.5 Km and more than 1.5 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 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.

4.2.5 Variation to Overlap Distances

If the line headway is adversely affected by the overlap distance in a particular section, then a reduction of the overlap distance should be investigated based on the appropriate factors presented under Principle 4.1.4.

4.2.5.1 Turnout Exists Within the Overlap

Where a low speed turnout exists in the overlap, the approach speed used to determine the overlap length need not exceed twice the turnout speed.

4.2.5.2 Train Approaches Through a Turnout

Where a train approaches a signal at stop through a turnout, the overlap may be determined based upon the turnout speed (i.e. effectively the line speed for that approach).

4.2.5.3 Speed Board Increase Prior to a Signal

Where a speed board increases the speed in the block prior to the signal at stop, the lower approach speed leading to up to this board, providing it is within the restrictive aspect sequence, may be used.

4.2.5.4 Speed Board Decrease Prior to Signal

Where a speed board decreases the speed in the block prior to the signal at stop, the higher approach speed leading up to this board shall be used, unless the track configuration physically limits the speed otherwise, or the board is further than 300m from the signal.

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4.2.5.5 Applicable Braking Curves for Overlaps on Particular Lines

Line	Braking Requirements (Overlaps)
South	
Joppa Junction – Canberra	GW16, GX4M, GR2
Cootamundra – Griffith	GW 16
Griffith – Hillston	GW 17
Junee – Griffith	GW 18
West Wyalong – Burcher	GW 19
Ungarie – Naradhan	GW 20
Barmedman –Rankin Springs	GW 21
Demondrille – Cowra	GW 22
Cowra – Eugowra	GW 23
Koorawatha – Grenfell	GW 24

West	
Lithgow – Wallerawang	GW30, GW10, GX4M, GR2
Wallerawang – Charbon	GW 10 Up, GW Down
Wallerawang – Tarana	GW30, GX4M, GR2
Tarana – Bathurst (Kelso)	GW30, GX4M, GR2
Bathurst – Orange	GW30, GX4M, GR2
Orange – Parkes	GW30
Orange – Dubbo	GW30, GX4M, GR2
Narromine – Parkes	GW30
Narromine – Cobar	GW 16
Dubbo – Coonamble	GW 16
Nevertire – Warren	GW 16
Bogan Gate – Tottenham	GW 16
North	
Narrabri – Merrywinebone	GW 16
Moree – Delungra	GW 16
Moree – Weemelah	GW 16
Werris Creek – Armidale	GW 16 , GX4M, GR2 (<140)
Armidale – Glen Innes	GW 16
Binnaway – Gwabegar	GW 16
Casino – Murwillumbah	GW 16 , GX4M, GR2

4.3 Overlaps on Lines in Tunnels: Principle 4.4

4.3.1 Introduction

This principle addresses the requirements for the provision of overlaps in continuous tunnels.

4.3.2 Provision of an Overlap

If a running signal on a passenger line 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.

4.3.3 Overlap Distance

The requirements of section **Error! Reference source not found.** may also apply in tunnels.

However, where a reduced speed is used, an acceleration allowance shall be included in the overlap speed determination. The acceleration allowance shall be based upon:

The train accelerating at maximum acceleration from the location of any previous speed check (usually a train stop).

The maximum speed obtained at the stop signal (or raised speed checking trainstop) as a result of this acceleration.

A maximum speed of line speed being applied.

4.4 Overlaps in CTC / RVD Territory: Principle 4.5

4.4.1 Introduction

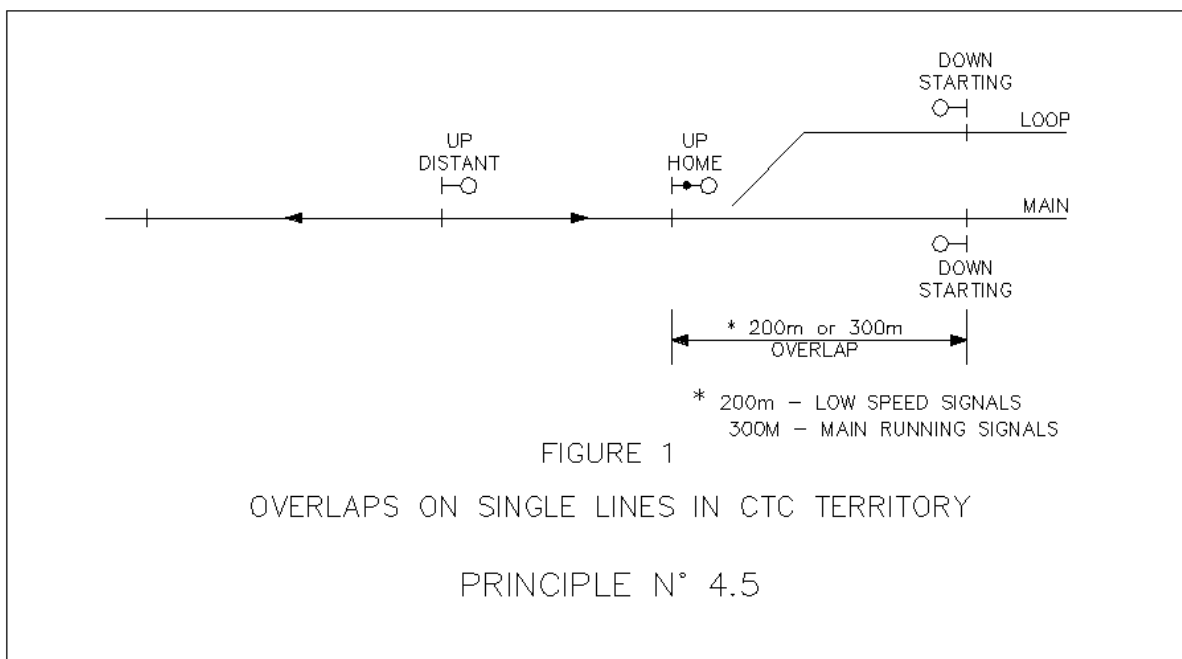
This Principle addresses the requirements for the provision of overlaps on single lines and in crossing loops in C.T.C. colour light territory.

4.4.2 Provision of an Overlap on a Single Line

4.4.2.1 Requirements

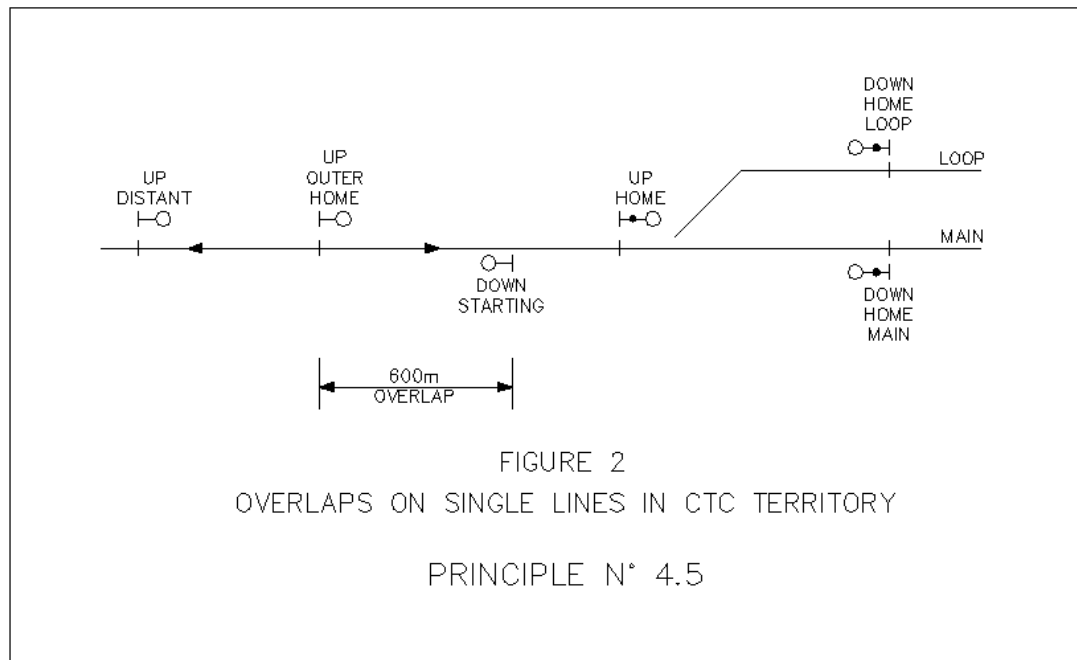
An overlap shall be provided at the exit from a single line block section immediately in advance of the home signal.

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 Principle 4.10. Refer to figure 1.



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 2.



4.4.2.2 Overlap Distance

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 1.

If an outer home signal is provided then a nominal overlap of 500m shall be provided for the single line block section and this shall about a 100m overlap provided immediately in advance of the opposing starting signal. Refer to figure 2. and section 4.4.3 of this Principle.

4.4.2.3 Variations to Overlap Distances

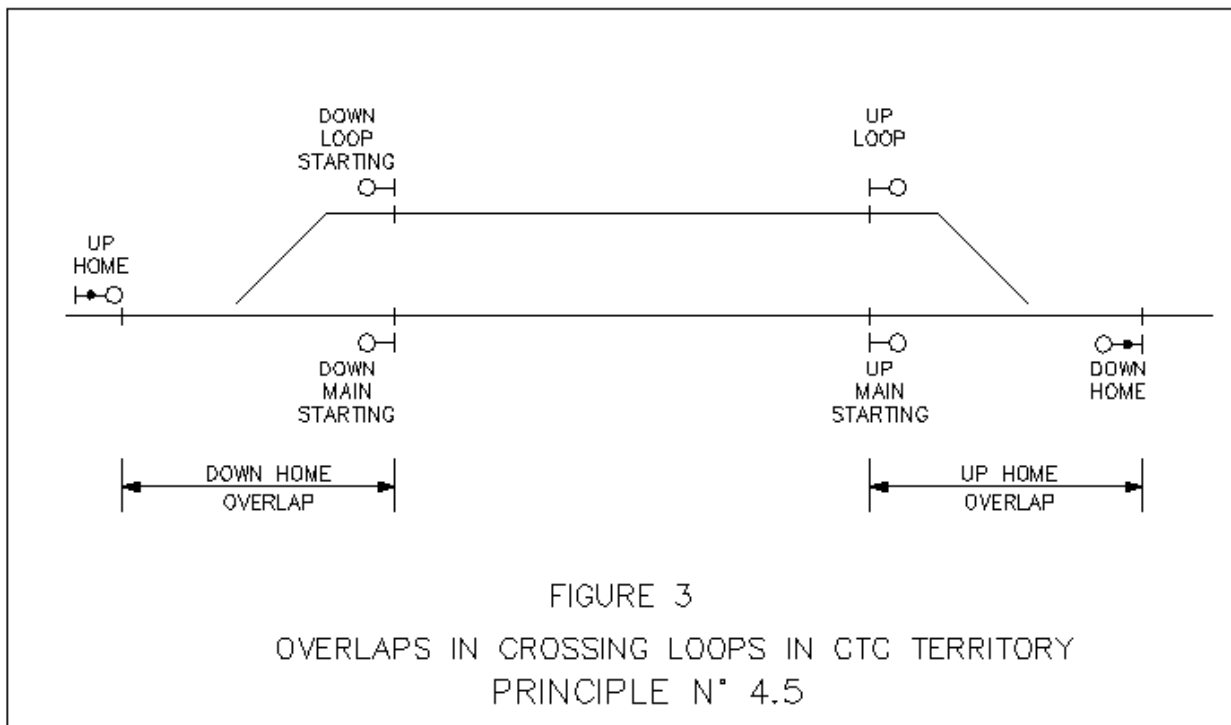
If a block joint which already exists or is to be provided for other purposes could also be used as an overlap block joint without adversely affecting the line headway, then the overlap distance may be increased to avoid the provision of a separate overlap track circuit.

4.4.3 Provision of Overlaps at a Crossing Loop

4.4.3.1 Requirement

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

The overlap shall extend from the main or loop starting signal into the single line section in advance as far as the opposing home signal. Refer to figure 3.



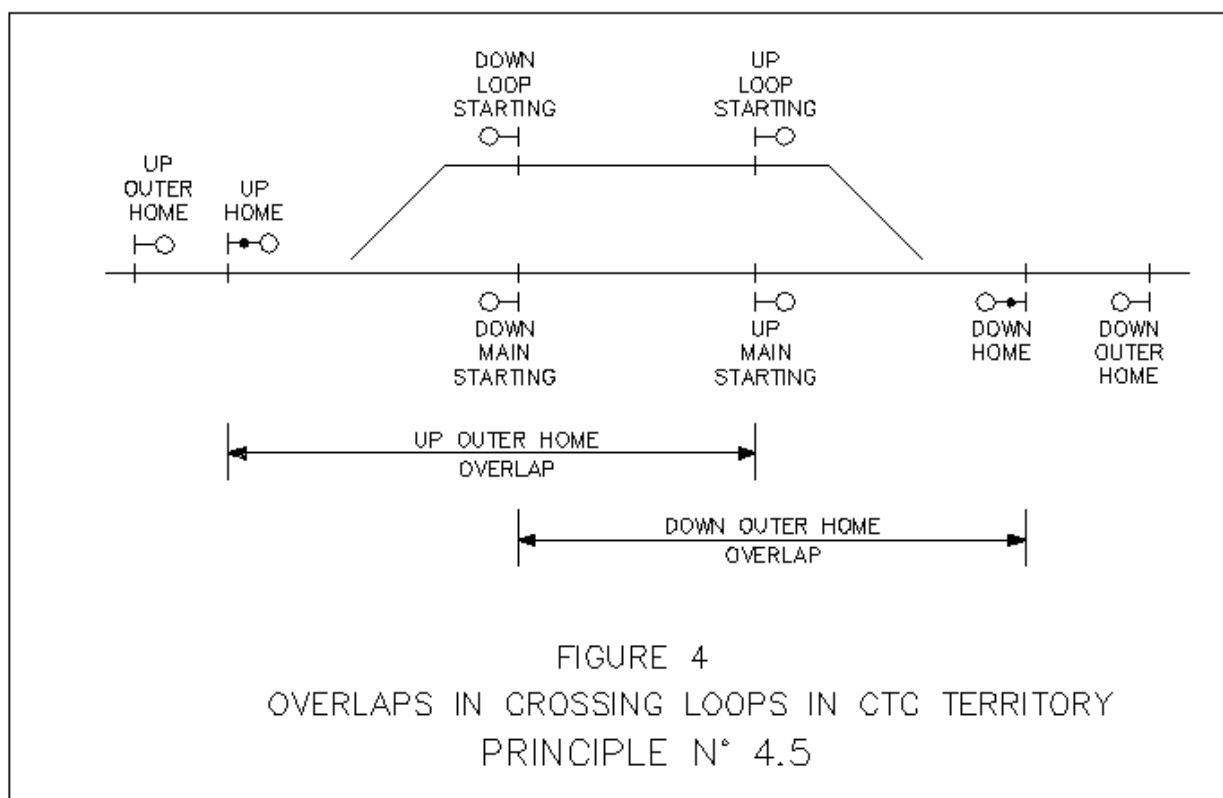
If a subsidiary shunt signal is fitted to a home signal, then it shall be provided with an overlap immediately in advance of the main and loop starting signals into the single line block section in advance.

This overlap shall extend from the main or loop starting signals into the single line block section in advance towards the opposing home signal.

This overlap shall be a locking overlap only and no overlap track circuit control shall apply to the subsidiary shunt aspect.

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 4



If a main or loop exit signal is fitted with a subsidiary shunt signal, then the subsidiary shunt signal shall be provided with an overlap which extends towards the opposing outer home signal. Refer to figure 2.

This overlap shall be a locking overlap only and no overlap track circuit control shall apply to the subsidiary shunt aspect.

4.4.3.2 Overlap Distances

At CTC loops using low speed 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 a subsidiary shunt signal shall be 100m.

The nominal overlap distance for an outer home signal shall not be less than that required under Principle 4.2 and not greater than the distance to the main and loop signals leading into the section in advance.

4.5 Withdrawn: Principle 4.6

4.6 Conditional Overlaps: Principle 4.7

4.6.1 Introduction

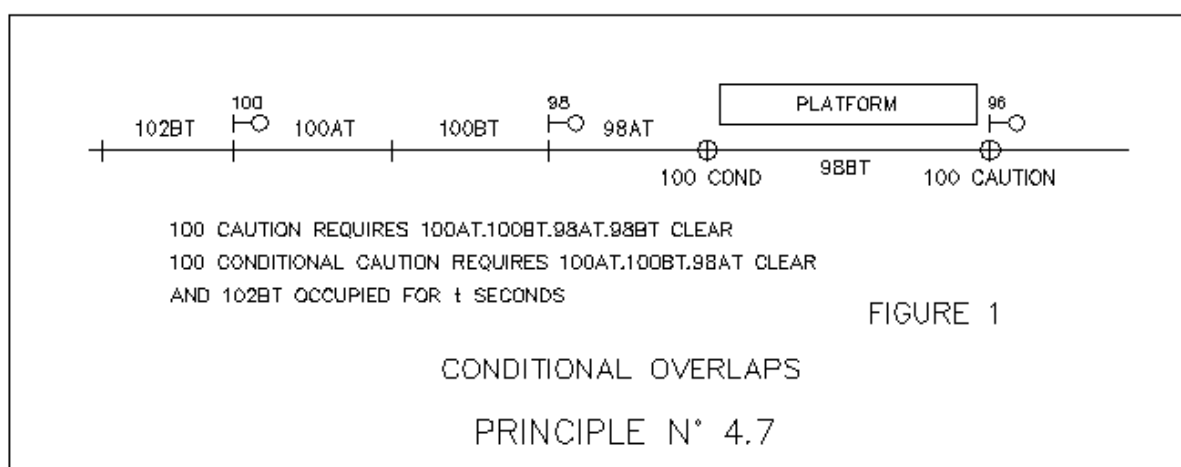
This Principle addresses the need to provide and the requirements for conditional overlaps in colour light signal territory.

4.6.2 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 Principles 4.2, 4.3 then a conditional overlap may be provided enabling a running signal to show a conditional caution aspect.

4.6.3 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 1.



4.7 Locking Opposing Routes Leading into or Situated within an Overlap: Principle 4.8

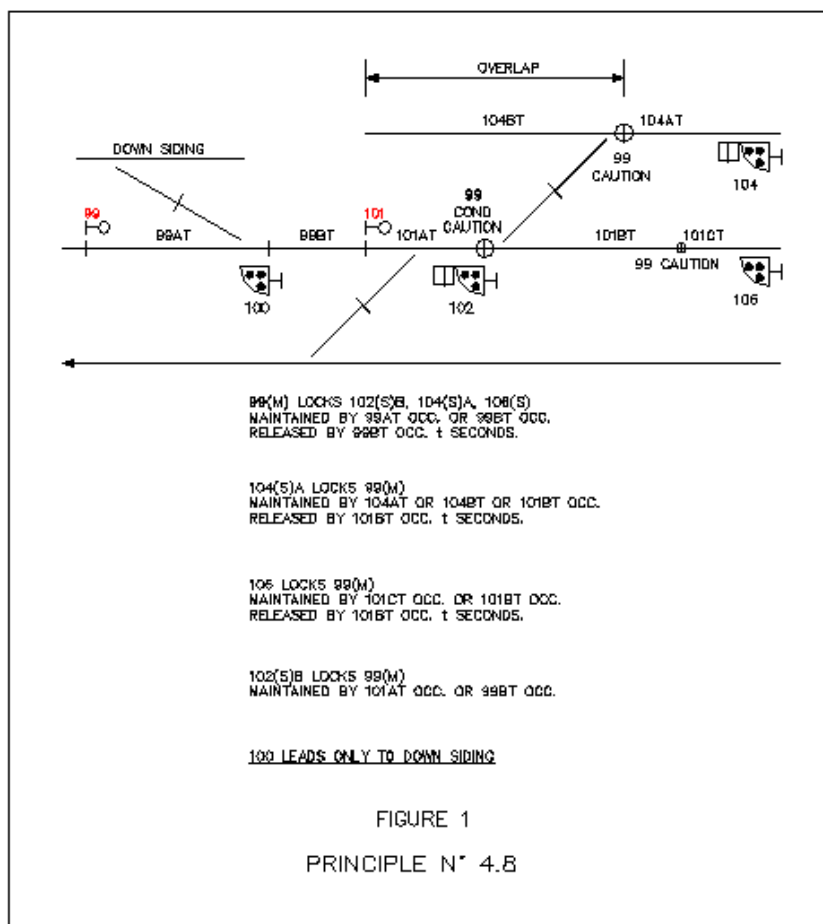
4.7.1 Introduction

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.

4.7.2 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 1.

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 1.



4.7.3 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.

4.8 Setting and Locking Of Points within an Overlap: Principle 4.9

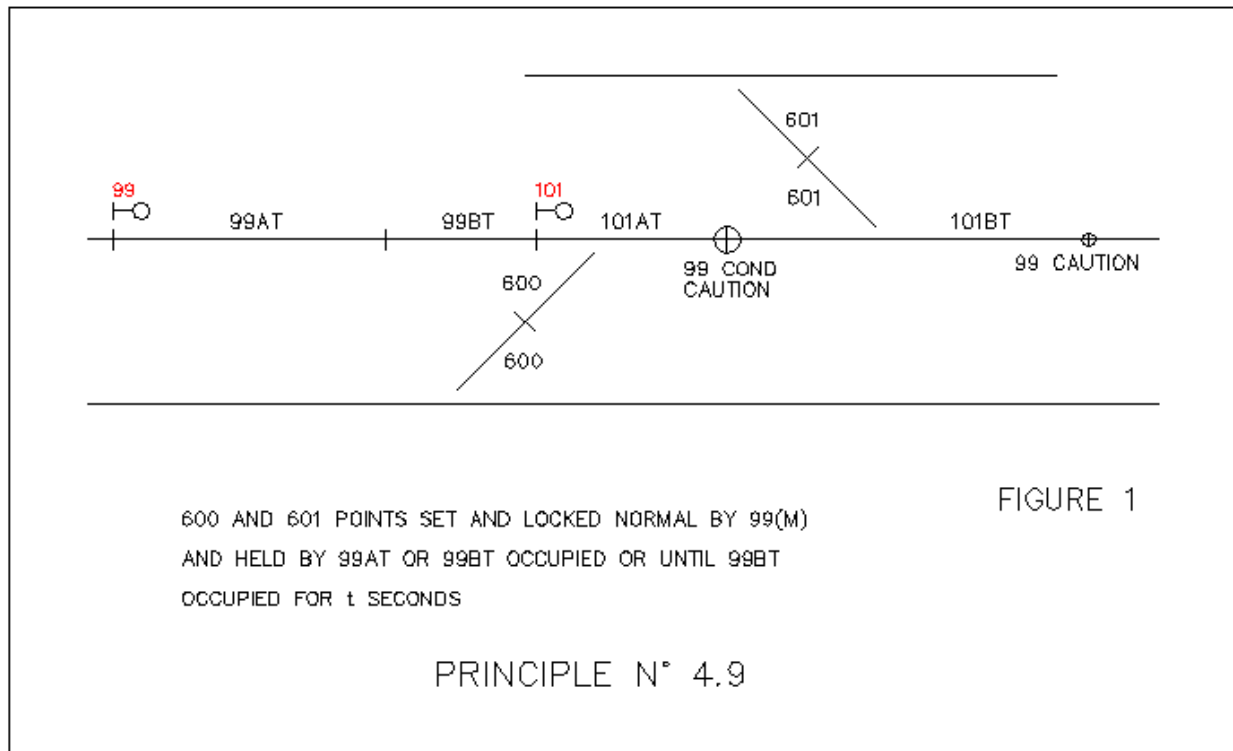
4.8.1 Introduction

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.

4.8.2 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 1.



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 2.

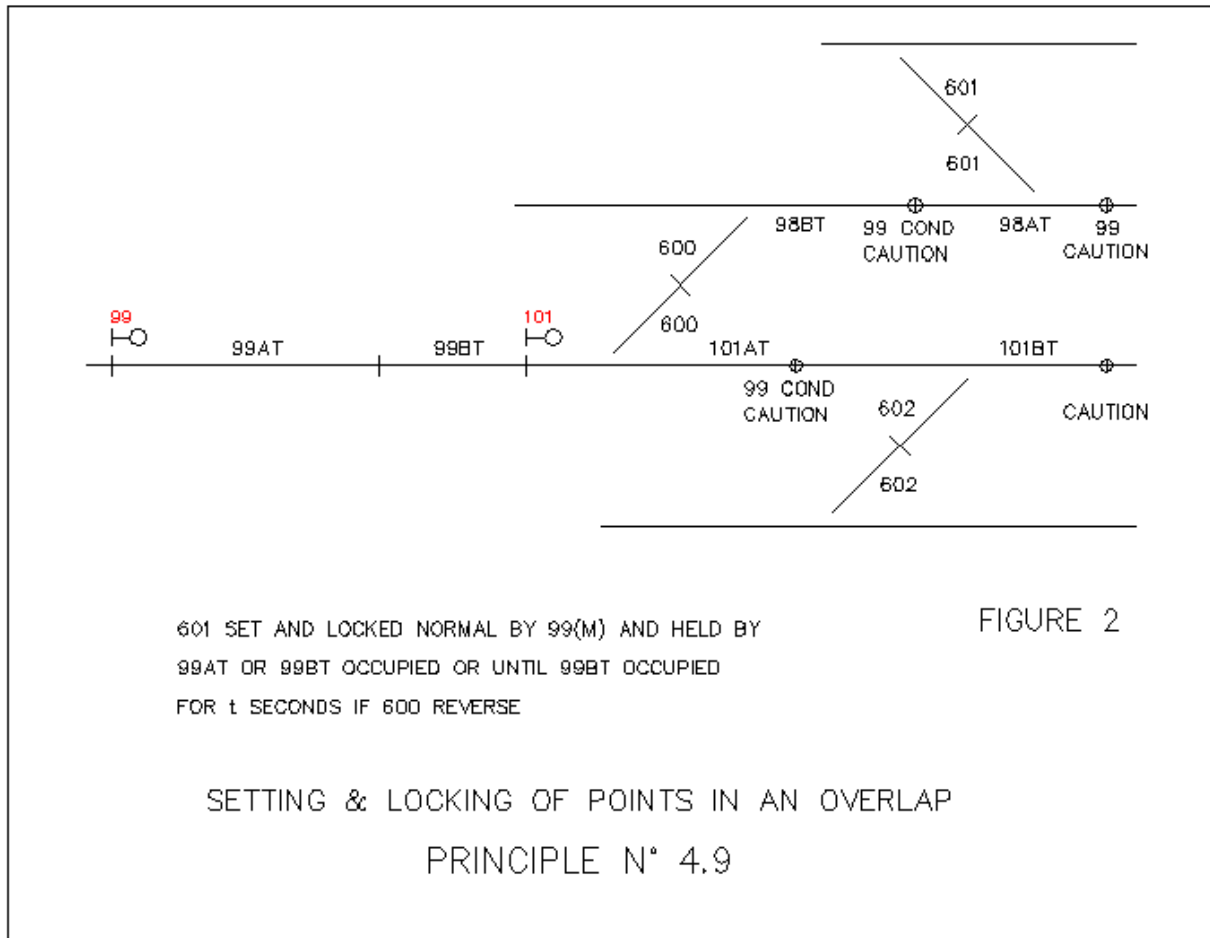
If a set of trailing points situated within an overlap is not available then the particular route of the signal requiring the overlap shall be inhibited from setting.

4.8.3 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 3.

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 3.

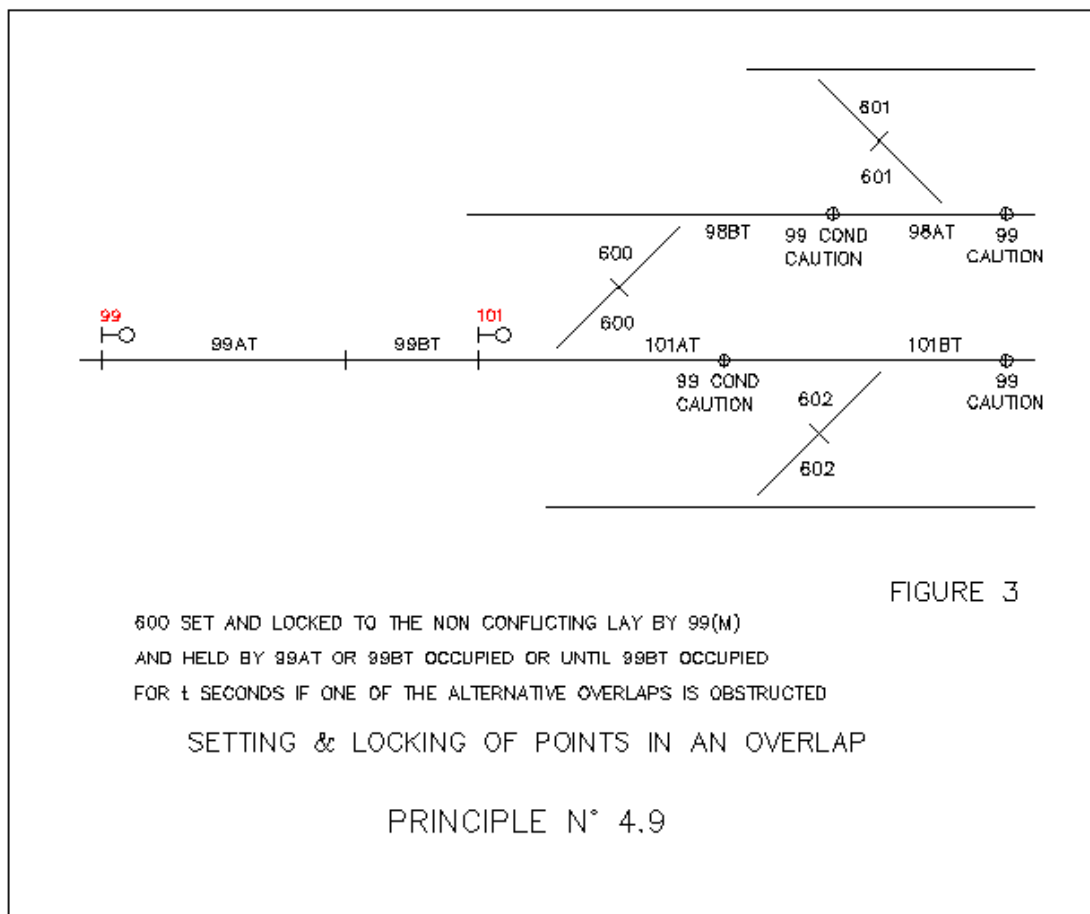
If a train passes the signal requiring the overlap then the facing points shall remain locked in position, if required, by track circuit occupancy until the train has come to a stand at the signal in advance and any time release provided has expired or the train has passed beyond the signal in advance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

4.8.4 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.



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 1.

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 2.

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.

4.8.5 Special Arrangements

Under certain circumstances it may be permissible to provide special arrangements for the setting of overlap conditions. For example the provision of dedicated push buttons to enable special arrangements to be invoked.

4.9 Setting and Locking Of Points within an Overlap at a Crossing Loop in CTC / RVD Territory: Principle 4.10

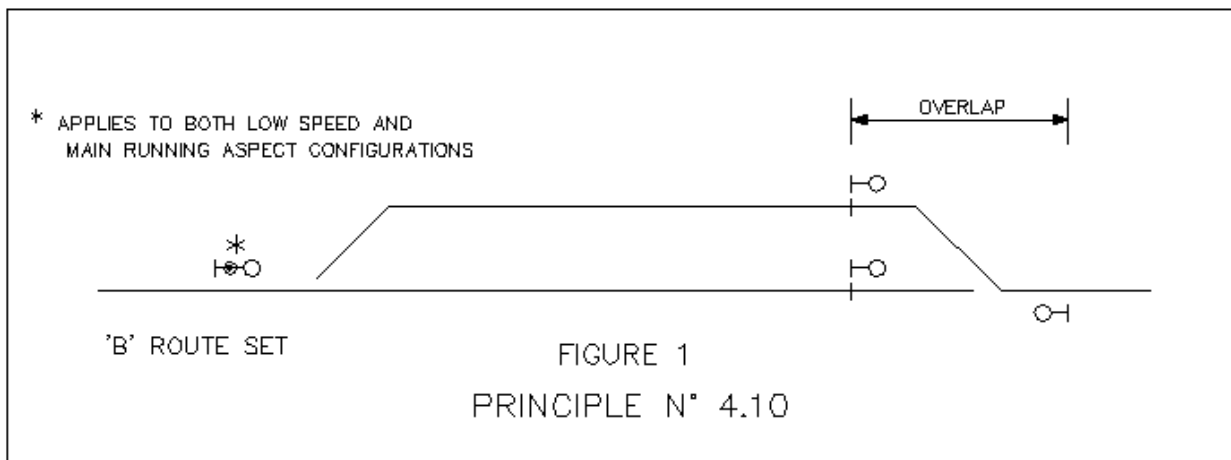
4.9.1 Introduction

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.

4.9.2 Requirements for Home Signals

4.9.2.1 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 1.



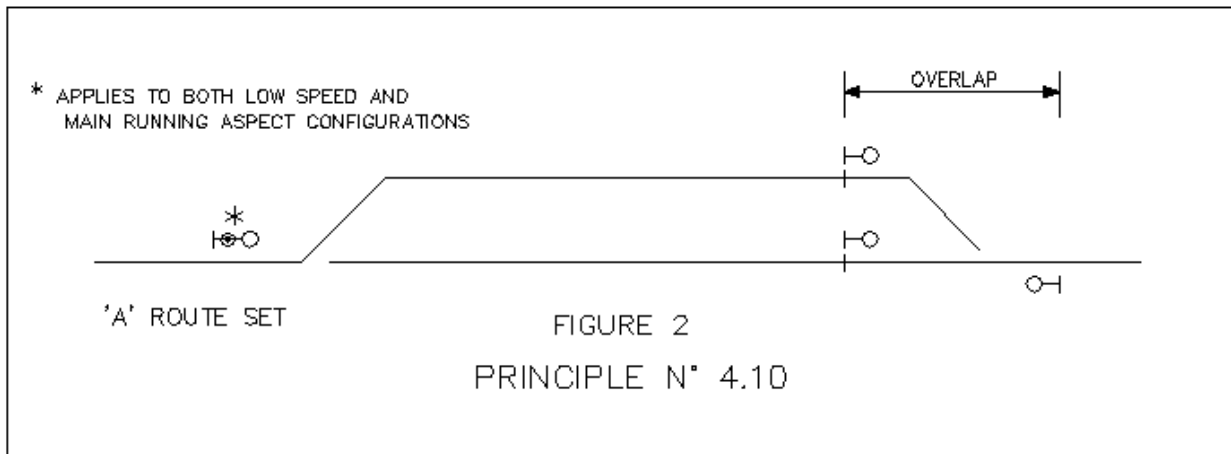
This locking shall not be held by the occupation of track circuits.

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

If it is required to clear the low speed subsidiary signal fitted to 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 2.

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

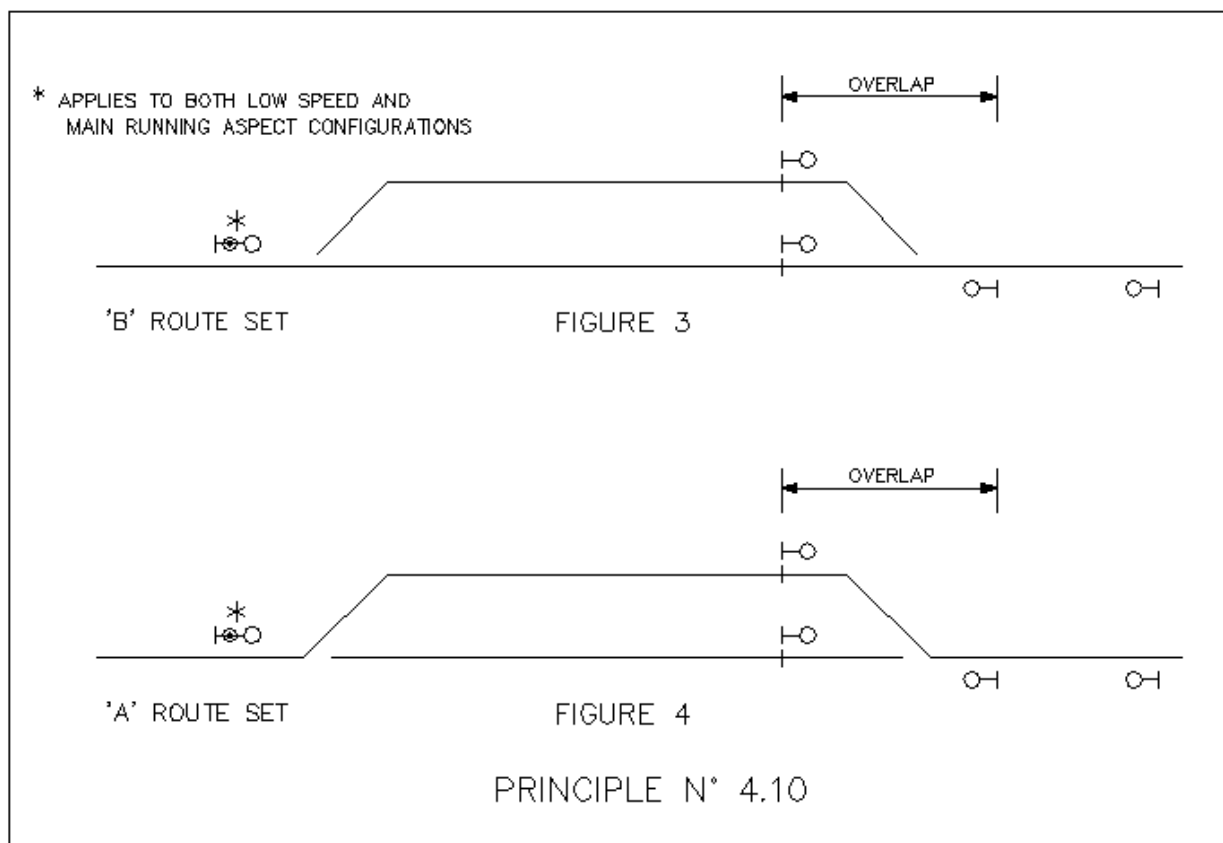
The points shall be detected normal before the signal is permitted to clear and continuously thereafter.



4.9.2.2 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 Principle 4.9. Refer to figures 3 and 4.

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



4.10 Section Intentionally Left Blank: Principle 4.11

4.11 Overlaps for Low Speed Subsidiary Signals In Colour Light Territory: Principle 4.12

4.11.1 Introduction

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.

4.11.2 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.

Depending on circumstances governing the overlap conditions, consideration should be given to the provision of an intermediate trainstop for low speed movements.

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

4.12 Overlaps For Subsidiary or Ground Shunting Signals: Principle 4.13

4.12.1 Introduction

This Principle addresses the requirements for the provision of an locking overlap for a movement from a shunting signal in colour light territory and applies whether the shunt signal takes the form of a subsidiary on a running signal or a ground shunt.

4.12.2 Requirement

A nominal locking overlap of 100m on a running line shall be provided for a subsidiary shunting signal or ground shunting signal.

If necessary the shunt signal requiring the overlap shall set, lock and maintain one or more sets of points in the locking overlap to eliminate the possibility of converging or opposing movements obstructing the overlap once established particularly where the opposing movement is a main route.

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.

In yards where speeds are suitably restricted, the locking overlap distance may be reduced to 60m, or braking distance from the STOP signal if less.

In yards, for directly opposing movements between low speed shunt routes, the shared overlap may be reduced to three quarters of the combined distance of the individual overlaps, however the 60m minimum overlap (or braking distance overlap, if less) must be applied to any converging movements.

Overlap track circuits shall not be proved clear in shunting signal aspects. Refer to Principle 1.20.

4.13 Preferential Setting of Conditionally Locked Points In An Overlap: Principle 4.14

4.13.1 Introduction

This Principle addresses the requirements for the provision of preferential setting of conditionally locked points in an overlap.

4.13.2 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.

4.13.3 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 1.

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 2.

This lay of overlap shall be the second preference.

4.13.4 Control Tables

These complimentary setting and locking conditions shall be placed in parenthesis and suffixed 1 and 2 to indicate the preference.

e.g.	101 sets & locks points normal	(401N W 400 N)1
	101 sets & locks points reverse	(400R W 401 R)2

Where 2 denotes "and not free".

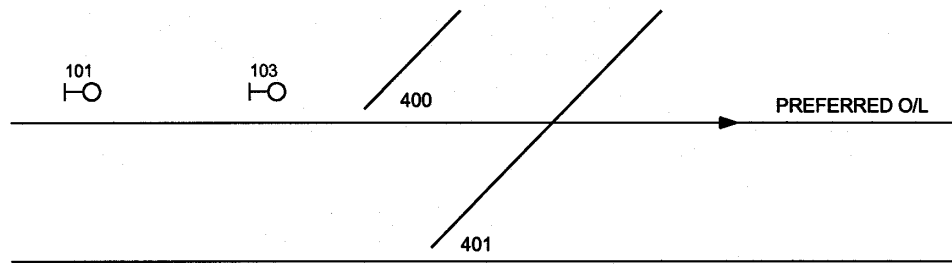


FIGURE 1

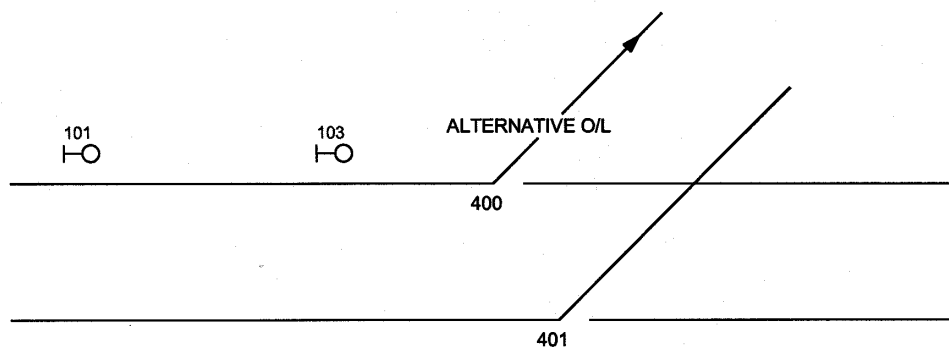


FIGURE 2

PREFERENTIAL SETTING OF CONDITIONALLY LOCKED POINTS IN AN OVERLAP

PRINCIPLE N° 4.14

4.14 Automatic Overlap Setting By Track Circuit Occupation: Principle 4.15

4.14.1 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.

4.14.2 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.

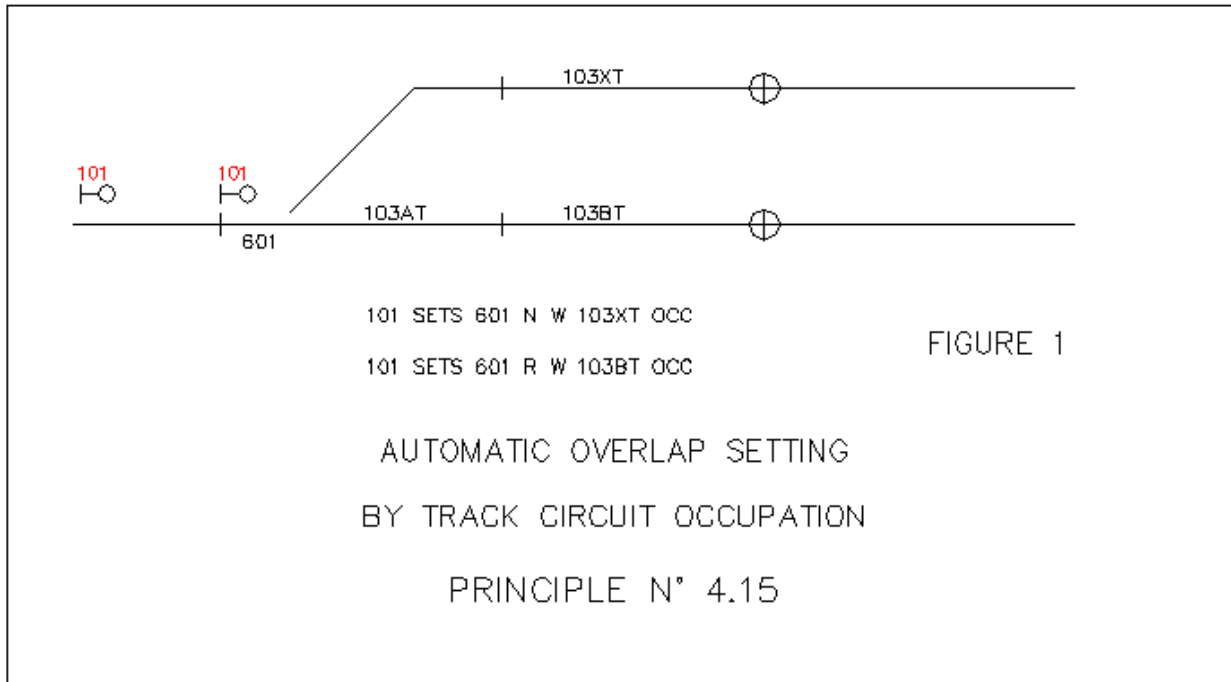
4.14.3 Requirements

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. Refer to figure 1.

These arrangements may become overly complicated if two or three sets of facing points are involved and multiple overlap choices are available and care should be exercised to restrict the overlap swinging to the minimum to satisfy traffic conditions. Overlaps should not be swung across opposing roads.

4.14.4 Control Tables

Details of the overlap setting shall be shown on the Control Table points sheet concerned.



4.15 Overlap Swinging: Principle 4.16

4.15.1 Introduction

This Principle addresses the requirements for the provision of overlap swinging facilities.

4.15.2 Purpose

Overlap swinging is provided to assist an operator to establish routes which will interact with one or more overlaps previously set for one or more routes. This avoids the operator from having to manually establish the alternative overlaps by individual point key movements before the route to be set becomes available. This may become a complex and time consuming operation where two or more junctions overlap and several routes have already been set.

4.15.3 Requirements

If one or more routes have already been set, the appropriate overlaps established and the signals are displaying proceed aspects and another route requires to be set which will alter the lay of one or more sets of points in the overlaps of the previously cleared signals then the route which is to be set shall adjust the lay of the established overlaps progressively and prove that an alternative overlap is available before the facing points leading towards the alternative overlap are reset to opposite lay.

If several sets of points are involved then this process of overlap swinging shall be enforced by the setting and locking of the overlap points in sequence.

Signals already displaying proceed aspects shall have their aspects maintained during the overlap swinging and shall prove the appropriate alternative overlap conditions when the overlap movement is complete.

4.16 Overlap Maintenance: Principle 4.17

4.16.1 Introduction

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.

4.16.2 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.

4.16.3 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.

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 combination of conditions.

4.16.4 Control Tables

Details of overlap maintenance locking shall be shown on the points sheet control table.

