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GKGN0645
Guidance on Lineside Signals, Indicators and Layout of Signals
Issue Five: June 2016
Rail Industry Guidance Note for GKRT0045



Documents

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Guidance on Lineside Signals, Indicators and Layout of Signals

Issue record

Issue	Date	Comments
One	06 February 2010	Original document
Two	03 March 2012	Replaces issue one Small scale change amendment to GKRT0045 issue two necessitated by revision of 2.3.1.2 and 2.3.1.4 to permit the use of a bar of light or a line of five lunar white light points to display the indication of the route Clauses 9.1.1, 9.1.2, 9.1.3, 9.1.4 and 9.1.5 relating to identity of signals and indicators were removed from GKRT0045 issue two as these were transferred to GKRT0009 issue four which was published in June 2011
Three	01 December 2012	Replaces issue two Small scale change amendment to GKRT0045 issue three, clause 2.3.2.5c), to allow the use of the 'X' alphanumeric route indicator to additionally denote a movement along a bi-directional line in the opposite direction to the normal flow of traffic Guidance GN167 has been revised, and GN168 newly added, to take into account the revision of the clause in GKRT0045 issue three
Four	06 December 2014	Replaces issue three Revisions associated with the publication of GKGN0657 issue one and GKGN0658 issue one Withdrawal of guidance for passable stop signals that are not designated as intermediate block home signals
Five	04 June 2016	Replaces issue four Revisions associated with the publication of RIS-0737-CCS issue one

Revisions have not been marked by a vertical black line in this issue because the document has been revised throughout.

Guidance on Lineside Signals, Indicators and Layout of Signals

Superseded documents

The following Rail Industry Guidance Note is superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GKG0645, issue four, Guidance on Lineside Signals, Indicators and Layout of Signals	2.1.2, 2.2.1, 2.2.2, 2.2.3.1 to 2.2.3.5, 2.2.4.2, 2.2.5, 2.2.8.1 to 2.2.8.3, 2.2.10, 3.1.4.2, 3.1.5.5, 4.1.3.5, 4.1.5.1, 4.1.8, 4.2.1.1, 4.2.1.3, 4.2.1.4, 5.1.3.1, 5.2.1.2, 5.2.6.3, 5.2.6.4, 5.2.6.5, plus corresponding guidance	04 June 2016

GKG0645, issue four, Guidance on Lineside Signals, Indicators and Layout of Signals is withdrawn as of 04 June 2016.

Supply

The authoritative version of this document is available at www.rssb.co.uk/railway-group-standards. Enquiries on this document can be forwarded to enquirydesk@rssb.co.uk.

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Part 1 Introduction

1.1 Purpose of this document

This document gives guidance on interpreting the requirements of Railway Group Standard GKRT0045, issue five, Lineside Signals, Indicators and Layout of Signals. It does not constitute a recommended method of meeting any set of mandatory requirements.

Relevant requirements in GKRT0045 are reproduced in the sections that follow. Guidance is provided as a series of sequentially numbered clauses prefixed 'GN' immediately below the text to which it relates. Where there is no guidance given, this is stated.

Further guidance on lineside signalling system hardware and display requirements and the product acceptance requirements is given in GKGN0657.

Further guidance on signal aspect and indication requirements is given in GKGN0658.

Further guidance on signal and indicator configuration requirements and the signal sighting assessment process is given in RIS-0737-CCS.

Specific responsibilities and compliance requirements are laid down in the Railway Group Standard itself.

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1.3 Approval and authorisation of this document

The content of this document was approved by Control Command and Signalling (CCS) Standards Committee on 18 February 2016.

This document was authorised by RSSB on 29 April 2016.

Guidance on Lineside Signals, Indicators and Layout of Signals

Part 2 Guidance on Application of Lineside Signalling Equipment

2.1 Display of operational information using the signalling system

2.1.1 Signalled movement authorities shall be displayed only using the sequences of signal aspects and indications set out in this document.

- G 01 Guidance on using lineside signal aspects and indications to convey MA, routing, system status and operational information to authorised users is given in GKGN0658.
- G 02 The aspect sequences set out in GKRT0045 Part 4 provide the driver with information about the extent of movement authority and sufficient warning of the end of movement authority. This is necessary because, in most cases, trains travelling at permissible speeds cannot be stopped within the distance visible to drivers. In an emergency, the signaller may normalise a stop signal after a train has passed the first signal in the cautionary aspect sequence (see GERT8000 Rule Book). In this case, the driver would not observe the required cautionary aspect sequence and assume that an emergency stop is required, although a signal overrun may occur.
- G 03 The permitted methods for junction signalling set out in GKRT0045 Part 5 provide the driver with information about the route set at the junction. Other junction aspect sequences should not be used.
- G 04 The signalling system should be designed to display signal aspects that are logical and that provide adequate warning of an end of movement authority.
- G 05 The arrangements for bi-directional signalling, in particular the requirement for provision of parallel signals so that drivers do not misread signal aspects are set out in GKRT0045 Part 6.
- G 06 The signalling system should be designed to control the operational risk that arises when signal and indicator equipment could display non-compliant signal aspects and / or indications that could mislead drivers during failure. Guidance on how to address this risk is given in Part 7.

2.2 Lineside signal and indicator configuration requirements

2.2.1 Co-acting signals (colour light signal and semaphore signal)

2.2.1.1 Colour light signal lights that are designed to flash shall flash in synchronism throughout the primary and co-acting signal heads when flashing aspects are displayed by co-acting signals.

- G 07 The synchronism of signal aspects that are designed to flash includes synchronism between primary and co-acting signal heads, where flashing aspects are displayed by co-acting signals. It is not necessary to provide signal light synchronism between adjacent signals or consecutive signals that display a flashing aspect sequence.
- G 08 Further guidance about flashing colour light signal displays is given in GKGN0657.

2.2.1.2 Signals shall only display movement authorities towards co-acting signals when both the primary and co-acting signals are detected to be displaying the correct signal aspect, except when a failure of the second yellow light of a double yellow aspect in either the primary signal or co-acting signal results in one signal displaying a more restrictive single yellow aspect in error.

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- G 09 If either the primary or the co-acting part of the signal fails to display the correct aspect, the previous signal should display a stop aspect because there is a possibility that the co-acting signal may not be readable. The one exception is where the 'top yellow' of a double yellow aspect has failed in one of the signal heads. In this case the driver will observe a more restrictive aspect in one of the signal heads. However, it is preferable to allow a signalled train movement than resort to degraded operations.
- G 10 Guidance on colour light signal aspects is given in GKGN0658.
- G 11 The signal sighting assessment process is set out in RIS-0737-CCS.

2.2.2 Position light signals

2.2.2.1 Independent position light signals that display the ON aspect using two yellow lights shall only be provided by exception and only as a direct replacement for an existing semaphore yellow shunting disc signal or existing yellow / white position light signal.

- G 12 The ON aspect incorporating two yellow lights should only be used where an existing semaphore yellow disc or position light signal displaying one yellow light and one white light is to be renewed. In this circumstance, the alternative provision of a red ON aspect would require a modification of the interlocking to permit clearance of the signal for all routes.
- G 13 The ON aspect incorporating two yellow lights should not be provided for new layouts because of the risk of derailment or run-through at points operated by the signaller. This risk arises because shunting movements may pass this position light signal ON aspect when the points are not route locked and so could be operated by the signaller in error.

2.2.3 Train dispatch system indications

2.2.3.1 A self-restoring, secure control device shall be provided for train dispatchers to operate each close doors ('CD') and right away ('RA') indication.

- G 14 CD and RA indicators may be provided to display information to drivers about station operations. GERT8060 sets out the operating requirements the dispatch of trains from platforms. GEGN8560 gives additional technical guidance about provision of CD and RA indicators.
- G 15 The CD and RA indications are controlled by platform staff. The control device(s) should be:
- Located near to the position from which the train is dispatched (that is to say, on the platform) so that the signal is visible when the device is operated, and
 - Designed to prevent operation by an unauthorised person.
- G 16 Right away indicators can also be used as a SPAD risk mitigation measure.
- G 17 CD and RA indicators are generally provided as a means of communicating messages about station operations from the platform staff to the driver as an alternative to hand-signals.
- G 18 The visibility of a hand-signal may be obstructed by:
- Station facilities and people.
 - Line curvature in the platform.
 - The design of driving cabs.
 - The position of the driving cab relative to the position of the dispatcher.

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2.2.3.2 The 'CD' indication shall be displayed only when the control device has been operated.

G 19 The CD indication repeats the operation of the control device, subject to any other signalling system controls being established.

2.2.3.3 Where the movement authority is displayed by a lineside signalling system:

- a) The 'OFF' indication shall be displayed only when the associated signal is displaying a proceed aspect.
- b) The 'RA' indication shall be displayed only when:
 - i) The associated signal is displaying a proceed aspect, and
 - ii) The associated control device has been operated.

G 20 The signalling system should be designed so that the OFF indication is displayed only when the relevant signal OFF aspect is also displayed.

G 21 Where the RA indicator is associated with a stop signal, the RA indication should be interlocked so that it only illuminates when the signal is displaying an OFF aspect. This is to mitigate the risk that a train could be dispatched in error when the driver does not have a movement authority.

2.2.3.4 In ERTMS areas:

- a) The 'OFF' indication shall be displayed only when a train has confirmed that it has received an in-cab movement authority to pass the node to which the OFF indicator applies.
- b) The 'RA' indication shall be displayed only when:
 - i) The train has confirmed that it has received an in-cab movement authority to pass the node to which the right away indicator applies, and
 - ii) The associated control device has been operated.

G 22 On lines operated by ERTMS, OFF indicators may be provided as part of train dispatch operations. GERT8000 sets out the operational rules for train dispatch on these lines.

G 23 Where the RA indicator is provided on an ERTMS line and there are no lineside signals, the RA indication should be interlocked so that it only illuminates when the relevant movement authority has been issued. This is to mitigate the risk that a train could be dispatched in error when the driver does not have a movement authority.

2.2.4 BU indicators

2.2.4.1 Where provided, barriers up (BU) indicators shall be positioned at a distance beyond the level crossing, so that the 'BU' indication is displayed before the front of the train that has passed over the level crossing passes the BU indicator.

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- G 24 BU indicators are provided at a train crew operated barrier level crossing (TMOB) if 'auto-raise' functionality is provided. Additional guidance on train crew operated level crossings is given in in GKGN0692.
- G 25 Where 'auto-raise' functionality is not provided, train crew are required to locally operate the level crossing raising sequence and confirm that this has been done before the train leaves the level crossing area. In this case, a BU indicator is not required.
- G 26 A barriers up indicator should be provided for all exits of the level crossing where 'auto-raise' functionality is available.
- G 27 The location and sighting of each barriers up indicator should be compatible with the length of trains, attainable train speeds and the level crossing barrier raise time, so that drivers receive a minimum reading time of 4 s when going away from the level crossing.
- G 28 On lines where trains of significantly different lengths are operated (for example, short multiple unit passenger trains and long locomotive hauled trains), a sequence of BU indicators may be provided, each one positioned according to the relevant train lengths. This is to avoid the situation where the driver of a short train would have to walk an excessive distance from a BU indicator positioned to accommodate a long train.

2.2.5 Train Protection and Warning System (TPWS) indicators

2.2.5.1 Where a TPWS indication is associated with a points indicator and / or a level crossing indicator, the indications shall be consistently displayed in a logical sequence at each location along a line of route.

- G 29 The points indication differs from the indications displayed by an independent points indicator because the points set indication is not positively displayed. 'Points set' is inferred by the flashing blue TPWS indication, meaning TPWS disarmed, which infers that it is safe to pass the stop board. The flashing red points indication is only displayed when the points are moving between normal and reverse.
- G 30 During a normal sequence of operations, a driver may typically observe the following sequence of TPWS and points indications:
- | | | |
|---|---------------------------|---------------------|
| 1 | TPWS armed at stop board | Steady blue light |
| 2 | Driver sets forward route | Flashing red light |
| 3 | TPWS disarms | Flashing blue light |
- G 31 If the train does not use the movement authority before the TPWS resets, the driver may subsequently observe the following sequence of TPWS and points indications:
- | | | |
|---|-----------------------|--------------------|
| 4 | Points auto-normalise | Flashing red light |
| 5 | TPWS re-arms | Steady blue light |
- G 32 The driver's level crossing indication should be controlled independently from the TPWS / points indication. The flashing white light may be displayed at the same time as a flashing red light or a TPWS indication.
- G 33 The operating instructions should require the driver to only pass the stop board when a movement authority is obtained and when the flashing blue indication is displayed. If either no indication is displayed, or just a flashing white light is displayed when the train arrives at the stop board, this means that the TPWS has failed.

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2.2.6 Stop boards

2.2.6.1 The wording displayed on each stop board shall be determined using the process for assessment of compatibility set out in GERT8270.

- G 34 Stop boards display a fixed stop aspect and written instructions about the action to be taken by the train crew.
- G 35 Typically, stop boards are provided at:
- a) Level crossings where all trains are required to stop on the approach (see GKRT0192).
 - b) The end of signalled routes where a transition is made to a different method of control where worked signals are not appropriate (for example, at the end of a yard reception line).
 - c) The end of a passing loop on a line signalled using RETB or NSKT systems.
 - d) The exit from a siding where the points are controlled by a ground frame and it is not appropriate to provide a worked signal.
- G 36 The wording displayed on a stop board should be agreed with the relevant railway undertakings and be compatible with the operating requirements set out in the GERT8000 Rule Book, Sectional Appendix and relevant local operating instructions.
- G 37 Where stop boards are the primary means of displaying the end of movement authorities along a line of route, wording should be consistently applied.
- G 38 GKRT0055 sets out additional requirements for stop boards on single lines.

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Part 3 Guidance on Layout of Signals: Requirements for Stop Signals

3.1 Provision of stop signals and signalling indicators

3.1.1 Position of stop signals

3.1.1.1 The signalling layout shall provide for all normal train movements.

G 39 The signalling layout should be designed to be compatible with the required train operations, which should be determined using the process for assessment of compatibility set out in GERT8270.

3.1.1.2 Except for lines where movement authority information is conveyed using lineside operational signs (see GKRT0055), the signalling layout shall provide stop signals at the following locations:

- a) At the entrance and exit of every block section.
- b) At the entrance to every signal section, including signal sections associated with station limits.
- c) At the end or exit of every signal section, including signal sections associated with station limits.

G 40 Signallers are responsible for operating the signalling system in accordance with the GERT8000 Rule Book and the relevant block signalling regulations.

G 41 Drivers are responsible for controlling train movements, using their route knowledge, within the limits of the movement authorities provided by the signalling system and in accordance with the GERT8000 Rule Book.

G 42 On certain single lines (see GKRT0055):

- a) Stop signals may be omitted if lineside operational signs are used to display the required operating instructions to drivers, and / or
- b) Movement authorities may also require transfer of a physical or electronic token between the signaller and a driver (see GKRT0055).

G 43 Stop signals define fixed positions within the infrastructure layout at which trains may be required to stop. They provide the means for the infrastructure manager to:

- a) Display the start of a movement authority, and
- b) Display the end of a movement authority.

G 44 When communicating with each other, drivers and signallers use signals as common reference points so that they both have the same understanding of the position of the train within the infrastructure. This is particularly important when operational rules require verbal communication between a driver and the signaller (for example, during degraded operations).

G 45 The designed position of stop signals should address the operational risk that should be controlled. GERT8270 sets out the process for assessment of compatibility between the signalling system and railway operations, which should take account of the following:

- a) The types and lengths of trains that will be operated (for example, to ensure a stationary train will not cause an obstruction).

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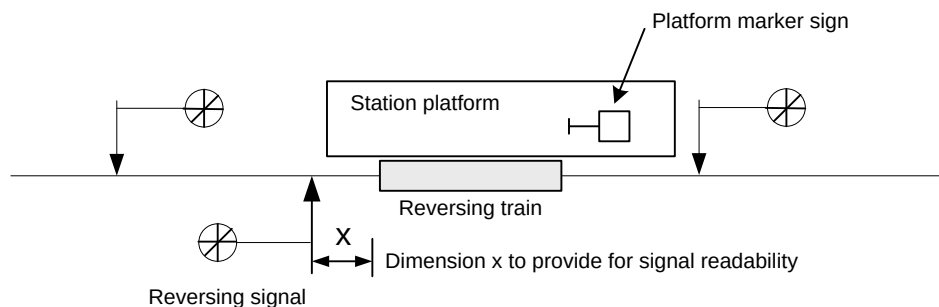
- b) The required train operations, including:
 - i) Headways and permissible speeds.
 - ii) Locations where all trains start from rest (for example, at yard exit points and terminal platforms).
 - ii) Reversing movements.
 - c) The position of infrastructure features such as station platforms, junctions and level crossings.
 - d) Signal sighting requirements (see RIS-0737-CCS).
 - e) Overrun mitigation requirements (for example, overlap and clearing points).
 - f) Gradients and areas of poor adhesion that may increase operational risk.
 - g) Potentially hazardous locations (for example, tunnels and viaducts).
 - h) The requirement for train crew to exchange single line tokens or use lineside equipment (for example, a telephone or token instrument) in accordance with the GERT8000 Rule Book.
- G 46 In order to prevent a derailment if a train rolls back on a gradient when the brakes are released, stop signals should be positioned so that trains do not straddle catch points when stopped at a signal.
- G 47 The type and format of signalling equipment should be determined in accordance with RIS-0737-CCS so that the ON and OFF signal aspects are readable by the driver:
- a) From the position from which trains may start from rest, taking account of operational stopping positions (for example, station platforms) and reversing operations, and
 - b) When trains are approaching the signal.
- G 48 Stop boards should be positioned so that any necessary verbal authority can be granted safely and efficiently (for example, by the shunter or person-in-charge). Where this is not practicable, alternative methods of issuing the movement authority should be considered, including:
- a) Provision of a means of direct communication (that is to say, telephone or radio), and
 - b) Provision of a worked signal, instead of the stop board.
- G 49 Main stop signals are sometimes given particular designations according to the block system that is used, for example:
- a) Section signal; a stop signal incorporating a line clear release function that protects the entrance to an absolute block section or a single line section not worked using the track circuit block system.
 - b) Home signal; a stop signal provided at the exit end of an absolute block section or a single line that is not worked using the track circuit block system. Home signals protect station limits and, in the absence of station limits, may be combined with the section signal to protect the entrance to the next section.
 - c) Intermediate block home signal; a signal located at the end of an additional block section that is controlled by one signal box and operated in accordance with the absolute block regulations.
 - d) Non-block signal; a stop signal that is specifically provided part way through a block section to protect a level crossing or other infrastructure hazard.

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- G 50 Except for intermediate block home signals, these designations are only relevant to the operational rules and instructions for signallers; they are not associated with the operational interface between the infrastructure manager and railway undertakings, which is addressed using signal identification plates. Intermediate block home signals are specifically identified to the driver.

- d) Where signalling facilities are provided for trains to reverse direction, at the point of reversal.

- G 51 At some locations, a stop signal is provided to issue movement authorities for trains that need to reverse. In this case, the stop signal should be positioned so that:
- At the end of the inward movement, the whole of the train comes to a stand behind the signal that will be used to display the reversing movement authority.
 - When the train has stopped, the signal used to display the reversing movement authority is readable from the driving cab used for the reversing move (see GN Figure 1).
 - There are no facing points or level crossings between the train and the signal displaying the reversing movement authority.



GN Figure 1 Example of a stop signal provided for a reversing move

- G 52 One or more platform marker signs (for example, multiple-unit car stop or other appropriate signs) may be provided at the inward stopping point as an aid to the driver. The provision and layout of these signs should take account of different train formations and stopping positions. The signs do not define the end of a movement authority.

- e) On the approach to a ground frame (see GKRT0077).

- G 53 Where a ground frame is provided, the protecting stop signal denotes the boundary between the part of the railway that is controlled by the signaller and the part of the railway where operational control may be handed over to a ground frame operator using a release function (see GKRT0077).
- G 54 Ground position light signals or semaphore shunting signals may be provided for the ground frame operator to display shunting movement authorities using the ground frame. The requirement for such signals should be determined using the process for assessment of compatibility set out in GERT8270.

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- f) On the approach to moveable infrastructure, except where a points indicator is provided instead of a signal.

G 55 The stop signal is used to control movement authorities along sections of line where the infrastructure incorporates a feature that disrupts the line of route when operated. Examples include:

- a) Facing or trailing points, except for trailing catch points, and
- b) Moveable bridges.

G 56 Where points are not fully interlocked with the movement authority (for example, on lines signalled using the RETB system), a points indicator should be provided to indicate that the points are correctly set. In this case, the movement authority requires the driver to observe and respond to points indications within the route.

- g) On the approach to level crossings (see GKRT0192).

G 57 GKGN0692 gives additional guidance about signals that protect level crossings

- h) On the approach to areas protected by a signalling lockout system that is provided for use by railway undertaking personnel, and at the exit from such an area that is used by personnel working on the outside of trains (see GKRT0212).

G 58 Stop signals are provided on the approach to the lockout system to prevent the issue of movement authorities into the protection area that is being used.

G 59 The stop signals that display movement authorities for train movements out of the protection area should be interlocked with the lockout system if the protection system is used by people working on the outside of a train. This is to prevent the train from moving in response to a signal OFF aspect before the work is complete. The requirement for this functionality should be agreed using the process for assessment of compatibility set out in GERT8270.

- i) Where there is a requirement to stop trains to protect against other identified hazards (for example, airport runways).

G 60 The stop signal is used to control movement authorities along sections of line where a non-railway hazard may disrupt the line of route in certain circumstances. Examples include:

- a) Airport runways (low flying aircraft), and
- b) Rock fall or coastal hazards.

3.1.1.3 The requirements for positioning stop signals on electrified lines is set out in Appendix A.

G 61 Appendix A includes additional guidance about stop signals and electrified lines

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- 3.1.1.4 Stop signals controlling movements through diverging junctions shall be positioned not more than 800 m from the first set of facing points, except where either:
- a) The facing points are operated from a ground frame.
 - b) The stop signal is positioned parallel with other stop signals, one of which is positioned within 800 m of a set of facing points and there are other factors that prevent the positioning of stop signals closer to the junction.
 - c) The facing points are always set in the same position for facing moves from the stop signal.
 - d) The facing points are secured out of use (see GCRT5021).
 - e) A distance temporarily greater than 800 m is associated with planned engineering stage-works, and details of the excess distance are published in accordance with GORT3215.

G 62 The 800 m maximum distance is specified to address the risk that a driver may forget the route set at the junction after passing the junction signal and approach the divergence at excessive speed.

G 63 Because the 800 m maximum distance is not always compatible with project requirements, certain exceptions allow the signal to be more than 800 m away from the facing points. In all other circumstances, the project should apply for a deviation.

- 3.1.1.5 Signals on parallel lines shall be positioned so that they are within 20 m of each other longitudinally.

G 64 The similar position of the adjacent stop aspects helps drivers to judge the train stopping position at the limit of MA.

G 65 The permitted tolerance is intended to accommodate site specific application constraints (for example, the position of a suitable insulated rail joint or to improve signal readability). Greater variation in longitudinal position is a factor that has the potential to increase the likelihood of a signal overrun.

G 66 An application for deviation against this requirement should be supported by a signal sighting assessment and a signal overrun risk assessment.

3.1.2 Stop signal types, displayed signal aspects and movement authorities

- 3.1.2.1 Stop signals on running lines shall be main stop signals, except where the criteria for position light signals, semaphore shunting signals and points indicators allow these to be provided as an alternative.
- 3.1.2.2 Main stop signals shall only be provided using the following equipment types:
- a) Colour light signal.
 - b) Semaphore main stop signal.
 - c) Stop board.
 - d) Buffer stop that is indicated to the driver.

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- G 67 The type of stop signal and the signal aspects displayed at each limit of movement authority (start and end) should take account of all of the following:
- a) The classes of signal route associated with the signal (that is to say, main, calling-on, warner, shunting).
 - b) The classes of train that will be operated (see GERT8000).
 - c) The types of train movements required (for example, passenger and / or shunting).
 - d) The SPAD risk and potential consequences arising from a SPAD at the start and end of the signal section.
 - e) The prevailing signalling arrangements.
 - f) The compatibility of the signal equipment and the train operations (for example, train speed).
- G 68 A colour light signal or semaphore stop signal should always be provided to display a movement authority for a passenger train to proceed into a clear signal section.
- G 69 The stop aspect at the end of a movement authority should always be displayed using a main stop signal if either:
- a) A movement authority towards the signal can be displayed using a colour light signal or semaphore stop signal, or
 - b) The movement authority towards the signal can be used by a passenger train.
- G 70 By exception, and only if no train movements take place during the hours of darkness, it is permissible to provide a semaphore stop signal that does not incorporate a signal light. This is only acceptable if the semaphore arm / disc on its own provides the required signal aspect readability and visibility.

- 3.1.2.3 Independent position light signals and semaphore shunting signals shall only be provided to display shunting movement authorities in either one of the following circumstances:
- a) From running lines into sidings.
 - b) Wholly within sidings.
 - c) From sidings onto running lines, except at locations where a colour light signal or semaphore stop signal is necessary to mitigate SPAD risk or collision risk.
 - d) Along running lines, except at locations where a main stop signal is necessary to mitigate signal passed at danger (SPAD) risk or collision risk.

- G 71 Independent position light signals and semaphore shunting signals should only be used to display shunting movement authorities that are compatible with the operational rules for shunting (see GERT8000 Rule Book) typically, either:
- a) Non-passenger train movements into occupied signal sections that are not associated with calling-on operations.
 - b) Set back and running round moves on running lines.
 - c) Movements within sidings.

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- G 72 It is good practice to provide a colour light signal or semaphore stop signal for movements into clear signal sections, even if the only requirement is for shunting operations (for example, an empty stock movement from a siding into a station platform). This is because:
- a) The equipment used provides better visibility and therefore contributes to SPAD mitigation, and
 - b) The non-permissive movement authority informs the driver that the train has been signalled into a clear signal section. Displaying a permissive movement authority into a section that is clear may be a causal factor leading to a collision when the same signal aspect is displayed for a move into the same occupied signal section.
- G 73 The end of a shunting movement authority may be defined by either one of the following:
- a) A main stop signal (colour light or semaphore).
 - b) An independent position light signal (including limit of shunt) or semaphore shunting signal.
 - c) A stop board.
 - d) A buffer stop.
 - e) The end of a train (indicated by a tail lamp), where the shunting move is towards an occupied line.
 - f) Where a 'shunt ahead' movement is authorised into a forward block section, when the train has proceeded as far as is required so that the reversing move may be authorised by the appropriate signal. In this case it is permissible to provide stopping position marker boards to assist the driver (see GIRT7033).
- G 74 It is good practice to provide a main stop signal at the end of a shunting movement authority associated with a long signal section, because the equipment used provides better visibility of the signal and therefore contributes to SPAD mitigation.
- G 75 A position light signal or semaphore shunting signal should only be used to display the end of a shunting movement authority if a main stop signal is not required for any other reason.

3.1.2.4 Before providing a position light signal or semaphore shunting signal to display shunting movement authorities onto or along running lines, the infrastructure manager and relevant railway undertaking(s) shall jointly assess the SPAD risk and collision risk associated with the planned train movements. Factors to be considered shall include (as appropriate):

- a) Visibility and sighting of the stop signal that defines the end of each shunting movement authority on the running line.
- b) The distance to the stop signal that defines the end of each shunting movement authority on the running line.
- c) The number and frequency of shunting movements from the signal that involve train movements onto running lines.
- d) The proportion of shunting movements from the signal that involve train movements onto the running line.
- e) The number and proportion of shunting movements from the signal into an occupied section on a passenger line.

- G 76 The risk assessment should be managed using the process for assessment of compatibility set out in GERT8270.

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- G 77 The adequacy of the type of stop signals provided within a signalling layout should also be reviewed before any significant changes are made to train operations that could increase the SPAD risk, in particular where position light signals or semaphore shunting signals are used to control shunting movements that may conflict with passenger train operations.

3.1.2.5 Where an independent position light signal is provided within a main signal route in a facing direction, the following apply:

- a) The position light signal OFF aspect comprising two lunar white lights shall be displayed when the route is set from the main stop signal, and
- b) The position light signal ON aspect shall only be displayed to a driver using a movement authority from the main stop signal if the signaller intentionally replaces the signal to danger in an emergency.

3.1.2.6 Where a semaphore shunting signal is provided within a main signal route in a facing direction:

- a) The OFF aspect shall be displayed when the route is set from the main stop signal, and
- b) The ON aspect shall only be displayed to a driver using a movement authority from the main stop signal if the signaller intentionally replaces the signal to danger in an emergency.

- G 78 A movement authority displayed by a main stop signal extends to the next main stop signal. Any facing direction independent position light signals or semaphore shunting signals within a main route should be controlled to display the OFF aspect when the main route is set so that drivers do not observe the ON aspect at those signals.

- G 79 Where a preset position light signal is configured to display the proceed on sight aspect (PoSA – see GERT8071), the PoSA aspect should not be displayed when the signal is in preset mode. Instead, where a PoSA route from a main signal presets a position light signal, the preset signal should display the non-flashing OFF aspect.

- G 80 The signals used to display shunting movement authorities may not be compatible with the train operation between the main stop signals. In this case, the driver is not expected to read the position light signal or semaphore shunting signal aspect.

3.1.2.7 Stepping up or down to a calling-on class route is prohibited.

3.1.2.8 Stepping up or down to a shunt class route is prohibited.

3.1.2.9 Stepping up or down to a Proceed-on-Sight Authority (PoSA) class route is prohibited.

- G 81 When a stop signal OFF aspect is displayed, the signal aspect should not change to display a movement authority for a different type of train movement. For example:

- a) A signal should not step up to display a main OFF aspect when a subsidiary OFF aspect, shunting OFF aspect or a PoSA aspect is displayed. This is to prevent driver anticipation that the less restrictive movement authority could be issued before the train reaches the signal, and
- b) A signal should not step down from a main OFF aspect to a more restrictive subsidiary OFF aspect, shunting OFF aspect or a PoSA aspect. This is because the driver has

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already been issued with a movement authority that may be less restrictive in terms of speed and destination.

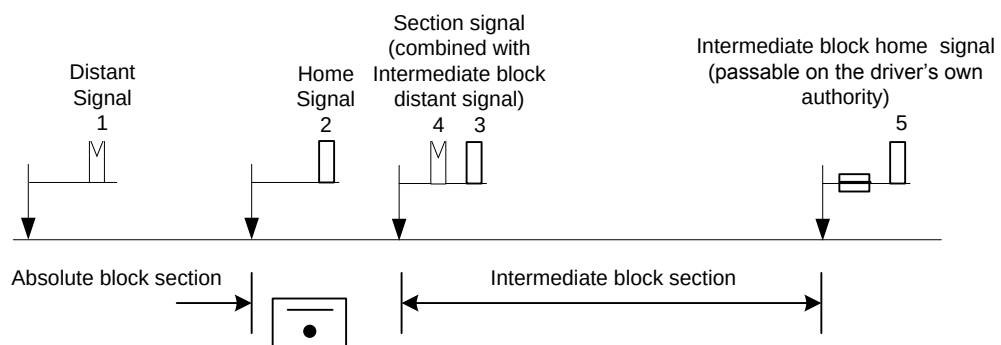
G 82 Drivers observing signal aspects that step up or step down are required to report a signal irregularity in accordance with the GERT8000 Rule Book.

3.1.3 Designation of a stop signal as an 'intermediate block home' signal

- 3.1.3.1 A colour light stop signal or semaphore main stop signal shall only be designated an 'intermediate block home' signal if:
- The signal is located at the end of an additional block section that is controlled by one signal box and operated in accordance with the absolute block regulations, and
 - The next signal section(s) does not incorporate any of the following:
 - Ground frame.
 - Crossover, facing or trailing points.
 - Moveable infrastructure (for example, a swing bridge).
 - Manually controlled level crossing.
 - Automatic level crossing remotely monitored by the signaller.
 - A directly opposing route or overlap that conflicts with the route or overlap.
 - Any other hazard protected by the stop signal that, if passed at danger, could result in a collision or derailment.

G 83 At some locations on lines that are signalled and operated in accordance with the absolute block signalling regulations an additional (intermediate) block section is provided, where both sections are under the control of one signal box (see GN Figure 2).

G 84 Typically, intermediate block sections are provided to avoid the need for extensive re-signalling alterations associated with capacity enhancement schemes, or where an intermediate signal box is abolished on a line operated in accordance with the absolute block signalling regulations. However, if the section signal is a long way beyond the home signal and is not visible from the home signal, the section signal should be treated as an intermediate block home signal if the SPAD risk that arises when a train accelerates towards the section signal is unacceptable.



GN Figure 2 Example of an intermediate block home signal beyond the signal box

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- G 85 All of the items set out in clause 3.1.3.1b) constitute an unacceptable hazard, which means that signals protecting such features should not be designated as intermediate block home signals. While the rules for passing a signal at danger require the driver to be prepared to stop the train clear of an obstruction (for example, a stationary train occupying the section), the driver is not required to check that the infrastructure is correctly set.
- G 86 Intermediate block home signals are identified using an identification plate incorporating a vertical black bar against a white background (see GIRT7033).

3.1.4 Provision of point indicators

3.1.4.1 A points indicator shall be provided:

- a) On the approach to facing points unless a stop signal is used to display movement authorities through those points, and
- b) On the approach to trailing points, unless either:
 - i) A stop signal is used to display movement authorities through those points, or
 - ii) A train operated point mechanism is fitted to the trailing points.

- G 87 Worked points should be protected using stop signals unless the method of block working is incompatible with the provision of worked stop signals.
- G 88 Points indicators are provided when it is not appropriate to provide a stop signal to authorise train movements through the points. This may arise because of the type of signalling system provided (for example, lines fitted with minimum signalling facilities) or because the distance from the stop signal to the points is excessive.
- G 89 Points indicators are typically provided at the following locations:
- a) On the facing approach to self-restoring train operated points (which may be fitted with a hydro-pneumatic operating mechanism), in which case the indication is used by the driver to confirm that the facing points are correctly set in the normal position.
 - b) On the facing approach to power operated points, in which case the indication is used by the driver to confirm that the facing points are correctly set for the facing move.
 - c) On the trailing approach to non-trailable points, in which case the indication is used by the driver to confirm that the points are correctly set for the trailing move.
- G 90 There is no specified minimum or maximum distance between a points indicator and the associated points. However, consideration should be given to:
- a) The operational requirement for the driver to check that the points are correctly set when the flashing red indication is displayed, and
 - b) The possibility that the train may inadvertently pass the points indicator when the red light is flashing (this is classified as a SPAD; see the GERT8000 Rule Book).

3.1.5 Provision of loading / unloading indicators

3.1.5.1 Loading / unloading indicators shall be provided at locations where the infrastructure manager co-operates with railway undertaking shunting operations by displaying train movement indications in lieu of hand-signalling operations.

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- G 91 Loading / unloading indicators (sometimes referred to as 'Toton' signals) may be provided where speed and / or direction critical shunting movements need to be managed. Typically, they are provided within sidings or as setback indicators on running lines as an alternative to hand-signals, where it is necessary to precisely position rail vehicles adjacent to freight handling facilities (for example, a hopper, bunker or pipeline).
- G 92 Loading / unloading indicators should be controlled from the position where the loading / unloading operation is supervised, rather than from a signal box or ground frame. This is because the position of the train in relation to the facility is the critical factor, and the indications provide a method of remote communication between the operator and the train driver.

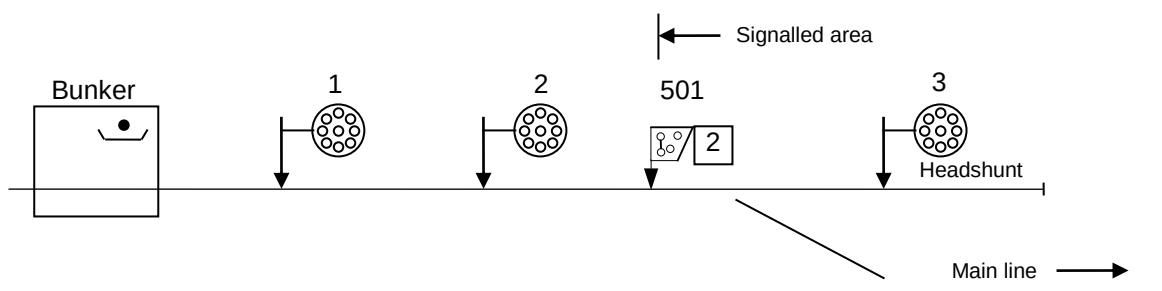
3.1.5.2 Where loading / unloading indicators are grouped as a set along a line, all of the indicators in the set shall display the same indication at the same time.

- G 93 The driver may be able to see more than one indicator at the same time and is required to control the train in accordance with the indication displayed. It is therefore necessary to make sure that the indications are consistently displayed so that the driver does not observe different indications at the same time.

3.1.5.3 A stop signal shall protect the running lines beyond the sidings in accordance with 3.1.1.

3.1.5.4 No indication shall be displayed for movements into a signalled area when the signal applicable to the movement is displaying a stop aspect.

- G 94 Where a signal is provided at the exit from the siding (signal 501) on the same line as the loading / unloading indicator, the signalling system should be configured so that the indications displayed do not conflict with the signal stop aspect. An example is illustrated in GN Figure 3.



The loading / unloading indicators '1', '2' and '3' should not display an indication for a forward movement into the headshunt unless 501 signal is OFF for a route into the headshunt

GN Figure 3 Example of a loading / unloading indicator application

- G 95 When the signal is displaying an OFF aspect for a move out of the sidings (signal 501), for which the loading / unloading indications do not apply, the indications should be extinguished.

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Part 4 Guidance on Layout of Signals: Aspect Sequences

4.1 Requirements for cautionary aspect sequences

- G 96 This section sets out guidance about the cautionary aspect sequences that should be displayed to drivers on the approach to the end of movement authorities. Sections 5.2 and 5.3 provide further guidance about the aspect sequences approaching junction signals.
- G 97 Some examples of signal aspect sequences that are not compatible with Part 4 and Part 5 are listed below:
- a) The prohibited junction aspect sequences, as set out in 5.5.
 - b) A colour light signal red aspect preceded by a colour light signal displaying a flashing single yellow, double yellow, flashing double yellow or green aspect.
 - c) A colour light signal red aspect preceded by a semaphore distant arm in the OFF position.
 - d) Successive colour light signals simultaneously displaying a single yellow aspect, except where permitted, as set out in 4.1.3, or when the top yellow of a double yellow aspect has failed. (In practice, drivers may observe a series of consecutive single yellow aspects when following another train, but understand that when a single yellow aspect is displayed, the next signal ahead should be regarded as displaying a red aspect.)
 - e) Successive colour light signals simultaneously displaying a double yellow aspect, except where permitted, as set out in 4.1.3. (In practice, drivers may observe a series of consecutive double yellow aspects when following another train.)
 - f) A position light signal ON aspect, preceded by a colour light signal single yellow, double yellow or green aspect.
 - g) A position light signal ON aspect preceded by a semaphore main stop signal OFF aspect.
 - h) One or more successive semaphore main stop signal arms in the ON position preceded by a semaphore distant signal arm in the OFF position.
 - i) A semaphore main stop signal arm in the ON position preceded by a colour light signal displaying a flashing single yellow, double yellow, flashing double yellow or green aspect.
 - j) A semaphore shunting signal ON aspect preceded by a semaphore stop signal OFF aspect.
 - k) A semaphore shunting signal ON aspect preceded by a colour light signal caution, preliminary caution or proceed aspect.

4.1.1 Standard 3-aspect sequence

4.1.1.1 In 3-aspect colour light signalling areas, a first caution consisting of a single yellow aspect shall be displayed at the required signalling braking distance from the red aspect (see GKRT0075).

4.1.1.2 The standard 3-aspect sequence shall be:

Green	→	Single yellow	→	Red
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- G 98 Drivers, running under authority of a green aspect on a 3-aspect colour light signalled section of line expect a single yellow – red aspect sequence approaching the end of the movement authority.

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- G 99 Drivers should know that the single yellow aspect means that the next signal denotes the end of the movement authority ahead and they are required to control the deceleration of the train according to the relevant professional driving policy.
- G 100 If a single yellow aspect is not displayed on the approach to the end of the movement authority, the train may not be able to stop at the signal displaying the red aspect. In these circumstances, the driver will assume that an emergency stop is required. This situation may arise because the signaller requires the train to stop in an emergency or because of a signalling system failure.
- G 101 Where headway requirements are such that that the distance between successive stop signals is excessive (see GKRT0075), separate distant signals should be considered. This is because excessive braking distance can be a cause of SPAD.
- G 102 Where significantly different train speed profiles operate on the same line, 4-aspect signalling should be considered to address the risk arising from over-braking (see GKRT0075), even where 3-aspect signalling would otherwise be adequate for the required train service. The decision whether to provide 3- or 4-aspect signalling in these circumstances should consider the following:
- a) The operating speeds and braking performances of the trains authorised to use the route.
 - b) Any planned future changes in permissible speeds.
 - c) Signal visibility and readability.
 - d) Any variation in signalling braking associated with gradient profiles.
 - e) The risks associated with isolated sections of 4-aspect signalling along a predominantly 3-aspect route.
- G 103 Where it is necessary to position signals such that the required signalling braking between the yellow and red aspects in the standard 3-aspect sequence cannot be provided (for example, for operational or topographical reasons), sufficient warning of the red aspect should be provided using one of the following:
- a) An isolated standard 4-aspect sequence, incorporating 3-4 aspect transitions.
 - b) A lower permissible speed.
 - c) Approach control from red of the signal that displays the yellow aspect in the 3-aspect sequence. The approach control should be configured so that the speed of the train is reduced to an extent commensurate with the available signalling braking. This arrangement may result in loss of headway and an increased SPAD risk due to driver anticipation of a proceed aspect at an approach controlled signal. Where approach control is applied, the exit signal from the section concerned should not be approach controlled from red itself or protect a conflict which is likely to result in the approach control being seen on a regular habit forming basis.

4.1.2 Standard 4-aspect sequence

4.1.2.1 In 4-aspect colour light signalling areas:

- a) A first caution consisting of a double yellow aspect shall be displayed at the required signalling braking distance from the red aspect (see GKRT0075), and
- b) The red aspect shall also be preceded by a single yellow aspect displayed at the required signalling braking distance (see GKRT0075).

4.1.2.2 The standard 4-aspect sequence shall be:

Green	→	Double yellow	→	Single yellow	→	Red
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- G 104 A driver, running under authority of a green aspect on a 4-aspect colour light signalled section of line expects a double yellow – yellow – red aspect sequence approaching the end of the movement authority.
- G 105 Drivers should know that the double yellow aspect means that the signal after the next signal denotes the end of the movement authority and that they are required to control the deceleration of the train according to the relevant professional driving policy.
- G 106 If a double yellow aspect is not displayed on the approach to the end of the movement authority in a 4-aspect area, the train may not be able to stop at the signal displaying the red aspect. In these circumstances, the driver assumes that an emergency stop is required. This situation may arise because the signaller requires the train to stop in an emergency or because of a signalling system failure.
- G 107 It is good practice to design a signalling layout to maximise the opportunity for train movements to be made under green aspects. The additional signal sections associated with 4-aspect sequences contribute towards this, as well as providing additional capacity. Regular train operations made under routinely cautionary aspects are known to be a causal factor of SPAD.

4.1.3 Non-standard 4-aspect sequences

4.1.3.1 By exception, the signalling system shall only display the following non-standard 4-aspect sequences, either:

- a) A sequence incorporating two successive double yellow aspects, or
- b) A sequence incorporating two successive single yellow aspects.

- G 108 RSSB research project T998 is investigating the effect of using non-standard 4-aspect sequences on driveability.
- G 109 When a cautionary aspect sequence is observed, the driver should prepare to stop the train. Observation of long sequences of cautionary signal aspects (for example, successive single yellow aspects) is a causal factor affecting SPAD risk. This risk arises if the driver anticipates another single yellow aspect at the signal that is displaying a red aspect, which can arise if the driver thinks that there is another moving train ahead.
- G 110 The signalling system should be designed so that:
- a) Whenever possible, drivers observe green aspects.
 - b) Standard cautionary aspect sequences are displayed wherever possible.
 - c) Non-standard cautionary aspect sequences are only displayed by exception and in accordance with section 4.1.3.1.
- G 111 The decision to provide a non-standard cautionary aspect sequence or, alternatively, to impose approach control from red, should be determined using the process for assessment of compatibility set out in GERT8270.
- G 112 Before a project implements a different non-standard 4-aspect sequence to that specified in GKRT0045 (for example, a sequence incorporating a sequence of four cautionary aspects), an assessment of the SPAD risk should be completed and:
- a) A derogation against GKRT0045 should be obtained before the proposed arrangements are implemented on the operational railway for the first time, and
 - b) A proposal for standards change should be submitted to amend GKRT0045 to incorporate the new arrangements if it is likely to be used at a number of sites in the future.

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- 4.1.3.2 A sequence incorporating two successive double yellow aspects shall only be displayed where it is necessary to achieve the required signalling braking distance between the first double yellow aspect and the red aspect. In this case the non-standard 4-aspect sequence shall be:

Green	→	Double yellow	→	Double yellow	→	Single yellow	→	Red
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- G 113 Where it is necessary to position signals such that the signalling braking cannot be provided (that is to say, between the double yellow aspect and the red aspect), an additional double yellow aspect may be displayed. In this case the signalling braking requirement is provided between the outermost double yellow aspect and the red aspect.
- G 114 This non-standard sequence should be avoided and only displayed if the required headway and signalling braking cannot be achieved by another means and the SPAD risk is acceptable. RSSB research project T998 provides further information that is relevant to projects associated with these aspect sequences.
- G 115 Alternative solutions, both of which affect the available headway include either:
- Imposition of a lower permissible speed that is compatible with a standard 4-aspect sequence, or
 - Provision of a standard 4-aspect sequence with approach control from red at the signal displaying the single yellow aspect, subject to the assessment of SPAD risk.

- 4.1.3.3 A sequence incorporating two successive single yellow aspects shall only be displayed where it is necessary to provide the required signalling braking distance between the single yellow aspect and the red aspect in a 4-aspect sequence. In this case the non-standard 4-aspect sequence shall be:

Green	→	Double yellow	→	Single yellow	→	Single yellow	→	Red
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- G 116 Where it is necessary to position closing-up signals or mid-platform signals such that the distance between the single yellow and red aspect in a 4-aspect sequence does not comply with the 1/3 rule (see GKRT0075), a second single yellow aspect may be displayed within the cautionary aspect sequence. In this case, the requirement for signalling braking between the double yellow aspect and the red aspect is not affected.
- G 117 This non-standard sequence should be avoided and only displayed if the required headway cannot be achieved by another means and the SPAD risk is acceptable. A causal factor of SPAD risk arises if the driver assumes that a second single yellow aspect will be displayed when the signal is displaying a red aspect. This is because the same double yellow aspect provides the first caution for two stop signals.
- G 118 Alternative solutions include either:
- Where possible, imposition of a lower permissible speed that is compatible with a standard 4-aspect sequence, or
 - Providing approach controlled from red at the closing-up signal or mid-platform signal, subject to an assessment of SPAD risk. The approach control should be sufficient so that the speed of the train is reduced to an extent commensurate with the reduced signalling braking to the signal ahead.

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4.1.3.4 Where a non-standard 4-aspect sequence is provided, the train protection system (see GERT8075) shall be configured to mitigate the additional SPAD risk that arises:

- a) At the signal that displays the single yellow aspect as part of the non-standard 4-aspect sequence incorporating two double yellow aspects, and
- b) At the signal that displays the second single yellow aspect as part of the non-standard 4-aspect sequence incorporating two single yellow aspects.

G 119 Because non-standard 4-aspect sequences introduce variability from the usual meaning of the double yellow and single yellow aspects, train protection system infrastructure (for example, TPWS loops) may have to be provided to mitigate the SPAD risk that arises at the signal that displays the single yellow aspect in the non-standard 4-aspect sequence.

G 120 It may be possible to demonstrate that the additional SPAD risk is negligible if the driver can always see the red aspect at the same time as the repeated cautionary aspects. In this case, it may not be necessary to enhance the train protection system.

4.1.3.5 Where, in a non-standard 4-aspect sequence, the stop signal is a junction signal for which the diverging route is not approach controlled from red, sufficient distance shall be provided to the signal beyond the junction on the diverging route so that a train traversing the junction at the permissible speed can stop at that signal.

G 121 This requirement is associated with a junction signal that is configured to display an unrestricted aspect sequence for the diverging route.

G 122 This provides the driver with full braking distance when the junction signal is displaying a single yellow aspect so that drivers traversing the diverging junction at turnout speed are able to stop at the first stop signal beyond the junction. This is to address the additional SPAD risk that arises at the first signal beyond the junction, because the modified 4-aspect sequence usually provides excess braking distance, which may cause drivers to misjudge the point at which the brake should be applied.

4.1.4 Cautionary aspect sequence transition methods: 3-aspect to 4-aspect signalling

4.1.4.1 The transition from a 3-aspect sequence to a 4-aspect sequence (including where an isolated 4-aspect signal is displayed within an otherwise 3-aspect sequence), shall be provided using either one of the following:

- a) Transition method 1: Using a signal that displays a first caution for both of the next two stop signals.
- b) Transition method 2: Using an additional 4-aspect distant signal.
- c) Transition method 3: By configuring the first 4-aspect signal so that it is approach controlled from red when the next signal is displaying the red aspect.

G 123 The following represents good practice:

- a) The number of transitions between 3- and 4-aspect signalling should be kept to a minimum.