

Railway Group Standard

GK/RT0075

Issue Four

Date September 2015

Lineside Signal Spacing and Speed Signage

Synopsis

This document specifies the minimum distances that must be provided between the first cautionary aspect and the stop signal to which it applies. In addition, it addresses the signing for permissible speeds and speed restrictions.

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Lineside Signal Spacing and Speed Signage

Issue record

Issue	Date	Comments
One	March 2011	Original document. Superseded GK/RT0034 issue four, Lineside Signal Spacing, and GK/RT0038, issue two, Signing of Permissible Speeds and Speed Restrictions.
Two	September 2011	Small scale change to correct inconsistencies between GK/RT0075 issue one, Lineside Signal Spacing and Speed Signage, and its associated guidance note GK/GN0675.
Three	September 2014	Revision to E.2.1 to remove requirement for a risk assessment before an emergency speed restriction is applied. Other changes delivered by project 12/033 include: • Revisions to clauses 2.1.3b), 3.3.2.4, 3.4.1.4a), D.1.1.2, D.2.5.1a), D.2.5.2, D.4.2.1 and E.2. • New clause at D.2.5.3. • Updates to Figures D-21 and D-27. • The removal of clause D.4.2.3. • Changes made to address typographical errors in Table B.1 and Table X-3. • Clause number 3.3.1.5 corrected to 3.4.1.5. • Updates to the definitions section. • Clause 4.1.1.3 deleted from application section.
Four	September 2015	New issue to modify the requirements in 3.4.1.4 for the provision and position of warning boards for temporary speed restrictions (TSRs) with additional changes which include: • Minor clarification in clause 1.1.1. • Reinstatement of reference in clause 2.1.3 to excess signal braking distances. • Easement in clause D.2.1.2 for the non-standard positioning of warning boards (and associated AWS) for TSRs. • Amendment of Tables X-1, X-2 and X-3. • Correction of errors in Appendix X-3 relating to inconsistencies in deceleration distances for braking from speeds of 45, 50 and 55 mph. (These changes have not been made to the associated guidance note GK/GN0675, as this was already correct.)

Amended or additional parts and / or sections of revised pages have been marked by a vertical black line in the adjacent margin.

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Superseded documents

The following Railway Group Standard is superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GK/RT0075, issue three Lineside Signal Spacing and Speed Signage	All	05 December 2015

GK/RT0075 issue three Lineside Signal Spacing and Speed Signage, ceases to be in force and is withdrawn as of 05 December 2015.

Supply

The authoritative version of this document is available at www.rgsonline.co.uk. Enquiries on this document can be forwarded to enquirydesk@rssb.co.uk.

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Part 1 Purpose and Introduction

1.1 Purpose

- 1.1.1 This document mandates requirements for lineside signal spacing, permissible speeds and temporary and emergency speed restrictions. The scope of this document does not include compatibility of lineside signalling and speed signage with train driving processes when an in-cab signalling system is in use.

1.2 Introduction

1.2.1 Background

- 1.2.1.1 Lineside signals are provided by the infrastructure manager at locations where it is necessary to provide information about the movement authority to drivers.
- 1.2.1.2 The movement authority displayed by each lineside signal provides the driver with information about:
- a) The distance to go, depicted by the signal aspect.
 - b) The route that is set and the destination, depicted by the combination of the signal aspect and route indication.
- 1.2.1.3 Lineside operational signs are provided by the infrastructure manager at locations where it is necessary to display information about permissible speeds and temporary speed restrictions to drivers.
- 1.2.1.4 Driver competence incorporates:
- a) Correct interpretation of lineside signal aspects and route indications.
 - b) Route knowledge, including knowledge of the signalling layout and permissible speeds.
 - c) Traction knowledge, including braking performance.
- 1.2.1.5 The safety of train operations depends on compatibility between the movement authority system, the driver and the train braking system.
- 1.2.1.6 The minimum signalling braking distances in this document are compatible with the braking performance data for traction and rolling stock, as set out in the following Railway Group Standards:
- GM/RT2041 Braking System Requirements and Performance for Trailer Coaching Stock
 - GM/RT2042 Braking System Requirements and Performance for Traction Units
 - GM/RT2043 Braking System and Performance for Freight Trains
 - GM/RT2044 Braking System Requirements and Performance for Multiple Units
 - GM/RT2045 Braking Principles for Rail Vehicles.

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- 1.2.1.7 With respect to lineside signal spacing, the interface between the infrastructure manager and railway undertakings is concerned with:
- a) Compatibility with train braking performance, so that when the driver observes a normal sequence of signal aspects (that is, the expected aspect sequence compliant with the requirements of GK/RT0045) leading up to a signal displaying a stop aspect, the train can decelerate from the permissible speed and stop within the distance available from the first cautionary aspect to the stop signal.
 - b) The driver's ability to perceive and remember information about the movement authority as part of the overall driving task.
- 1.2.1.8 Loss of compatibility in either of these areas is a causal factor of a signal passed at danger (SPAD).

1.2.2 Principles

- 1.2.2.1 The meaning of lineside signal aspects and the responsibility that train drivers have to control the speed of the train with respect to permissible speeds and the aspects displayed by signals is set out in Handbook RS521.
- 1.2.2.2 Compatibility between train braking performance and lineside signal spacing is essential so that drivers consistently have sufficient distance to bring the train to a stand at the associated stop signal when a caution signal aspect is displayed.
- 1.2.2.3 Consistency of signal spacing assists drivers by enabling them readily to interpret the information presented by the signal aspect sequences in terms of the required stopping position of the train, thus reducing the potential for misleading drivers.
- 1.2.2.4 Permissible speeds applicable to each type of train over each section of line are specified in the Sectional Appendix. Speed signs are provided and positioned consistently to provide drivers with clear information on permissible speeds, and to provide adequate warnings of significant speed reductions and temporary and emergency speed restrictions.

1.2.3 Related requirements in other documents

- 1.2.3.1 The following Railway Group Standards contain requirements that are relevant to the scope of this document:

GE/RT8000	Rule Book
GE/RT8012	Controlling the Speed of Tilting Trains Through Curves
GE/RT8075	AWS and TPWS Interface Requirements
GE/RT8037	Signal Positioning and Visibility
GI/RT7033	Lineside Operational Safety Signs
GK/RT0045	Lineside Signals, Indicators, and Layout of Signals
GK/RT0192	Level Crossing Interface Requirements
GM/RT2041	Braking System Requirements and Performance for Trailer Coaching Stock
GM/RT2042	Braking System Requirements and Performance for Traction Units
GM/RT2043	Braking System and Performance for Freight Trains

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GM/RT2044 Braking System Requirements and Performance for Multiple Units

GM/RT2045 Braking Principles for Rail Vehicles.

1.2.4 Supporting documents

1.2.4.1 GK/GN0675 Guidance on Lineside Signal Spacing and Speed Signage.

1.3 Approval and authorisation of this document

1.3.1 The content of this document was approved by Control Command and Signalling (CCS) Standards Committee on 09 July 2015.

1.3.2 This document was authorised by RSSB on 31 July 2015.

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Part 2 Requirements for Lineside Signal Spacing

2.1 Compatibility requirements for lineside signal spacing

- 2.1.1 GE/RT8270 sets out the process for the assessment of compatibility that is required whenever a material change is to be made that affects the interface between the signalling system and railway undertakings or any infrastructure managers that operate stations.
- 2.1.2 The assessment of compatibility shall check that the signalling spacing data used to determine minimum signalling braking distances (further requirements are set out in 2.3) is compatible with all of the following:
- a) The types of rolling stock that will be operated on the route.
 - b) The maximum speeds that the rolling stock will be authorised to operate on the route.
 - c) The maximum attainable speeds of the rolling stock, where this is used to determine minimum signalling braking distances.
- 2.1.3 The assessment of compatibility shall check that the actual signalling braking distance is compatible with the SPAD risk mitigation measures that will be put in place by the railway undertakings, where any of the following apply:
- a) There is more than 50% excess signalling braking distance, except where an exemption applies (see Table 1).
 - b) A variation in excess signalling braking distances means that the distance between the signals displaying the first cautionary aspect and the stop aspect is reduced by 34% or more, compared with the excess signalling braking distance for the preceding sequence of signals on the same line.
 - c) In four-aspect signalling areas, where the distance between the signals displaying the single yellow aspect and the red aspect is less than one third of the distance between the signals displaying the double yellow aspect and the red aspect.

Situation		Scope of compatibility check where actual signal spacing exceeds the minimum signalling braking distance by more than 50%
a	Where signals control movements in the same direction on parallel lines that have different permissible speeds, and signals are positioned adjacent to each other to minimise the risk of driver misread or disregard	The compatibility check is only required for signalling braking distances on the higher speed line. Signal braking distances on the lower speed line are exempt from the compatibility check
b	Where trains join a higher speed line at a converging junction from a lower speed line or start from a siding, loop or another platform line	The compatibility check is only required for signalling braking distances on the higher speed line. Signal braking distances for train movements from the lower speed line are exempt from the compatibility check

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Situation		Scope of compatibility check where actual signal spacing exceeds the minimum signalling braking distance by more than 50%
c	Where trains start from a platform on a through line	The compatibility check is only required for signalling braking distances associated with non-stopping trains. Signal braking distances for train movements that start from rest are exempt from the compatibility check
d	Where the signal spacing is designed using particular signalling braking distance data (for example, Appendix A for a mixed traffic line)	The compatibility check is only required for signalling braking distances associated with the appendix to which the line is signalled
e	Where the signal spacing is designed to Appendices B or C, and a differential speed restriction is applied to enable traffic with an inferior braking characteristic to operate	The compatibility check is only required for signalling braking distances associated with the appendix to which the line is signalled
f	At the approach to buffer stops at terminal stations or at bay platforms	The compatibility check does not apply to the spacing distance between the approach signals and the buffer stops

Table 1 Exemptions from compatibility check

2.2 Requirement for signal spacing

- 2.2.1 The position of lineside signals shall be compatible with the braking performance of rolling stock so that trains moving at the permissible speed (or attainable speed in the circumstances set out in 2.7) can stop within the actual signalling braking distance.

2.3 Determining minimum signalling braking distances

- 2.3.1 Minimum signalling braking distances shall be determined using the data set out in Appendices A to C, as set out in 2.3.3 to 2.3.5. The associated guidance note (GK/GN0675) contains signalling braking distance data in imperial (yards) as well as metric units. Additionally, in respect of Appendices A, B and C, these data are included in graphical form.
- 2.3.2 Additional requirements for assessing compatibility of the data used and rolling stock performance are set out in 2.1.2.
- 2.3.3 The minimum signalling braking distance shall be established from Appendix A, based on the maximum permissible speed for freight trains (taking account of standard differential speeds and speed limits imposed by special instructions).

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- 2.3.4 Where passenger trains (including those with enhanced braking where specific non-standard differentials are not provided) are authorised to travel at speeds greater than the permissible freight train speed (by means of standard or non-standard differential speeds), the signalling braking distance shall be equal to or exceed the distance derived from Appendix B, for the maximum permissible speed of those trains.
- 2.3.5 Where passenger trains with enhanced braking are authorised to travel at speeds greater than the permissible freight train speed (by means of non-standard differential speeds), the signalling braking distance shall be equal to or exceed the distance derived from Appendix C, for the maximum permissible speed of passenger trains with enhanced braking.
- 2.3.6 The minimum signalling braking distance shall be determined using:
- The permissible speed at the signal displaying the first cautionary aspect, and
 - The average gradient of the line between the signals displaying the first cautionary aspect and the stop aspect.
- 2.3.7 For gradients between two values shown in the tables, the signalling braking distance for that gradient shall be calculated by linear interpolation between the signalling braking distances for the two adjacent gradient values.
- 2.3.8 Where a falling gradient varies and the mean gradient is 1 in 200 or steeper, the minimum signalling braking distance to be used shall be the shorter of either:
- The distance for the mean gradient plus 10% of that distance, or
 - The distance for the steepest falling gradient.

2.4 Acceptable variations in signal spacing

- 2.4.1 The position of signals shall be designed so that the actual signalling braking distance is no less than the minimum signalling braking distance.
- 2.4.2 Wherever practicable, the position of signals shall be designed so that excess signalling braking distance does not exceed 50%.
- 2.4.3 Additional requirements for assessing compatibility of actual signalling braking distances and train operations, where there is more than 50% excess signalling braking distance, are set out in 2.1.3.

2.5 Consistency of signalling braking distances

- 2.5.1 Variation in the excess signalling braking distances between successive signals shall be kept to a minimum in order to control the risk associated with signals passed at danger (SPAD).
- 2.5.2 Additional requirements for assessing compatibility of variation of excess signalling braking distances and train operations are set out in 2.1.3.

2.6 Four-aspect signalling

- 2.6.1 In areas of 4-aspect signalling, the distance between the single yellow aspect and the red aspect shall be no less than one-third of the actual signalling braking distance between the double yellow aspect and the red aspect, unless the criteria set out in either 2.6.2 or 2.6.3 apply.
- 2.6.2 It is permissible for the distance between the single yellow aspect and the red aspect to be reduced to no less than one-third of the required minimum signalling braking distance between the double yellow aspect and red aspect.

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- 2.6.3 It is permissible for mid-platform signals to be located so that the distance from the single yellow aspect at the mid-platform signal to the red aspect at the platform starting signal is less than one-third of the required minimum signalling braking distance between the double yellow aspect and the red aspect. In this case the permissible speed and the location of the mid-platform signal shall be configured to comply with all of the following requirements:
- a) The distance between the running-in platform ramp and the platform starting signal is greater than the minimum signalling braking distance at the permissible speed.
 - b) The mid-platform signal is sighted so that it is visible to the driver from the running-in platform ramp, as set out in GE/RT8037.
 - c) The platform starting signal is sighted so that it is visible to the driver from the mid-platform signal, as set out in GE/RT8037.
- 2.6.4 Additional requirements for assessing compatibility of four-aspect signal spacing and train operations are set out in 2.1.2.

2.7 Use of attainable speed to determine minimum signal spacing

- 2.7.1 Where attainable speed is used to determine minimum signalling braking distances, the maximum attainable speed shall be derived using current acceleration data for the appropriate types of rolling stock. Additional requirements for assessing compatibility of minimum signalling braking distances and rolling stock performance are set out in 2.1.2.
- 2.7.2 On a 4-aspect signalled line, at a converging junction, the distance between the first signal beyond the junction and the next stop signal shall be compatible with both of the following:
- a) The permissible speed and aspect sequence through the junction on the straight route, and
 - b) The permissible speed and aspect sequence on the converging route.
- 2.7.3 Where the converging route is a 3-aspect signalled line and the permissible speed through the convergence is lower than the permissible speed on the straight route, one of the following shall apply:
- a) The attainable speed at the first (4-aspect) signal beyond the junction (taking account of any permissible speed restriction through the junction) shall be compatible with the actual signalling braking distance to the next signal so that the train can stop when the signal is displaying a single yellow aspect, or
 - b) The last signal on the converging route shall be a 4-aspect signal.
- 2.7.4 Where there is signalling braking distance from the commencement of an existing reduction of permissible speed and the stop signal, it is permissible to use the attainable speed at the first caution.

2.8 Requirements at infrastructure manager boundaries

- 2.8.1 The requirements for signal spacing set out in this document shall apply also to the transitions between different signalling systems that are part of Network Rail managed infrastructure.
- 2.8.2 Where a signalling braking distance crosses a boundary between infrastructure managers, the minimum distance between a caution signal and the associated stop signal (or equivalent end of movement authority) shall be determined using the signalling braking criteria specified by the infrastructure manager controlling the stop signal (or responsible for end of movement authority).

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Part 3 Requirements for Signing of Permissible Speeds and Speed Restrictions

3.1 Compatibility requirements for signing of permissible speeds and speed restrictions

- 3.1.1 GE/RT8270 sets out the process for the assessment of compatibility that is required whenever a material change is to be made that affects the interface between the signalling system and railway undertakings or any infrastructure managers that operate stations.
- 3.1.2 The assessment of compatibility shall check that permissible speeds and temporary speed restrictions are compatible with existing and planned train operations on each route, including a check of all of the following:
- a) The permissible speed profile.
 - b) The configuration and position of permissible speed indicators and permissible speed warning indicators.
 - c) The provision of additional speed signs, where this is a permitted option to manage operational risk, including:
 - i) Additional permissible speed warning indicators (see 3.3.1).
 - ii) Repeater permissible speed indicators at converging junctions (see 3.3.3).
 - d) Where the nature of engineering work results in complex signage arrangements. The proposed configuration and position of temporary speed indicators and warning boards and the arrangements for their implementation and withdrawal.
 - e) The configuration and position of signs that display standard and non-standard differential speeds, where trains compatible with the signalling braking distances set out in Appendices B and C are authorised to operate at higher permissible speeds (see 3.3.2).
 - f) The omission of differential speed signs, where differential speeds are implemented by instruction (see 3.3.1).
 - g) The display of metric speed information, where this is required (see 3.2.1).
 - h) The overall presentation of information to the driver (further requirements are set out in 3.2.2).
- 3.1.3 The assessment of compatibility shall check that the deceleration distances (see 3.2.3) used, which are the minimum spacing distances between the warning indicator and the speed indicator, are compatible with all of the following:
- a) The types of rolling stock that will be operated on the route.
 - b) The maximum speeds that the rolling stock will be authorised to operate on the route.
 - c) The maximum attainable speeds of rolling stock, where these are used to determine the signal spacing.
 - d) The permissible speed(s) on every signalled approach to the speed reduction, including differential speeds which are authorised for different types of rolling stock.

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- e) The speed reduction(s) required on every signalled approach.
- f) The applicable speed restriction, including differential speeds.
- g) The average gradient on the approach to the speed indicator/board.

3.2 Requirements for permissible speeds and temporary speed restrictions

3.2.1 Display of speed information

- 3.2.1.1 The infrastructure manager shall provide lineside operational safety signs to display permissible speeds and temporary speed restriction information, applicable to each running line, for each direction that trains can be operated under signalled movement authorities for main running movements.
- 3.2.1.2 Speed signs shall display speed information in units of miles per hour.
- 3.2.1.3 Where trains are operated using speedometers calibrated in kilometres per hour, speed signs shall also display speed information in units of kilometres per hour.
- 3.2.1.4 Speed signs that display differential speeds shall display the lower (or lowest) speed above the higher speed(s).
- 3.2.1.5 Speed signs shall be positioned on the left-hand side of the line in the direction of travel, unless they cannot be accommodated there.
- 3.2.1.6 Speed signs shall be configured so that all of the applicable speeds (including differential speeds) over the same section of track are displayed together at the same position and location. It is permitted for nominally co-located signs to be separated by a short distance where readability would not be impaired.

3.2.2 Overall presentation of information to the driver

- 3.2.2.1 Speed signs and associated automatic warning system (AWS) equipment shall be positioned so that the totality of information (including lineside signs, signal aspects, indications and lineside equipment) displayed to the train driver is not liable to cause confusion.
- 3.2.2.2 Where train protection systems are in use, the position of speed signs shall be compatible with the warning and intervention functionality of these systems so that a driver obeying the lineside signs does not receive unwarranted warnings or interventions.

3.2.3 Deceleration distances

- 3.2.3.1 Where attainable speed is used to determine the deceleration distance (only permitted for temporary speed restrictions), the maximum attainable speed shall be derived using current acceleration data for the appropriate types of rolling stock. Additional requirements for assessing compatibility of deceleration distances and rolling stock performance are set out in 3.1.3.
- 3.2.3.2 Where differential speeds are associated with a speed reduction to a lower permissible speed or a temporary speed restriction (whether they are applicable to the permissible speed on the approach, the lower permissible speed or temporary speed restriction, or both), the deceleration distance shall be determined for each type of train, taking account of:
 - a) The applicable speeds for that train, and
 - b) The longest deceleration distance required.

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- 3.2.3.3 Deceleration distances shall be determined using one of the following:
- a) The deceleration data set out in Appendix X which is compatible with Appendix A (composite data for all trains).
 - b) The signalling braking distance, where minimum signalling braking distances have been determined using Appendix B (composite data for passenger trains), and the deceleration distance derived from Appendix X is greater than the minimum signalling braking distance.
 - c) The signalling braking distance, where minimum signalling braking distances have been determined using Appendix C (data for trains with enhanced braking), and the deceleration distance derived from Appendix X is greater than the minimum signalling braking distance.
- 3.2.3.4 Appendices B or C shall only be used to determine deceleration distances for permissible speeds and temporary speed restrictions where all of the trains that operate over the route have a braking performance that is compatible with the required reduction in speed, taking account of the following factors:
- a) The permissible speeds, including any enhanced permissible speeds and differential speeds, and
 - b) The authorised speed limits applicable to each category and type of train.

3.3 Signs for permissible speeds

3.3.1 Position and sighting of signs

- 3.3.1.1 A signal sighting committee (as set out in GE/RT8037) shall agree the position and sighting of:
- a) Permissible speed indicators.
 - b) Permissible speed warning indicators.
- 3.3.1.2 Permissible speed indicator(s) shall:
- a) Display the relevant permissible speed(s).
 - b) Be provided for every increase or decrease of permissible speed, except where differential speeds applying to certain types of train are implemented by instruction. This applies where speed is required to be restricted for particular types of train that do not constitute a recognised category for which differential speed signs are specified in the Rule Book.
 - c) Be positioned where the change of permissible speed occurs (see Figure 1).

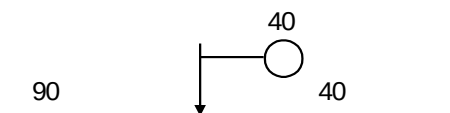


Figure 1 Example of a permissible speed indicator

- 3.3.1.3 Permissible speed indicators shall be provided at converging and diverging junctions in accordance with 3.3.3 and 3.3.4.

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- 3.3.1.4 Except where the criteria in 3.3.1.5 apply, a permissible speed warning indicator shall be provided on all signalled approaches to each permissible speed reduction, where either:
- The permissible speed on the approach, including any differential speed, is 60 mph or greater and the required speed reduction is one-third or more, taking account of any differential permissible speeds that apply, or
 - There are two or more successive reductions in permissible speed within a distance of 3.2 km (2 miles), none of which individually represents a reduction of one-third, but which together require a speed reduction of one-third or more from an approach speed of 60 mph or greater (see Figure 2).

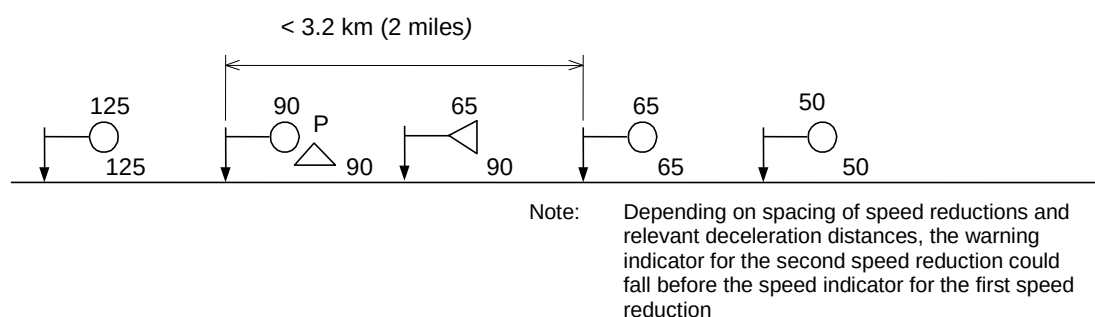


Figure 2 Example of two or more successive reductions in speed

- 3.3.1.5 Permissible speed warning indicators shall not be provided for:
- A speed reduction over a diverging route where the signalling system is configured to display signal aspects that provide for the required speed reduction (see 3.3.7).
 - A speed reduction over a level crossing where a Level Crossing Warning Sign (St Georges Cross) is provided.
- 3.3.1.6 Where provided, permissible speed warning indicators shall be positioned in accordance with 3.3.5, 3.3.6, 3.3.7 using the appropriate deceleration distance set out in 3.2.3.3.
- 3.3.1.7 Only one permissible speed warning indicator shall be provided on each approach to a permissible speed indicator, unless an additional indicator is required to mitigate safety risk and will not cause confusion to drivers. Further requirements are set out in 3.1.2.

3.3.2 Display of differential permissible speeds

- 3.3.2.1 Permissible speed indicators and permissible speed warning indicators shall display a maximum of three differential speeds (applicable to different categories of trains), including standard and non-standard differential speeds. For the purposes of this section, an enhanced permissible speed as defined in GE/RT8012 shall be considered as a non-standard differential speed. The only permitted combinations are:
- Two displayed speeds, each for one of two standard categories of train, where standard differential speeds apply.
 - One displayed speed for a standard category of train and either one or two displayed non-standard speeds applicable to the train categories set out in GE/RT8000 Rule Book module SP.

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- c) Two displayed speeds for the two standard categories of train (standard differential speeds), together with one displayed non-standard differential speed applicable to a train category set out in GE/RT8000 Rule Book module SP.

3.3.2.2 Further requirements applicable to differential speeds are set out in 3.1.2.

3.3.2.3 Where standard differential speeds apply, the two speeds shall be displayed on a single permissible speed indicator (see Figure 3) and, where a warning indicator is provided, on a single permissible speed warning indicator (see Figure 4).

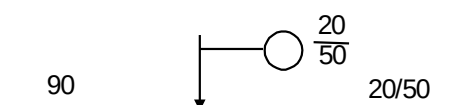


Figure 3 Example of a standard differential permissible speed indicator

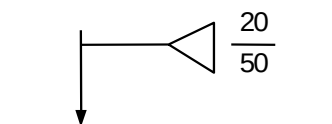


Figure 4 Example of a standard differential permissible speed warning indicator

- 3.3.2.4 Non-standard differential permissible speeds shall be displayed by a separate speed sign, which shall incorporate an indication of the applicable train category. The meanings of letter abbreviations for non-standard speeds are set out in Rule Book Module SP. The classes of train that apply in a given situation are set out in the Sectional Appendices.
- 3.3.2.5 A non-standard permissible speed indicator shall be mounted on the same post as the associated standard permissible speed indicator (see Figure 5) and:
- Where the non-standard speed is higher than the standard speed(s), it shall be displayed below the standard speed(s).
 - Where the non-standard speed is lower than the standard speed(s), it shall be displayed above the standard speed(s).