Signal Sighting Assessment Requirements

Synopsis
This document sets out the signal sighting assessment process that is used to confirm compatibility of lineside signalling system assets with train operations (signal sighting).
Signal Sighting Assessment Requirements

Issue record

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<tr>
<td>One</td>
<td>June 2016</td>
<td>Original document This document replaces GERT8037 issue one Signal Positioning and Visibility and some content of GKRT0045 issue four Lineside Signals, Indicators and Layout of Signals, that relate to signal sighting assessment.</td>
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Superseded or replaced documents

The following Railway Group Standards are superseded or replaced, either in whole or in part as indicated:

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<td>GERT8037 issue one Signal Positioning and Visibility</td>
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GERT8037 issue one Signal Positioning and Visibility, ceases to be in force and is withdrawn as of 04 June 2016.

GKRT0045 issue four Lineside Signals, Indicators and Layout of Signals, ceases to be in force 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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Signal Sighting Assessment Requirements

Part 1 Introduction

1.1 Purpose of this document
1.1.1 This document is a standard on signal sighting assessment.
1.1.2 This document sets out the signal sighting assessment process that is used to confirm compatibility of lineside signalling system assets with train operations (signal sighting).

1.2 Application of this document
1.2.1 A member of RSSB may choose to adopt all or part of this document through internal procedures or contract conditions. Where this is the case the member of RSSB will specify the nature and extent of application.
1.2.2 Therefore compliance requirements and dates have not been specified since these will be the subject of internal procedures or contract conditions.

1.3 Health and safety responsibilities
1.3.1 Users of documents published by RSSB are reminded of the need to consider their own responsibilities to ensure health and safety at work and their own duties under health and safety legislation. RSSB does not warrant that compliance with all or any documents published by RSSB is sufficient in itself to ensure safe systems of work or operation or to satisfy such responsibilities or duties.

1.4 The structure of this document
1.4.1 This document is set out as a series of requirements, in some cases followed by relevant guidance.

1.5 Approval and authorisation of this document
1.5.1 The content of this document was approved by Control Command and Signalling (CCS) Standards Committee on 18 February 2016.
1.5.2 This document was authorised by RSSB on 19 April 2016.
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Part 2  Signal Sighting Assessment Process Requirements

2.1  Introductory guidance

2.1.1  The signal sighting assessment is part of the overall framework of assessments that are applied by the Proposer before putting a change into use. Other necessary assessments include route compatibility assessment and signal overrun risk assessment.

2.1.2  The signal sighting assessment provides some of the information needed to complete the route compatibility assessment and signal overrun risk assessment processes. Requirements for signalling layout route compatibility assessment are set out in RIS-0703-CCS (when published) and requirements for signal overrun risk assessment, including questions which may require information from a signal sighting assessment, are set out in RIS-0386-CCS.

2.1.3  For change projects, the signal sighting assessment process is consistent with applying the common safety method on risk evaluation and assessment (CSM RA) risk acceptance principle: Explicit risk evaluation and assessment, to the hazard of incompatibility of a lineside signalling asset with train operations.

2.1.4  If the signal sighting assessment process being applied to a change project does not conform to Part 2, the Proposer should obtain an approval for deviation in accordance with the procedures set out in the company safety management system.

2.1.5  Some elements of the signal sighting assessment process are also relevant to managing risk at existing operational assets. Examples of when a signal sighting assessment is applied in these circumstance include:

a)  When an infrastructure manager (IM) or railway undertaking (RU) reports that signal sighting is being adversely affected.

b)  When an IM or RU identifies that a planned change external to the railway could affect signal sighting, for example changes that affect:

   i)  The built environment (for example, a new structure causing obscuration, a solar farm causing reflection.

   ii)  Artificial lighting.

   iii)  A distraction (for example, a new road).

   iv)  The natural environment (for example, tree management).

c)  To discharge an accident or incident investigation recommendation.

2.1.6  The assessment of signal sighting of an existing operational asset might include:

a)  A check against the current asset record and results of previous assessment(s).

b)  A check of the assumptions, dependencies and caveats underpinning a previous assessment result or decision to see if anything was missed.

c)  A check that any recommendations have been acted upon, are still valid and remain in place.

d)  A check for compliance with relevant standards.

e)  A reassessment of the compatibility factors set out in Appendices A, B and C to identify if anything has changed since the last assessment.
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2.1.7 If a signal sighting assessment confirms that making changes to the asset or its operational context would reduce the likelihood of a further accident or incident occurring, the signal sighting committee (SSC) should recommend what retrospective action is appropriate, taking account of the guidance set out in RSSB publication Taking Safe Decisions.

2.1.8 Many existing lineside signalling assets are maintained to be compliant with the historical standards that were applicable at the time that the asset was introduced. This standard does not require retrospective action to bring existing lineside signalling assets into full compliance.

2.2 Requirement to apply the signal sighting assessment process

2.2.1 The signal sighting assessment process shall be applied:

a) Before a new lineside signalling asset is put into use.

b) Before a modified lineside signalling asset is put into use, if the change could affect signal sighting.

c) Before modifying the network infrastructure, if the change could affect signal sighting.

d) Before operating a different type of rolling stock on a route fitted with a lineside signalling system, if the change could affect signal sighting.

e) Before changing the train operations on an existing route fitted with a lineside signalling system, if the change could affect signal sighting.

Rationale

G 2.2.1.1 These planned changes could either invalidate an assumption, dependency or caveat underpinning the results of a previous signal sighting assessment, or introduce a new factor that adversely affects signal sighting.

G 2.2.1.2 The signal sighting assessment process is used to confirm that drivers and other authorised users will be able to reliably read, interpret and act upon the information presented at a lineside signalling asset throughout the range of operational and ambient conditions applicable at that location, within the operational context and while performing their required duties.

G 2.2.1.3 The objectives of the signal sighting assessment process are to:

a) Assess the change(s) for the hazard: Incompatibility of a lineside signalling asset with train operations.

b) Specify and record achievable measures that would eliminate or reduce the impact of the hazard.

c) Assess and record the minimum response time (MRT).

d) Specify and record the required readable distance (RRD) of the asset.

e) Specify and record the asset configuration.

Guidance

G 2.2.1.4 Lineside signalling asset modifications that could affect signal sighting include:

a) Replacing all or part of an existing asset with a different type (for example, replacing a semaphore distant signal with a fixed distant board).
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b) Replacing all or part of an existing asset using a similar type(s) that has a different readability performance (for example, the replacement equipment has a wider beam angle, which could affect the readability of signals on other lines).

c) Altering the configuration of an existing asset (for example, reducing the height of a semaphore signal or repositioning an existing signal).

d) Fitting additional equipment to an existing asset (for example, adding a route indicator to an existing signal).

G 2.2.1.5 Infrastructure alterations that could require a signal sighting assessment include changes to:

a) Track alignment or track layout.

b) Overhead line electrification equipment.

c) Lineside structures if they cause obscuration, reflection etc.

d) Permissible speed.

e) Gradient profile.

G 2.2.1.6 Introducing a different type of rolling stock or modified rolling stock could require a signal sighting assessment if:

a) Cab sight lines are affected (for example, the cab design includes a centre gangway).

b) The train driving task is different.

G 2.2.1.7 Changes to train operations that might require a signal sighting assessment include changes to:

a) Network operations (for example, introducing a reversing train movement using an existing signalling layout).

b) Station operations (for example, changes to the train dispatch process).

c) Train operations (for example, changing the position where trains are required to stop on the approach to a signal or increasing the authorised speed applicable to a vehicle type).

2.3 Assessment process: IM (network) responsibilities

2.3.1 The IM (network) shall:

a) Authorise and appoint the SSC chair, SSC signal engineer and SSC network operator to the SSC.

b) Invite SSC representation from affected stakeholders.

c) Manage the signal sighting assessment end-to-end process.

Rationale

G 2.3.1.2 The IM (network) is responsible for operating the lineside signalling system and maintaining signal sighting.
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Guidance

G 2.3.1.3 IM (network) SSC members should have experience of the lineside signalling systems used on the Great Britain (GB) mainline railway and the operational context relevant to the assessment. Subject to authorisation by the IM (network), the same person can be appointed to multiple SSC roles; for example:

a) SSC Chair and SSC network operator.
b) SSC Chair and SSC signal engineer.

G 2.3.1.4 The Proposer should identify any issues of concern to affected stakeholders (Actors) related to the overall project before planning the signal sighting assessment. Unresolved issues of concern may result in an SSC failing to reach agreement on the signal sighting assessment outcome.

G 2.3.1.5 If the Proposer is an RU or an IM (stations), the project plan should include the arrangements with the IM (network) for managing the signal sighting assessment process.

G 2.3.1.6 The IM (network) should invite representation of all parties affected by the change, including any transport operator(s) external to the mainline railway if the asset(s) being assessed is relevant to their operations. This is consistent with a legal obligation to cooperate in order to manage shared risk. Examples of when a transport operator external to the mainline railway should be invited include assessment of:

a) An asset on a route used by mainline trains and a metro operator.
b) An asset associated with a depot or yard that is the responsibility of another IM.
c) An asset adjacent to infrastructure operated by another transport undertaking, such as a tramway.

2.3.2 The SSC shall include the following roles as a minimum:

a) SSC chair.
b) SSC network operator.

Rationale

G 2.3.2.2 These SSC roles provide the minimum competence and information about the lineside signalling system operational context necessary to reach an informed assessment decision.

G 2.3.2.3 The SSC chair manages the efficient and effective delivery of the signal sighting assessment process, which includes the following activities:

a) Planning the assessment:
   i) Convening the SSC.
   ii) Preparing the assessment remit.
   iii) Collating the information needed to reach an informed decision.
   iv) Authorising the signal sighting assessment plan.
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v) Making the signal sighting assessment plan available to SSC members prior to the assessment.

b) Leading the signal sighting assessment:
   i) Managing quoracy.
   ii) Facilitating the SSC to reach the assessment decision.

c) Recording the signal sighting assessment result, including:
   i) The SSC decisions and recommendations.
   ii) The reasons underpinning the SSC decisions and recommendations.

d) Managing the signal sighting assessment records, including:
   i) Preparing an assessment report, where necessary, and making it available to stakeholders.
   ii) Co-ordinating any follow-up actions.
   iii) For infrastructure changes, taking the SSC decisions and recommendations forward to the design approval stage.

G 2.3.2.4 The SSC network operator contribution to the assessment is to confirm the applicability of the following assumptions, dependencies and caveats to the assessment:

a) IM (network) operating processes.

b) Existing and planned timetables.

c) Existing and planned traffic patterns and train lengths.

d) Movement authorities and routing; type and frequency of use.

e) Existing and potential operational risk.

f) Hazard elimination and mitigation available to IM (network) operators.

g) Records of operating incidents relevant to the asset being assessed, including:
   i) Signal overruns.
   ii) Excess train speed relative to the signalling display presented by the asset.
   iii) Misrouting.
   iv) Train dispatch incidents relevant to signal aspects and indications.
   v) Level crossing incidents relevant to signal aspects and indications.

Guidance

G 2.3.2.5 Planned timetables and traffic patterns are the future operating requirements that the change project is intended to provide for. It is good practice for the SSC to take account of operational developments where these can be reasonably foreseen and where taking a decision at this stage would provide a long-term safety / cost benefit.
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G 2.3.2.6 Examples of information about operational risks relevant to signal sighting assessment include the use of rail head sanding, flange oilers and areas with a record of poor wheel-rail adhesion.

G 2.3.2.7 Examples of operating incidents relevant to the asset being assessed include:

a) A signal overrun caused by misreading the cautionary aspect presented at a previous signal.

b) Misrouting or excessive train speed caused by misreading or the absence of routing information on the approach to the junction signal.

2.3.3 The SSC shall include the IM (network) signal engineer if the assessment is for a change to the lineside signalling system that affects signal sighting.

Rationale

G 2.3.3.1 The signal engineer provides the technical competence and information about the lineside signalling system necessary to reach an informed assessment decision.

G 2.3.3.2 The SSC signal engineer contribution to the assessment is to confirm the applicability of the following assumptions, dependencies and caveats to the assessment:

a) Asset configuration details.

b) Signalling layout configuration details.

c) Signalling system functionality.

d) GSM-R radio coverage.

e) Existing and proposed Automatic Warning System / Train Protection and Warning System (AWS / TPWS) track mounted equipment positions.

f) Infrastructure data relevant to the assessment, including:

i) Specified train performance (permissible, attainable and assessed speeds).

ii) Gradients.

iii) Signalling braking distances.

iv) Electrification system interfaces.

G) Signal engineering options available to the SSC.

h) Stage work.

i) Compatibility factors relevant to the signal sighting assessment identified by the project.

j) Hazard elimination and mitigation available using the CCS system.
Signal Sighting Assessment Requirements

Guidance

G 2.3.3.3 It is good practice to invite additional IM (network) representatives if additional competence and expertise is needed to reach a decision that takes account of what is actually achievable, for example:

a) Signalling system design engineer.

b) Voice communication system engineer.

c) Electrification engineer.

d) Track engineer.

e) Structures engineer.

2.3.4 The IM (network) shall invite representation from affected RUs if the assessment includes compatibility with train operating processes managed by the RU.

Rationale

G 2.3.4.1 The train driving task involves a continuous human process, which includes:

a) Monitoring the railway environment.

b) Gathering and assimilating the information needed for train driving, including information presented at the lineside, in the cab, from other people and using procedures.

c) Taking train driving decisions based on the information available.

d) Controlling the train speed, including accelerating and braking, responding to indications and in-cab alarms.

G 2.3.4.2 The RU representative(s) provides the additional competence and information about the train operating processes managed by the RU necessary to reach an informed assessment decision.

Guidance

G 2.3.4.3 RU competence and expertise is needed to reach a decision that takes account of all operations at that location, for example:

a) Driver.

b) Guard.

c) Shunter.

d) Ground frame operator.

G 2.3.4.4 Train operating processes relevant to signal sighting assessment include:

a) Train driving.

b) Train dispatch.

c) Shunting.

G 2.3.4.5 If the scope of assessment is limited to signalling indications and signs that are visible to, and used by, only IM (stations) personnel, the RU operator might not be necessary.
2.3.5 The IM (network) shall invite representation from affected IM (stations) if the assessment includes compatibility with station operations.

**Rationale**

G 2.3.5.1 The IM (stations) operator role provides the additional competence and information about station operations necessary to reach an informed decision.

**Guidance**

G 2.3.5.2 Compatibility with station operations typically includes the assessment of platform indicators and operational signs provided to support train dispatch operations.

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2.4 Assessment process: RU responsibilities

2.4.1 RUs shall authorise and nominate the RU representation on SSCs.

**Rationale**

G 2.4.1.1 The RU contribution to signal sighting assessment is the relevant train driving competence, traction knowledge and train operating experience.

**Guidance**

G 2.4.1.2 The nominated RU SSC member(s) should have experience in an operational context relevant to the assessment but does not have to be a current train driver.

G 2.4.1.3 The RU contribution to the assessment is to confirm the applicability of the following assumptions, dependencies and caveats to the assessment:

a) The train driving task at the location(s) being assessed.

b) RU train driving policy and procedures.

c) Relevant train operating parameters such as train speeds, braking and acceleration performance.

d) Traction and vehicle types, including:
   
i) Input into the assessment of cab sightlines.
   
ii) Development of cab vision plots.
   
e) In-cab train protection systems associated with obeying lineside signals and indicators.
   
f) Existing and potential train driving risks.
   
g) Existing and potential train dispatch risks.
   
h) Hazard elimination and mitigation available to RUs.

2.4.2 RUs shall share SSC representation only if the nominated person(s) has sufficient understanding to fulfil the role requirements.
Signal Sighting Assessment Requirements

Rationale
G 2.4.2.1 The nominated RU representative is responsible for providing sufficient train driving competence, traction knowledge and experience covering all train operations relevant to the assessment.

Guidance
G 2.4.2.2 Before deciding to share SSC representation, RUs should confirm that the nominated person will be capable of advising on the train driving task assumptions, dependencies and caveats relevant to the asset(s) being assessed.

2.5 Assessment process: IM (stations) responsibilities
2.5.1 IM (stations) shall authorise and nominate the IM (stations) representation on SSCs.

Rationale
G 2.5.1.1 The IM (stations) contribution to the signal sighting assessment is the relevant station operations competence, knowledge and train operating experience.

Guidance
G 2.5.1.2 The nominated IM (stations) representative should have station operating experience in an operational context relevant to the assessment but does not have to be a current station operator.

G 2.5.1.3 The IM (stations) contribution to the assessment is to confirm the applicability of the following assumptions, dependencies and caveats to the assessment:

a) IM (stations) operating processes.
b) Existing and planned station operations, including train dispatch equipment location and operations.
c) Existing and planned station infrastructure.
d) Existing and potential station operations risks.
e) Hazard elimination and mitigation available to IM (stations).

2.5.2 IM (stations) shall share an SSC member only if the nominated person has sufficient understanding to fulfil the role requirements.

Rationale
G 2.5.2.1 The nominated RU representative is responsible for providing sufficient train driving competence, traction knowledge and experience covering all train operations relevant to the assessment.

Guidance
G 2.5.2.2 Before deciding to share SSC representation, IMs (stations) should confirm that the nominated person will be capable of advising on the station operating assumptions, dependencies and caveats relevant to the asset(s) being assessed.
2.6 Signal sighting assessment plan

2.6.1 The IM (network) shall consult with affected IMs and RUs on the signal sighting assessment plan prior to the signal sighting assessment.

Rationale

G 2.6.1.1 Consultation on the assessment plan can provide process efficiencies if all stakeholders confirm that the assessment will be capable of addressing issues of concern and that the required resources and information will be available.

G 2.6.1.2 Some of the necessary information is only available from other stakeholders.

Guidance

G 2.6.1.3 The signal sighting assessment plan helps to establish a consistent approach to signal sighting assessment.

2.6.2 The signal sighting assessment plan shall record the following information relevant to the assessment:

a) Why the assessment is needed.

b) What will be assessed.

c) When the assessment will take place.

d) Where the assessment will take place.

e) Who will perform the assessment.

f) Which assessment method will be used.

g) How the assessment will be done.

h) The assumptions, dependencies and caveats underpinning the assessment.

Rationale

G 2.6.2.1 The assessment plan makes information available to stakeholders before the assessment takes place, to inform their understanding of the scope and method of assessment and the SSC member roles and responsibilities.

Guidance

G 2.6.2.2 The content of each signal sighting assessment plan is dependent on:

a) The assessment remit.

b) The scope and complexity of the signal sighting assessment activities being covered.

G 2.6.2.3 The aim of the assessment plan is to specify an assessment that is sufficiently rigorous to evaluate the applicability of the compatibility factors set out in Appendices A, B and C, and assess their impact on signal sighting.

G 2.6.2.4 A well-planned assessment helps the SSC to reach fully informed decisions and recommendations.
Signal Sighting Assessment Requirements

G 2.6.2.5 A single assessment plan can be produced for any number of lineside signalling assets; however, it might be advantageous to develop separate plans if the assessment requirements for groups of assets are particularly distinctive.

G 2.6.2.6 The assessment plan content may develop over time. It is good practice to start planning the assessment and consulting with stakeholders at an early stage, starting with a high-level description of the approach to be applied to signal sighting assessment.

G 2.6.2.7 The final version of the plan provides SSC members with all of the relevant information they need to fulfil their roles in the assessment.

G 2.6.2.8 Information relevant to ‘why the assessment is needed’ includes the reason for the signal sighting assessment. The plan should include a reference to the assessment remit and make it clear what is included / excluded from the assessment.

G 2.6.2.9 Information relevant to ‘what will be assessed’ includes:

a) The signalling layout context, which can be a reference to signalling layout design details.

b) For each lineside signalling asset(s) being assessed:

i) Asset identity.

ii) Signal sighting form reference(s).

iii) Equipment type(s).

iv) Performance specification(s).

v) Relevant signalling system functionality (for example, an approach controlled proceed aspect).

vi) Any restriction on its use, relevant to the assessment. Information about any restrictions on use should be available on the product conformity certificate(s).

vii) Any deviation relevant to the assessment. A deviation certificate is relevant if the assessment is for an operational trial of a new or modified product or a use of a non-compliant asset, which might be needed to overcome a site specific constraint.

G 2.6.2.10 Information relevant to ‘when the assessment will take place’ includes the dates and times of each part of the assessment.

G 2.6.2.11 Information relevant to ‘where the assessment will take place’ includes:

a) Assessment venues.

b) Transport and trackside access arrangements.

c) Personal protective equipment requirements.

G 2.6.2.12 Information relevant to ‘who will perform the assessment’ includes:

a) Nominated SSC members, their role(s) and their affiliation.

b) Arrangements for confirming SSC members’ identity and authorisation.
Signal Sighting Assessment Requirements

G 2.6.2.13 Information relevant to 'which assessment method will be used' includes the signal sighting assessment method. The assessment plan can specify a combination of assessment methods including:

a) Simulated assessment.
b) Site assessment before the asset is constructed.
c) Site assessment of a constructed asset that is not yet operational.
d) Site assessment of an operational lineside signalling asset.
e) Assessment using information shared by correspondence.

G 2.6.2.14 Information relevant to ‘how the assessment will be done’ includes:

a) The standard(s) against which the assessment will be carried out. Details should include any standards being applied to the assessment that are additional to the requirements in this document, for example, technical standards published by the IM (network) and project specifications. Where compatibility of an existing asset is being assessed, the information should include the standards applicable when the asset was taken into use.
b) Use of specialist tools and equipment.
c) The overall approach being applied to hazard assessment, elimination and mitigation. The final details of hazard elimination and mitigation recommended by the SSC are recorded on the signal sighting form.
d) The method of recording the assessment result.

G 2.6.2.15 Information relevant to ‘the assumptions, dependencies and caveats underpinning the assessment’ includes the data being used by the proposer to inform the proposed change. Examples include:

a) The codes of practice and reference system designs being applied to eliminate or militate against the compatibility factors present at an asset.
b) Train operating parameters (for example: maximum and attainable train speed, acceleration and deceleration performance), timetables and traffic patterns, rail vehicle types and their restrictions, cab sight lines, train lengths, the applicability of propelling moves and the contribution of route knowledge. This may take account of existing and future train operations that are relevant to the scope of the change project that the assessment is supporting. Sharing this information provides an opportunity for the IM to capture information about foreseeable longer term aspirations held by other IMs and RUs and incorporate these into the assessment if there is a cost benefit in doing so.
c) The date(s) when the change(s) is planned to be implemented, including any stagework.
d) Arrangements for monitoring signal sighting after the change is put into use. Historically, signalling projects have implemented a pro-active consultation process to obtain feedback from drivers from the time of taking into use until three months after final commissioning. IM (stations) and RUs should inform the IM (network) of any problems or concerns about the signal sighting of in-service lineside signalling assets, including those that may become apparent by day or night. If a problem or concern is identified, the IM (network) should consult with the relevant IM (stations) and RU to identify if any additional risk controls are needed pending implementation of remedial actions.
Signal Sighting Assessment Requirements

e) Records of previous assessments. This information might be relevant if it would help to inform the SSC in reaching a decision. For example, records of assessment of similar assets in similar operational contexts could be used as a baseline to inform consistent decision taking by the SSC.

G 2.6.2.16 A signal sighting assessment based on information shared by correspondence is suitable only if the scope is limited to confirming changes that have already been agreed in principle by SSC members or if the SSC members confirm that using documentary evidence alone would be sufficient to complete the assessment without the need to convene a meeting at a common location. Suitable evidence might include diagrams, photographs and videos.

G 2.6.2.17 A preliminary assessment of the compatibility factors present at each asset, or type of asset, might provide efficiencies if the scope of applicability of the compatibility factors and the proposed approach to their elimination or mitigation can be agreed before the full SSC is convened. For example, a preliminary assessment of the permissible speed signs present within a signalling layout might result in the following overall approach:

a) Assessment by correspondence.

b) A proposal that drivers’ route knowledge means that achieving a minimum visible distance equivalent to 4 s at the permissible speed is sufficient for drivers to interpret the permissible speed.

c) A reference system describing the type and position of each sign will be applied, in which case the only compatibility factors applicable to the assessment are C8 and C11.

G 2.6.2.18 Lineside signalling products that have been developed in accordance with GKRT0057 and GIRT7033 should be suitable if they are used in an application for which they are intended.

G 2.6.2.19 GKRT0057 sets out the requirements for lineside signalling products and product performance assessment, covering:

a) Colour light signal heads and position light signals.

b) Banner repeater indicators.

c) Semaphore signal arms and discs.

d) Route indicators.

e) Coloured light signalling indicators.

f) Stop boards, distant boards and buffer stop signs.

G 2.6.2.20 GIRT7033 sets out the requirements for lineside operational signs.

2.7 Signal sighting assessment

2.7.1 The SSC Chair shall confirm that the SSC is quorate throughout each signal sighting assessment.
Signal Sighting Assessment Requirements

**Rationale**

G 2.7.1.1 If the SSC is not quorate, the membership might not be sufficient to provide all of the competence and knowledge needed to reach a fully informed assessment decision.

**Guidance**

G 2.7.1.2 A quorate SSC is beneficial because the discussion during the assessment influences the pass / fail decision. Planning an assessment that relies on a separate meeting with some of the nominated SSC members after the assessment does not provide a fully informed SSC discussion.

G 2.7.1.3 It is good practice to maintain an attendance record throughout the assessment and, if any participants leave during the assessment, review the membership to confirm that the SSC still provides sufficient competence and knowledge to reach a fully informed assessment decision.

G 2.7.1.4 If the SSC Chair considers that the SSC membership does not provide all of the required competence and knowledge, continuing the assessment should conclude with only a preliminary assessment decision. The SSC Chair should arrange for further assessment when the additional competence and information becomes available.

G 2.7.1.5 If the SSC Chair considers that the membership provides sufficient competence and knowledge but not all of the invited IM and RU representatives attend, the SSC Chair should consult on the assessment decision with the absent representative(s) before taking the SSC recommendations forward for design approval.

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2.7.2 The SSC shall perform the signal sighting assessment using a sufficiently accurate representation of the real operational context or in the real operational context.

**Rationale**

G 2.7.2.1 The hazard ‘incompatibility of a lineside signalling asset with train operations’ arises from the complex interactions between:

a) The lineside signalling equipment.

b) The particular environment where it is installed.

c) The way it is installed.

d) The operational task requirements at that location.

G 2.7.2.2 Therefore the context the assessment is performed in should be sufficiently realistic to replicate the effects of these interactions.

**Guidance**

G 2.7.2.3 The SSC chair should confirm that:

a) The context that all assessment is performed in will be sufficiently realistic to replicate the effects of complex interactions.

b) The fidelity of any simulation being used will be sufficient to facilitate a reasonably accurate assessment of the effects of each compatibility factor on the reading task.
In many cases, signal sighting assessment using simulation tools provides the most effective and efficient method. In some circumstances it provides the only method, for example, if new infrastructure features are not yet built or where access to the real environment is impracticable (for example, assessment of an asset located in a tunnel).

Simulation tools are approved by the IM (network) as suitable for signal sighting assessment.

Approved simulation tools should provide a high definition visual representation of the driver’s view of the asset(s) being assessed and its operational context. Tools may use video and/or virtual reality technology and incorporate facilities to superimpose images onto the railway environment.

The level of granularity of the image presented by the simulation tool should equal or exceed that which would be achieved by a site assessment.

Assessment using approved simulation tools is sufficient to support a fully informed decision only if the presented images are an accurate representation of the real operational context and up-to-date. It is good practice for the signal sighting assessment plan to include the arrangements for confirming the accuracy of the simulation.

Any compatibility factors that cannot be accurately assessed using a simulation tool should be assessed within the real context.

The SSC shall specify the RRD of each lineside signalling asset being assessed, taking account of:

a) The display(s) and display combination(s) that can be presented.
b) The minimum readable distance (MRD) value(s).
c) An assessment of the achievable readable distance(s) on each approach.
d) Where relevant, an assessment of the achievable visible distance(s) on each approach.

The RRD characteristic of a lineside signalling asset is specified and maintained so that authorised users experience a consistent level of readability on the approach to the asset and have enough time to undertake all of the required actions while the presented displays asset remains in view.

The IM (network) safety management system includes the asset management requirements for maintaining the RRDs of all lineside signalling assets. The RRD value is always equal to or greater than the MRD value. An RRD that is equal to the MRD is capable of providing a sufficient level of readability but provides only the MRT to authorised users.

Where an asset has one RRD value, that value is applicable to all displays presented by that asset.
Signal Sighting Assessment Requirements

G 2.7.3.6 A complex asset may be assigned more than one RRD. This can assist in developing an optimum design solution in the following cases:

a) Some displays have a different readability performance capability than others. In this case, the SSC should consider the impact of different RRDs on the interpretability of all of the information being conveyed.

b) A particular display or display combination(s) is always read at a different train speed or requires a different MRT.

G 2.7.3.7 An example of a signal with three RRD values is shown in Figure G 1.

Figure G 1  Example of a complex signal with multiple RRDs

G 2.7.3.8 Before specifying the RRD value that is greater than the calculated MRD value, the SSC should take account of:

a) The additional measures needed to militate against any further compatibility factors that arise within the additional readable distance (for example, additional obscuration).

b) The cost of maintaining the RRD.

c) The benefit of providing the additional reading time (for example, to provide consistent reading times at successive signals on a route).

G 2.7.3.9 The RRD includes the additional reading time provided by any repeater or co-acting assets that increase the overall readable distance. For example, the RRD of a signal where a banner repeater signal is provided includes the following:

a) The baseline response time (BRT) and the readable distance of the main signal.

b) The MRD of the banner repeater indicator.

c) For 3-state banner repeaters, the contribution of the green / white light to interpretability of the signal aspect presented at the repeated signal.

G 2.7.3.10 Junction signals and splitting banner repeater indicators are configured so that the driver can read the route indication at the same time as the associated signal aspect, except where the junction approach signal aspect or a preliminary junction indicator (PJI) has presented advance routing information that enables the driver to interpret which route is set before the train reaches the point at which the junction signal is readable.
Signal Sighting Assessment Requirements

2.7.4 The SSC shall confirm that each RRD value is achieved in the operational context.

**Rationale**

G 2.7.4.1 This is to ensure that, when the lineside signalling asset is viewed from the normal operating position (for example, from the normal driving position in the train cab), the required RRD is achieved.

**Guidance**

G 2.7.4.2 This requirement is relevant to assessment of signal sighting associated with planned change and at an existing operational asset.

G 2.7.4.3 Methods of achieving this include the operation of a test train before the change is put into use.

2.7.5 The SSC shall confirm the design arrangement of the lineside signalling asset(s) being assessed, including:

a) Asset type and performance.

b) The asset layout, comprising all parts that:

   i) Present displays.
   
   ii) Support or influence readability (for example, a backboard).
   
   iii) Support or influence correct identification (for example, supplementary displays and labels).

c) The position of the asset relative to the line to which it applies.

d) The lateral position of the most restrictive lineside signalling system display relative to the left hand running rail.

e) The height of the most restrictive lineside signalling system display above rail level.

f) The alignment of the display(s) towards the train.

g) The appearance characteristics of the structure used to support the asset.

**Rationale**

G 2.7.5.1 The design arrangement influences the appearance of the asset and presented displays in the operational context.

**Guidance**

G 2.7.5.2 The SSC confirms that the product being used is fit for purpose, taking account of the particular operational context that applies to the lineside signalling asset being assessed. Products that conform to the requirements set out in GKRT0057 and GIRT7033 generate lineside signalling system displays that are capable of being readable if they are used in accordance with their design specification.
Signal Sighting Assessment Requirements

G 2.7.5.3 The SSC confirms that the totality of the asset is fit for purpose, taking account of the particular operational context that applies to the lineside signalling asset being assessed. The asset layout is relevant to mitigating against compatibility factors A2, A5, A7, C2, C3, C4, C5, C6, C8 and C15 as set out in the appendices to this document. Appendix D includes some typical asset configurations that may be suitable for application as reference systems. If a reference system design would not provide the best solution, the SSC can recommend an asset type and / or performance specification to mitigate against the following compatibility factors:

a) For factor A2, where performance specification options are available (for example, long, medium or short-range capability), the SSC should confirm that the chosen option is capable of providing the required visibility and readability performance. If the specification for readable distance performance exceeds the assessed MRD, the SSC should accept that its performance is sufficient, unless excessive performance would result in factor C13. Where a lineside signalling asset presents a display combination, the SSC should confirm that lit displays will not overpower each other.

b) For factor C5, a small asset might require a higher display: background contrast ratio to be as conspicuous in the scene as a larger asset of the same type. It is preferable to increase the contrast ratio by using a higher performing product or by other means. If this is not possible, the supplementary response time (SRT) should be added to increase the MRT.

c) For factor C15, before using a different asset type or one of the same type that generates a display with significantly different luminous intensity, size and contrast parameters compared with similar assets currently in use on the route, it is important to understand the consequence of doing so. In particular, significant variation in display element size could affect the driver’s perception of the distance to the lineside signalling asset, particularly if indiscriminate use results in frequent transitions. A display that has a smaller display element size could result in the driver perceiving a greater distance than the distance that is actually available, particularly in the absence of other visible stimuli. This might be less of a problem if the route is fitted with assets that generate similar displays.

G 2.7.5.4 The asset position to the line can influence the readable distance that can be achieved. It is also relevant to mitigating against factor C4. Figure G 2, configuration options 1 – 6 are examples of the positional relationship between typical colour light signalling equipment and the line that it applies to.
The position of the lineside signalling asset relative to the line is not specified as a requirement because a non-preferred position might provide the optimum design solution when all compatibility factors are considered together and when the cost : benefit of any alternative options has been assessed. The preferred configuration is to position the asset on the left hand side of the line facing the direction of travel (option 1, 2 or 3) because this is where most existing signalling assets are positioned and is where drivers tend to concentrate their visual search.

The position of the display relative to the left hand running rail is representative of its position relative to the driver's field of vision. This is relevant to militating against compatibility factors A7 and C4. Figure G 2 dimensions ‘x’ and ‘y’ represent the positional relationship between typical colour light signalling assets, the structure gauge and the centre of the driver’s field of vision.

a) Main signal aspects and indications should be presented close to the centre of the drivers’ normal field of vision, taking account of the constraints of the structure gauge, electrical clearances and any requirements for the display to be readable also when drivers are not positioned in the normal driving position (for example, option 1 or 2).

b) Semaphore main signal arms should be positioned so that the lowest element of the signal is presented above the centre of the drivers’ normal field of vision.

c) Independent shunting signals should be presented below the centre of the drivers’ normal field of vision, which helps to differentiate them from main signals (for example, option 3).
Signal Sighting Assessment Requirements

G 2.7.5.7 The alignment of the display can influence how conspicuous it appears to be to the driver. The SSC should aim to achieve a consistent display alignment at consecutive signals.

a) For colour light signals mounted at or above drivers’ eye level, historical practice has been to align the signal head towards the AWS magnet. Account should be taken of any documented good practice or application constraints, for example aligning a signal head to militate against phantom displays.

b) Ground mounted signals should be aligned towards a train standing at the normal stopping position.

c) Where the product includes a device for enhanced close-up viewing, the device should be orientated to optimise readability over this distance.

G 2.7.5.8 Switches, plungers and indicators that form part of a train dispatch system should be configured, in order to control the risk from operation of the wrong device. This is a particular concern where platforms are bi-directional or have mid-platform signals. Good design achieves an intuitive layout with appropriate labelling.

G 2.7.5.9 Signalling structure type, size, shape, colour and surface gloss are all relevant to militating against compatibility factors A5, C3, C4 and C8.

G 2.7.5.10 The requirements for visibility from driving cabs are set out in GMRT2161.

G 2.7.5.11 The requirements for maintaining clearances between railway infrastructure and rolling stock are set out in GCRT5212.

G 2.7.5.12 Further guidance about the effect of hardware characteristics on readability performance is given in GKG0657 Appendix F.

2.7.6 The SSC shall identify which of the compatibility factors set out in Appendices A, B and C are present within the RRD on each approach.

Rationale

G 2.7.6.1 An RRD value that provides for an MRT that is equal to the BRT provides drivers with only sufficient time to respond to the presented display(s) where no compatibility factors are present. Therefore, if any compatibility factors are present, they should be identified and either eliminated or militated against.

Guidance

G 2.7.6.2 The compatibility factors set out in Appendices A, B and C all have the potential to introduce the hazard: Incompatibility of a lineside signalling asset with train operations. The signal sighting assessment identifies which compatibility factors are relevant to the asset being assessed and what measures would eliminate or be sufficient to militate against each one.

G 2.7.6.3 The compatibility factors have been derived from an analysis of the following:

a) An analysis of the lineside signalling system interfaces with train operations.

b) Existing good practice set out in the signal sighting workbook, historically used by Network Rail to assess readability.
Signal Sighting Assessment Requirements

c) The SPAD Factor Checklist developed by RSSB.
d) The human factors incident classifications relevant to SPAD events.

G 2.7.6.4 Not all of the compatibility factors will be present at each asset. Appendices A, B and C give further guidance to help the SSC identify which compatibility factors are present, including the circumstances in which they can arise and methods of mitigating against each one.

G 2.7.6.5 Efficiencies in the assessment process can be achieved if the applicability of compatibility factors to each asset is identified and agreed by the SSC members at an early stage of the assessment.

G 2.7.6.6 If the assessment remit means that not all compatibility factors need to be assessed, the limited scope of assessment should be described in the assessment plan. For example, the scope of assessment for an incident investigation might be limited to confirmation that the existing mitigations are adequate to control a specific factor.

G 2.7.6.7 Compatibility factors can be eliminated or militated against by a combination of:

a) Altering the asset configuration.
b) Providing a readable distance that compensates for the additional time drivers need to reliably read, interpret and act upon the presented information.

G 2.7.6.8 Where the combination of applicable compatibility factors does not significantly increase the workload associated with the train driving task, providing an RRD that supports the MRT may be the primary decision criteria in determining the outcome of the assessment.

G 2.7.6.9 Determining compatibility using reading time as the primary decision criteria does not always provide the best solution, particularly at locations where a combination of compatibility factors combine to significantly increase the workload associated with the train driving task. An example of where this might be the case is at a stop signal within a complex station area, where there are multiple short signal sections, stationary trains, potential for light reflection, obscuration and train driver distraction. In such cases, the signal sighting assessment plan should include a comprehensive site specific evaluation of the train driving task.

G 2.7.6.10 Information about the applicability of the compatibility factors to an asset and the measures used to eliminate or militate against them is also relevant to signal overrun risk assessment. Guidance about the relationship between the compatibility factors and the Variable SPAD Probability Model (Vari-SPAD) questions is given in Appendix E.

2.7.7 If any of the compatibility factors set out in Appendix A are identified for the lineside signalling asset being assessed, the SSC shall decide how each of these will be eliminated or militated against.

Rationale

G 2.7.7.1 Compatibility factors A2 to A10 prevent the reading task from being carried out effectively and therefore cannot be mitigated against by just adding time. The only solution is therefore to either eliminate them or to reduce their impact.
Signal Sighting Assessment Requirements

**Guidance**

G 2.7.7.2 Further guidance is given in Appendix A.

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**2.7.8**

If any of the compatibility factors set out in Appendix B are identified for the lineside signalling asset being assessed, the corresponding amount of SRT shall be included in the MRT.

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**Rationale**

G 2.7.8.1 Compatibility factors B2 and B3 impose additional tasks on the driver as part of the overall operational task. Therefore additional time is added to provide sufficient time to complete these tasks.

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**Guidance**

G 2.7.8.2 Further guidance is given in Appendix B.

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**2.7.9**

If any of the compatibility factors set out in Appendix C are identified for the lineside signalling asset being assessed, the SSC shall decide what mitigation (if any) is needed to eliminate each factor or reduce the risk from authorised user error to an acceptable level.

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**Rationale**

G 2.7.9.1 Compatibility factors C2 to C18 increase the workload on the authorised user and therefore have the potential to increase the likelihood of error.

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**Guidance**

G 2.7.9.2 Further guidance is given in Appendix C.

G 2.7.9.3 The elimination of the compatibility factors is preferable to adding SRT because this approach minimises the difficulty of the operational task and provides the best consistency.

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**2.7.10**

If any compatibility factors identified from Appendix C cannot be eliminated or militated against for the lineside signalling asset being assessed, the SSC shall determine whether and how much SRT should be included in the MRT to compensate.

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**Rationale**

G 2.7.10.1 Where it is not possible to eliminate or sufficiently militate against a factor, additional response time could be made available to provide the authorised user with enough time to complete the more difficult task.

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**Guidance**

G 2.7.10.2 All compatibility factors in Appendix C can potentially be militated against by adding more time; however, it is preferable to eliminate the factor where this can be done.
2.8 Signal sighting assessment: pass / fail criteria

2.8.1 Signal sighting shall be deemed to be acceptable when the IM and RU representatives nominated to the SSC agree on the following:

a) The MRT(s).
b) The RRD(s).
c) The asset configuration.
d) The applicability of visible distance performance to interpretability.
e) The applicability of the compatibility factors to the asset being assessed.
f) The method(s) of eliminating or militating against each applicable factor.
g) Compatibility factors that require further risk assessment.
h) Any assumptions, dependencies and caveats underpinning the assessment decision.

Rationale

G 2.8.1.1 The SSC considers signal sighting from the point of view of all authorised users of the asset, and therefore the decision should take account of all nominated representatives.

G 2.8.1.2 The SSC provides the competence and experience needed to reach a decision on signal sighting.

Guidance

G 2.8.1.3 The SSC Chair should aim to reach a pass / fail conclusion that is acceptable to all SSC representatives.

G 2.8.1.4 The SSC may agree a decision with a caveat recommendation that the signalling layout assessment or signal overrun risk assessment should pay particular attention to specific factors. In such cases, the SSC Chair should provide details of the compatibility factors relevant to those assessments.

G 2.8.1.5 For example, a combination of infrastructure and environmental constraints means that the optimum design of a signal retains a level of obscuration that has the potential to increase SPAD risk. In this case, the SSC Chair should provide the obscuration plan to the signal overrun risk assessment.

G 2.8.1.6 A failure to agree on one or more of these items means that further management action might be necessary to reach a decision on signal sighting. If the SSC fails to agree:

a) The SSC Chair should record the reason for the disagreement.
b) SSC members should escalate the issue in accordance with their company procedures.

G 2.8.1.7 The Proposer should consult with affected Actors to develop and implement a resolution plan. It might be necessary to convene a panel of independent experts to review the issue(s) being escalated, the objections and rationale, and undertake discussions with the affected parties.

G 2.8.1.8 Any decision resulting from an escalation is subject to final agreement by an SSC.
2.9 Signal sighting assessment records

2.9.1 The following signal sighting assessment records shall be retained for the life of the asset:

a) The signal sighting assessment plan.

b) The SSC membership.

c) The assessment result.

d) The SSC decisions supporting the assessment result, including:
   i) The MRT(s).
   ii) The MRD(s).
   iii) The RRD(s).
   iv) The asset configuration.

e) The reasons underpinning the assessment decisions including:
   i) The applicability of visible distance performance to interpretability, where this option has been used.
   ii) The applicability of the compatibility factors to the asset being assessed.
   iii) The method(s) of eliminating or militating against each applicable factor.

f) Any further assumptions, dependencies and caveats, including recommendations about any compatibility factors that are relevant to signal sighting but which are not eliminated and require further risk assessment.

Rationale

G 2.9.1.1 These items are the historical record of the signal sighting assessment process and the decisions made by the SSC that can be referred to during future assessments or investigations.

G 2.9.1.2 The assessment plan records the method and scope of the assessment.

G 2.9.1.3 Records of SSC membership demonstrate that the assessment decision was informed by an appropriate level of knowledge, experience and representation.

G 2.9.1.4 The assessment decisions, reasons and the assumptions, dependencies and caveats describe what has been considered by the SSC in reaching a conclusion that the asset is compatible with train operations.

Guidance

G 2.9.1.5 The assessment record is additional to the asset record, which includes the signal sighting form.

G 2.9.1.6 This information is relevant to:
   a) Applying the CSM RA to the planned change before putting into use.
   b) Developing asset management system requirements to maintain signal sighting throughout the lifetime of the asset.
   c) Incident investigation, when signal sighting needs to be rechecked.
   d) Future change projects, which use the information to understand whether a further planned change would affect signal sighting and therefore require a signal sighting assessment.
Signal Sighting Assessment Requirements

Part 3  Compatibility Performance Requirements

3.1  Introductory guidance

3.1.1  The performance requirements in Part 3 are derived from historical signal engineering practices applicable to the GB mainline railway.

3.1.2  These requirements are suitable for adoption to support the application of the CSM RA risk acceptance principle: Conformity with a code of practice and assessment.

3.1.3  If the asset performance does not conform to a requirement in Part 3, the proposer should obtain an approval for deviation in accordance with the procedures set out in the IM (network) safety management system.

3.1.4  Supporting evidence that proposed alternative performance requirements provide adequate signal sighting includes a signal sighting assessment report.

3.2  Minimum readable distance (MRD)

3.2.1  The SSC shall specify the MRD by applying either:

a)  The formula: \( \text{MRD} = v(\text{max}) \times \text{MRT} \), where ‘\( v(\text{max}) \)’ is the assessed maximum train speed.

Or

b)  A readable distance criterion from Table 1.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Readable distance criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The display(s) is always read by the driver of a stationary train</td>
</tr>
<tr>
<td>2</td>
<td>A signal where all approaching trains are using a shunt movement authority (MA)</td>
</tr>
<tr>
<td>3</td>
<td>An independent shunt signal</td>
</tr>
<tr>
<td>4</td>
<td>A colour light signal or semaphore main stop signal that presents a fixed stop aspect</td>
</tr>
<tr>
<td></td>
<td>A stop board</td>
</tr>
<tr>
<td>5</td>
<td>A driver’s level crossing indicator</td>
</tr>
<tr>
<td>6</td>
<td>Indicators and signs provided at a signal that presents a fixed stop aspect</td>
</tr>
<tr>
<td>7</td>
<td>A cab signalling shunt entry board (AB05)</td>
</tr>
<tr>
<td></td>
<td>A countdown marker (AK102)</td>
</tr>
<tr>
<td>8</td>
<td>Loading / unloading indicator</td>
</tr>
</tbody>
</table>
### Signal Sighting Assessment Requirements

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Readable distance criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>A mechanical train stop system ‘TT’ indicator Readable from the normal driving position when the train has stopped at the signal associated with the mechanical trip-cock tester</td>
</tr>
<tr>
<td>10</td>
<td>Mirrors and monitors that form part of a driver only operation train dispatch system Readable from the normal driving position when the train has stopped at the station</td>
</tr>
<tr>
<td></td>
<td>Signs associated with ‘selective door opening’ operations</td>
</tr>
<tr>
<td>11</td>
<td>Switches, plungers, indicators and signs that form part of a train dispatch system Positioned so that authorised users can observe the relevant signalling system displays and the train being dispatched</td>
</tr>
</tbody>
</table>

#### Table 1 Minimum readable distance criteria

### Rationale

**G 3.2.1.1** The MRD is specified to provide the authorised user with enough time to respond to the information presented by a specific lineside signalling asset, taking account of the following human tasks:

a) Read the display or display combination.

b) Interpret the display or display combination.

c) Assimilate all of the available information.

d) Decide what action to take (if any), and when it needs to be taken.

e) Take the action, where necessary, before the train passes the asset.

**G 3.2.1.2** The formula is the method of calculating the amount of time available to the driver when the asset is read from a moving train.

**G 3.2.1.3** In some operational contexts, an MRD value compliant with a criterion in Table 1 would always provide enough time to complete the operational task.

### Guidance on applying the formula: MRD = v(max) MRT

**G 3.2.1.4** It may be necessary to perform a number of calculations to reach an MRD that is achievable and is supported by all SSC members.

**G 3.2.1.5** The SSC decides which speed to apply as the assessed maximum train speed v(max). This can be the permissible speed, the attainable train speed or an assessed train speed.

**G 3.2.1.6** The MRD calculation should use values of v(max) specified in metres per second (m/s). The calculated MRD result is specified in metres.

**G 3.2.1.7** Unless the asset being assessed is only relevant to slow speed train movements below the permissible speed, the first MRD calculation should use the permissible speed for v(max) because this is the highest authorised approach speed of any train at any time and therefore the resulting MRD would always provide the MRT. If this calculation results in an MRD value that is achievable, no further calculation is needed.
Signal Sighting Assessment Requirements

G 3.2.1.8 If the first calculation results in an MRD value that exceeds the readable distance that is actually available, the SSC should decide which of the following options, or combination of options, to apply:

a) Identify action(s) to increase the achievable readable distance (for example, remove obscuration, reposition the asset or use an alternative signalling product with better readability performance).

b) Use visibility performance to provide the MRD.

c) Re-evaluate the MRT for the whole asset, or a part of the asset being assessed, and recalculate the MRD using that value for 't'.

d) Reduce the permissible speed to a v(max) value that provides an assessed MRD that is achievable.

e) Recalculate the MRD using the attainable train speed or the assessed train speed value for v(max). This option should be used only if the SSC confirms that v(max) is valid for all train operations that will use the asset being assessed.

f) Recalculate the MRD using the assessed train speed for v(max), taking account of specific display(s) presented at the asset and the sequence of signal aspects and indications presented to the driver at preceding signals and indicators. This option should be used only if the SSC confirms that v(max) is valid for all train operations that will use the display(s) being assessed, for example, the train speed approaching a stop aspect.

g) Provide a repeater or co-acting asset.

Guidance on using Table 1

G 3.2.1.9 Table 1 describes eleven scenarios where a default MRD can be applied. This method of specifying the MRD is suitable only if the selected operational context is applicable every time the asset or display needs to be read.

G 3.2.1.10 For scenario 1, signal sighting is achieved when there is an uninterrupted line of sight between the presented display and the authorised user. Platform starting signals and the signals, indicators and lineside operational signs in terminal station platforms are viewed from a stationary train and, as such, calculating a readable distance based only on the maximum train speed is not appropriate. The assessment should take account of the stopping position of all trains that use the asset being assessed.

G 3.2.1.11 For scenario 2, MRD = 50 m approximates to 7s at 15 mph and 4 s at 25 mph. The MRD is not relevant when an independent shunt signal is acting as a preceding shunt.

G 3.2.1.12 For scenario 3, shunting MAs do not include a cautionary aspect sequence, therefore the MRD provides the driver with enough time to stop the train at the limit of MA. If the assessed signalling braking distance at 15 mph exceeds the readability performance supported by the signal, the SSC can assess the MRD using visibility of the signal aspect.
Signal Sighting Assessment Requirements

G 3.2.1.13 For scenario 4, the driver should be preparing to stop the train on the approach to a signal that displays a fixed stop aspect. The readable distance influences how soon the driver is able to confirm the limit of MA before the train reaches the required stopping position. 100 m is estimated to provide at least 4 s for the driver to monitor the track ahead to detect and identify the limit of MA and complete the action to stop the train. The RRD should take account of the achievable readable distance supported by the asset type and the RRD of similar asset types on the route.

G 3.2.1.14 For scenario 5, the automatic level crossing speed restriction sign acts as a reminder to the driver to read the indicator, and is positioned so that the driver has enough time to stop the train if the level crossing is not operating correctly. When the train reaches the speed restriction sign, the driver should be preparing to stop the train at the level crossing and have read and interpreted the sign. The level crossing speed restriction sign is located in a position where the driver has a clear view of the level crossing area, which can be up to 600 m from the level crossing. Further requirements applicable to the application of drivers’ level crossing indicators are set out in GKRT0192.

G 3.2.1.15 For scenario 6, the driver decides when to start the train and is in control of how much time is available to read and respond to the indication. This requirement applies to any lineside signalling asset where the driver would always read the display when the train is stationary, either because the train movement has not yet started or because the train has already stopped in response to a presented display and will then restart. Examples include:

a) CD / RA indications.

b) The instructions presented at a stop board.

G 3.2.1.16 For scenario 7, 100 m provides at least 4 s reading time to drivers of trains to which these signs apply. The driver requires at least 4 s to:

a) Monitor the track ahead to detect and identify the sign as applicable to the train being operated.

b) Detect and distinguish the sign.

c) Interpret the information conveyed.

d) Take the necessary action that is required.

G 3.2.1.17 For scenario 8, precision is required in the control of the train movement and, to achieve this, the driver needs to be able to view an indicator continuously.

G 3.2.1.18 For scenario 9, the driver uses the TT indication to understand that the train has been stopped because the trip-cock is out of alignment.

G 3.2.1.19 For scenario 10, the driver uses the image presented by DOO mirrors and monitors to understand whether it is safe to start the train.

G 3.2.1.20 For scenario 11, authorised users need to observe relevant signal aspects and indications before dispatching the train. This includes assets associated with TRTS, RA, CD and signal OFF functions. The SSC should take account of any requirement for the authorised user to observe the correct operation of infrastructure associated with train dispatch, for example a level crossing system.
3.2.2 No obscuration shall be present within 40 m on the signalled approach to a stop signal, or any indicator or lineside operational sign that denotes the stopping position of a train.

**Rationale**

G 3.2.2.1 The driver uses the stop signal, indicator or sign as a reference point to determine the stopping position of the train, which is usually within 40 m of the asset. Loss of visibility of the display could result in a driver misjudging the train stopping position.

**Guidance**

G 3.2.2.2 If the SSC identifies that the stopping position of the train is more than 40 m from the asset, the distance should be extended beyond 40 m.

G 3.2.2.3 This requirement is relevant to mitigating against factor C11.

3.2.3 The MRD shall be sufficient to reinstate any reading time that is lost due to obscuration.

**Rationale**

G 3.2.3.1 Obscuration within the MRD would reduce the time available to the driver to read and respond to the presented display.

**Guidance**

G 3.2.3.2 In many instances, the majority of the reading task takes place when the train is a long way from the asset, which is also where readability is most susceptible to obscuration.

G 3.2.3.3 The SSC should assess which part of the train driving task will be affected by the obscuration. Certain visual tasks such as identifying which asset is applicable, and distinguishing the aspect or indication, are more vulnerable to the impact of obscuration and are more likely to increase the probability of driver error.

G 3.2.3.4 Table G 1 is a simplified extract from HEL 2003b, an industry research report into the train driving task on the approach to lineside signals, including typical time values for component behaviour. Times are rounded up / down to the nearest 0.1 s.

G 3.2.3.5 Obscuration can cause a driver to repeat part of the reading task, which means that the time to be added back may need to exceed the duration of the obscuration in order to compensate.

G 3.2.3.6 How time can be added back to compensate for this is set out in Table G 2. Combined times indicate that, should an obscuration occur at a point where one of the component behaviours of the reading task occurs, the obscuration might require the driver to repeat both component parts of that task.
### Task: Maintain situation awareness
- **Component behaviour**: Awareness of lineside signalling system
- **Description**: Use of route knowledge
- **Time**: n/a
- **Requires signal in view**: No

### Find asset
- **Component behaviour**: Monitoring the track ahead for signs, signals etc
- **Description**: Reading
- **Time**: 0.8 s
- **Requires signal in view**: Yes
- **Notes**: #1

- **Component behaviour**: Detect the asset and distinguish the display
- **Description**: Reading
- **Time**: 1.0 s
- **Requires signal in view**: Yes
- **Notes**: #1

- **Component behaviour**: Identify the asset is relevant
- **Description**: Reading
- **Time**: 1.0 s
- **Requires signal in view**: No
- **Notes**: #1

### Response to AWS
- **Component behaviour**: Orient
- **Description**: Orient to unanticipated auditory feedback
- **Time**: 0.5 s
- **Requires signal in view**: Yes

- **Component behaviour**: Act
- **Description**: Discrete motor activity
- **Time**: 0.5 s
- **Requires signal in view**: Yes

### Interpret
- **Component behaviour**: Interpretation of display meaning
- **Description**: Interpreting
- **Time**: 0.5 s
- **Requires signal in view**: Yes
- **Notes**: #1

### Plan
- **Component behaviour**: Selection of (goal) action required
- **Description**: Evaluation / Judgement
- **Time**: 0.75 s
- **Requires signal in view**: No

### Action
- **Component behaviour**: Manipulate power control
- **Description**: Discrete motor activity
- **Time**: 1.0 s
- **Requires signal in view**: No

- **Component behaviour**: Manipulate brake control
- **Description**: Discrete motor activity
- **Time**: 1.0 s
- **Requires signal in view**: No

### Review
- **Component behaviour**: Strategy review
- **Description**: Evaluation / Judgement
- **Time**: 0.5 s
- **Requires signal in view**: No

---

#1 Time is relevant to clause 3.2.3

### Table G 1
Example component behaviour times

<table>
<thead>
<tr>
<th>Task</th>
<th>Component behaviour</th>
<th>Description</th>
<th>Time</th>
<th>Combined time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find asset</td>
<td>Monitoring the track ahead for signs, signals etc</td>
<td>Reading</td>
<td>0.8 s</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Detect signal and distinguish signal aspect</td>
<td></td>
<td>1.0 s</td>
<td>2.0 s</td>
</tr>
<tr>
<td></td>
<td>Identify signal is relevant</td>
<td></td>
<td>1.0 s</td>
<td></td>
</tr>
<tr>
<td>Response to AWS</td>
<td>Orient</td>
<td>Orient to unanticipated auditory feedback</td>
<td>0.5 s</td>
<td>1.0 s</td>
</tr>
<tr>
<td></td>
<td>Act</td>
<td>Discrete motor activity</td>
<td>0.5 s</td>
<td></td>
</tr>
</tbody>
</table>

### Table G 2
Extract of Table G 1 setting out combined times for component behaviour

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Signal Sighting Assessment Requirements

3.2.4 Where it is proposed to use visible distance performance of an asset to specify the MRD, the SSC shall apply both of the following criteria:

a) Confirm that visibility alone is sufficient to support interpretability of the presented display or display combination.

b) Confirm the maximum distance from the asset at which the relevant display(s) is readable.

**Rationale**

G 3.2.4.1 Using visibility performance places a greater reliance on driver knowledge and experience to correctly interpret the information being conveyed. The SSC is the means used to reach agreement that visibility is sufficient to support interpretability compatibility.

G 3.2.4.2 The visible distance adds to the time available for the driver to interpret and respond to the presented information. As the train approaches the asset, the driver will reach a position to be able to read the display to confirm correct interpretation.

**Guidance**

G 3.2.4.3 The SSC should consider visibility as a means of achieving interpretability only if all of the following apply:

a) Drivers will be able to interpret sufficient information using visibility to initiate the required action before the train reaches the point at which displays are readable.

b) The required action is always the same (for example, decelerate the train to 30 mph when a diverging route is set).

c) The readable distance provides enough time for the driver to confirm and complete the required action.

G 3.2.4.4 The contribution of visibility to interpretability depends on which other displays are presented along the route. For example, if there are many similar lineside signalling assets visible at the same time, then it may be necessary for the driver to fully distinguish the display to interpret the information.

G 3.2.4.5 If there is more than one diverging route at a junction signal, using visibility would not be acceptable if any of the following apply:

a) Different permissible speeds apply on each route.

b) The characteristics of each route are different (for example, distance to the next stop signal).

c) The driver is required to stop the train if an incorrect route is set.

G 3.2.4.6 Figure G 3 is an example where visibility of a lit alpha-numeric route indication could be used to support interpretability of the MA on the diverging route before the train reaches a position where the displayed character is readable.
Signal Sighting Assessment Requirements

![Diagram showing signal sighting requirements]

<table>
<thead>
<tr>
<th>Asset element</th>
<th>Performance</th>
<th>MRD</th>
<th>RRD</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main aspect only</td>
<td>Readable: 800 m</td>
<td>500 m</td>
<td>650 m</td>
<td>Visible distance is not relevant because RRD &gt; MRD 650 m provides 11.8 s reading time at 125 mph</td>
</tr>
<tr>
<td>Main proceed aspect + route indication combination</td>
<td>Visible: 500 m, Readable: 250 m</td>
<td>250 m (or 500 m *)</td>
<td>500 m (*)</td>
<td>Proceed aspect is delayed until the train driver can interpret that the MA is for the diverging route. If there is only one diverging route, the SSC can assess the acceptability of presenting the proceed-aspect for the diverging route when the route indication is visible.</td>
</tr>
<tr>
<td>Position Light Signal (PLS)</td>
<td>100 m</td>
<td>100 m</td>
<td>100 m</td>
<td>Approach controlled at 100 m</td>
</tr>
</tbody>
</table>

**Figure G 3** Example of a signal where visible distance is used to extend an RRD

### 3.3 Minimum response time (MRT)

#### 3.3.1

If the RRD is calculated using the formula MRD = v(max) MRT, the SSC shall calculate the MRT by adding the relevant BRT and the assessed SRT.

**Rationale**

G 3.3.1.1 The SSC provides the competence and knowledge to assess how much time is needed for authorised users to read, interpret and respond to the information presented at each lineside signal, indicator and lineside operational sign.
Signal Sighting Assessment Requirements

Guidance

G 3.3.1.2 An MRT that is equal to the BRT provides drivers with only sufficient time to respond to the presented display(s) where no compatibility factors are present. In some cases, adding SRT is necessary to militate against one or more factors. For example, factor C11 is present because a cab design includes a centre gangway. The SSC identifies that this means that the driver loses visibility of the signal aspect up to 30 m from the signal and decides to add 1 s SRT to compensate.

G 3.3.1.3 If the RRD is specified by applying a criterion in Table 1, it may be necessary to also calculate the MRT to confirm that the applicable criterion is met.

G 3.3.1.4 Further guidance about using SRT to militate against the compatibility factors presented on the approach to an asset is given in Appendices A, B and C.

G 3.3.1.5 If supplementary time is used to militate against multiple compatibility factors, the total SRT might result in an unrealistic MRT value and therefore an RRD that is unachievable or undesirable. In this case, the SSC should consider whether using SRT is an appropriate solution and whether adding less time would be sufficient to militate against the overall collection of compatibility factors.

G 3.3.1.6 Further guidance about the effect of eyesight performance on driver response times is given in Appendix F.

3.4 Baseline response time (BRT)

3.4.1 7 s BRT shall be used to calculate the MRT for:

a) A main signal that does not continuously present a stop aspect which can be approached by a moving train.

b) A signal presenting a fixed cautionary aspect.

c) A points indicator.

Rationale

G 3.4.1.1 For a worked signal or points indicator, or any signal that presents a cautionary aspect, the time needed to carry out the items set out below (taking into account the range of driver response times) is slightly under 3 s:

a) Monitor the track ahead to detect and identify the signal or indicator as applicable to the train being operated.

b) Detect and distinguish the signal aspect or indication.

G 3.4.1.2 One second is added for each of the following, for the driver to:

a) Interpret the information conveyed by the signal aspect or indication.

b) Plan what action needs to be taken.

c) Take the action that is required.

d) Cover the time between when the driver loses sight of the signal or indicator and when the train actually passes the lineside signalling asset.
Signal Sighting Assessment Requirements

Guidance

G 3.4.1.3 The BRT values set out in this standard are derived from information in RSSB research report HEL 2003b, which analyses the minimum amount of time needed by drivers to read and respond to lineside signalling displays, taking account of human factors and the range of human performance.

G 3.4.1.4 The BRT values set out in this standard are relevant to specifying and assessing the minimum performance of lineside signalling products.

G 3.4.1.5 Further information about signal aspects and indications and the information they convey is set out in GKRT0058 Appendix A.

3.4.2 5 s BRT shall be used to calculate the MRT for a main signal that can be approached by a moving train, where a banner repeater indicator is also provided.

Rationale

G 3.4.2.1 When the reading time provided by the 250 m MRD of the banner repeater indicator is added to the 5 s MRT of the repeated signal the overall reading time is at least 9 s.

Guidance

G 3.4.2.2 The driver needs at least 5 s to:

a) Monitor the track ahead to detect and identify the signal applicable to the train being operated.

b) Detect and distinguish the signal aspect and any associated route indication.

c) Interpret the information conveyed by the signal and associate it with the preceding banner repeater indication.

d) Cover the time between when the driver loses sight of the signal aspect and when the train actually passes the signal.

G 3.4.2.3 5 s should provide enough time for the driver to distinguish a flashing aspect displayed as part of a junction aspect sequence.

G 3.4.2.4 The MRD requirements applicable to banner repeater indicators are set out in Table 1.

3.4.3 5 s BRT shall be used to calculate the MRT for a PJI.

Rationale

G 3.4.3.1 The driver needs at least 5 s to:

a) Monitor the track ahead to detect and identify the preliminary junction indicator as applicable to the train being operated.

b) Detect and distinguish the presented junction indication, if lit.

c) Interpret the information conveyed by the lit indication and relate it to the repeated signal.

d) Cover the time between when the driver loses sight of the lit indication and when the train actually passes the indicator.
Signal Sighting Assessment Requirements

Guidance

G 3.4.3.2 5 s BRT equates to approximately 305 m at 125 mph, and 244 m at 100 mph.

G 3.4.3.3 A PJI product that is approved to support 250 m maximum readable distance performance can be used at locations where the assessed or attainable train speed is 100 mph or less. It is not appropriate to use visible distance performance to achieve the RRD because a PJI always displays at least two different indications and the train driver needs time to correctly interpret which route is set.

G 3.4.3.4 RIS-0703-CCS provides further guidance on how a PJI can be used to manage risk at a diverging junction.

3.4.4 4 s BRT shall be used to calculate the MRT for:

a) An independent alphanumeric indicator that presents only one lit indication (for example, a barriers up ‘BU’ indicator).

b) A banner repeater indicator.

c) A splitting banner repeater indicator.

3.4.5 4 s BRT shall be used to calculate the MRT for the following lineside operational signs:

a) Warning of start of cab signalling (AB01).

b) Indication of start of cab signalling (AB02).

c) Indication of end of cab signalling (AB03).

d) Transmission Voie-Machine or Track-to-Train Transmission (TVM) block marker (AB04).

e) Start / end of cab signalling directional arrows (AB07).

f) European Train Control System (ETCS) stop marker (AB08).

g) ETCS block marker passable plate (AB09).

h) Permissible speed and enhanced permissible speed signs (AD and AE series).

i) Signs on the approach to level crossings (AH series).

j) Signs for electric traction (AJ series).

k) Communications signs (DC series).

l) Signal reminder board (AK101).

m) Line identification board (AK103).

n) Platform stop marker (AK104).

o) Mid platform berth marker (AK105).

p) Whistle board (AK203z).

q) Coasting board (AK208).
Rationale

G 3.4.5.1 These indicators and signs act as markers and are not dynamic but require the driver to take an action in response to the presented information.

G 3.4.5.2 The driver needs at least 4 s to:
   a) Monitor the track ahead to detect and identify the lit indicator or sign as applicable to the train being operated.
   b) Detect and distinguish the lit indication or sign.
   c) Interpret the information conveyed.
   d) Take the necessary action that is required.

Guidance

G 3.4.5.3 4 s at 125 mph equates to approximately 250 m. On lines with a permissible speed of up to 125 mph, the combined MRT of a main stop signal where a banner repeater indication is provided on the approach is therefore at least 4 s + 5 s = 9 s.

G 3.4.5.4 When a banner repeater indicator is presenting the banner ON indication, the actual reading time will be significantly greater than 4 s when the driver is preparing to stop the train at the next signal.

G 3.4.5.5 Where a 3-state banner repeater indicator is provided, visibility of the green / white lit display provides an opportunity to significantly extend the distance at which the driver can distinguish a green aspect.

G 3.4.5.6 Further MRD requirements for other lineside operational signs that are relevant to the train driving task where the assessment does not need to take account of train speed are set out in Table 1.

3.4.6 2 s BRT shall be used to calculate the MRT for the following lineside operational signs:
   a) Commencement of AWS gap (AA01).
   b) Termination of AWS gap (AA02).
   c) Commencement of AWS special working (AA03).
   d) Termination of AWS special working (AA04).
   e) Permanently installed AWS cancelling indicator (AA05).
   f) Radio Electronic Token Block (RETB) loop clear marker (AB06).
   g) Spring catch board (AK204).
   h) Rear clear marker (AK205).
   i) Train class specific instruction / no entry (AK206/7).
   j) Miscellaneous instructions to train crew (AK209).
   k) Warnings for train crew (AK210).
   l) Sandite markers (AK211).
   m) Termination of adhesion condition (AK214).
Signal Sighting Assessment Requirements

Rationale

G 3.4.6.1 The driver needs only to view these signs without actually reading them.

G 3.4.6.2 The driver needs 2 s to detect and identify the sign as applicable to the train being operated.

Guidance

G 3.4.6.3 No further guidance is provided.
Part 4  Asset Configuration Requirements

4.1 Introductory guidance

4.1.1 The asset configuration requirements in section 4 are derived from historical signal engineering practices applicable to the GB mainline railway.

4.1.2 These requirements are suitable for adoption to support the application of the CSM RA risk acceptance principle: Conformity with a code of practice and assessment.

4.1.3 If the asset configuration does not conform to a requirement in Part 4, the proposer should obtain an approval for deviation in accordance with the procedures set out in the IM (network) safety management system.

4.1.4 Supporting evidence that proposed alternative configurations provide adequate signal sighting includes a signal sighting assessment report.

4.2 Colour light signalling assets

4.2.1 The most restrictive signal aspect or indication shall meet both of the following:

a) It shall be presented by the display element nearest to the centre of the driver’s field of vision.

b) It shall be positioned so that the centre of the signal aspect is no more than 5.1 m above rail level.

Rationale

The signal aspect or indication that is the closest to the centre of the driver’s field of vision is usually seen more quickly and identified more accurately. Therefore it is the easiest to read because this is where eyesight sensitivity to contrast is highest.

Research has shown that drivers search for signs / signals towards the centre of their field of vision. As train speed increases, drivers demonstrate a tunnel vision effect and focus on objects within a field of +8° from the direction of travel.

Guidance

Colour light signal heads comprising more than one display element are usually mounted so that the display elements are vertically aligned. Other arrangements may be used subject to compliance with GKRT0058 Appendix A.

If separate display elements are used to display each signal aspect:

a) The order of proximity of lights apparent to the driver’s eye as the train passes the signal should be:

   i) Red (nearest).

   ii) Single yellow.

   iii) Green.

   iv) Additional yellow (for double yellow).

b) If any of these signal aspects are not provided, or are combined into a single display element, the order set out above should be maintained by the remaining elements.
Signal Sighting Assessment Requirements

c) If the signal displays only red, single yellow and double yellow aspects, the red aspect may be positioned between the two yellow lights if the hazard of obscuration is controlled.

G 4.2.1.5 It is good practice to configure the signal or indicator to minimise the risk of obscuration caused by an accumulation of debris or snow. For this reason:

a) The preferred position of the most restrictive signal aspect of an elevated colour light signal is the lowermost display element.

b) Signal hoods are sometimes omitted from a ground mounted colour light signal head.

G 4.2.1.6 The SSC should aim to achieve a consistent asset and display position relative to the line in order to militate against factor C4.

G 4.2.1.7 Further guidance about human vision and perception which suggests that signal aspects and indications should be presented within an 8° cone of the driver’s line of sight to achieve prominence is given in Appendix F. Less restrictive signal aspects and indications should be positioned above 5.1 m only if the SSC confirms that these displays will be sufficiently readable.

G 4.2.1.8 The primary element of a co-acting signal can be displayed above 5.1 m if the co-acting equipment is positioned to optimise close-up readability.

G 4.2.1.9 An alternative position should be used only where it is necessary to overcome a location specific constraint and if mitigations are put in place to militate against the relevant compatibility factors.

4.2.2 Where a colour light signal in a 4-aspect signalling area does not present a double yellow cautionary aspect, the signal head and backboard shall be configured so that the signal has the overall appearance of a 4-aspect signal.

Rationale

G 4.2.2.1 Although the signal does not present a double yellow aspect, the single yellow aspect is part of a 4-aspect sequence. The appearance of the signal head is used to militate against the likelihood that a driver will misread a 3-aspect first caution and then misinterpret the availability of signalling braking distance to the next signal when a single yellow aspect is presented.

Guidance

G 4.2.2.2 Historical practice has been to configure the signal with a backboard that has a similar size and position as the preceding 4-aspect signals.

4.2.3 At a 4-aspect to 3-aspect signalling transition, the signal that presents the first 3-aspect caution shall not have the appearance of a 4-aspect signal, unless the transition occurs at a junction signal where only the diverging route(s) incorporates the 4-aspect to 3-aspect transition.

Rationale

G 4.2.3.1 If a 3-aspect signal has the appearance of a 4-aspect signal, the driver might assume that the top yellow light has failed, misread a 4-aspect first caution and then misinterpret the distance to the limit of MA.
Guidance

G 4.2.3.2 Further guidance about 4-aspect to 3-aspect signalling transitions is given in RIS-0703-CCS (when published).

4.2.4 Where a colour light signal is configured as a junction splitting distant signal, both of the following apply:

a) The signal head positioned nearest to the running line on which it applies shall present the signal aspect when the MA does not extend beyond the junction signal.

b) The SSC shall confirm the values of dimensions ‘a’ and ‘b’ and the alignment of the two signal heads to achieve axis ‘c – c’, shown in Figure 1.

\[
\begin{align*}
    a &= 9r \text{ (maximum)} \\
    b &= 5r \text{ (maximum)} \\
    \text{(where } r \text{ is the display element radius)}
\end{align*}
\]

Figure 1 Junction splitting distant signal configuration

Rationale

G 4.2.4.1 The signal aspect should be presented as close to the centre of the driver’s normal field of vision as can be achieved. When the MA does not extend beyond the junction signal, the junction splitting distant signal does not present a splitting distant aspect.

G 4.2.4.2 Values for ‘a’ and ‘b’ and axis ‘c – c’ maintain a consistent proportional appearance, which helps drivers to distinguish the splitting distant aspect. If the primary and offset signal heads are too close to each other, the splitting distant signal aspects might not be distinguishable enough at long distances. If they are too far apart, a driver might misread a splitting distant aspect as two separate signal aspects.

Guidance

G 4.2.4.3 Additional guidance about splitting distant signal aspects is given in GKGN0658 Appendix A.13.

G 4.2.4.4 This requirement is relevant to militating against compatibility factors A7, C4 and C6.
Signal Sighting Assessment Requirements

G 4.2.4.5 The signal head nearest to the running line is always lit and is sometimes described using the term ‘primary signal head’. The other signal head is lit only as part of a splitting distant signal aspect and sometimes described using the term ‘offset signal head’.

G 4.2.4.6 The value assigned to dimension ‘b’ is influenced by the layout of apertures in the signal head and whether or not the green or double yellow aspect is displayed. For the green splitting distant aspect:

   a) For a signal head comprising four separate display elements, dimension ‘b’ is typically 255 mm.

   b) For a signal head that presents four signal aspects using two display elements, dimension ‘b’ is typically 510 mm.

G 4.2.4.7 Further guidance about dimension ‘b’ is given in GKGN0657.

4.2.5 Where a colour light signal is configured with a subsidiary position light signal (PLS), the SSC shall confirm the position of the PLS and the values of dimensions ‘a’ and ‘b’ shown in Figure 2.

Figure 2 Position light subsidiary signal configuration

Rationale

G 4.2.5.1 A consistent proportional appearance helps drivers to associate the colour light signal stop aspect and PLS OFF aspect combination.

Guidance

G 4.2.5.2 This requirement is relevant to militating against compatibility factors C4, C6 and C15.

G 4.2.5.3 The values assigned to dimensions ‘a’ and ‘b’ should take account of the misreading risk that arises when simultaneously illuminated displays overpower each other.
Signal Sighting Assessment Requirements

G 4.2.5.4 Where there is no diverging route, the ‘centre’ position is preferred because it helps drivers interpret that the calling-on MA applies to the same route and destination as the non-permissive MA.

G 4.2.5.5 If a route indicator is provided with the PLS, an offset configuration should be used to minimise the spacing between the main stop aspect and the PLS aspect.

G 4.2.5.6 Because the main stop aspect is positioned as close as possible to the centre of the train driver's field of vision, the left or right hand position of the PLS and route indicator is dependent on which side of the line the signal is positioned.

G 4.2.5.7 Positions L2 and R2 should be used only in order to overcome physical constraints or where the assessment concludes that it would optimise signal sighting.

G 4.2.5.8 If the relative position of the colour light signal head and PLS does not support spatial compatibility with the track layout, the SSC should consider whether an alphanumeric route indication is required to support correct interpretation. Additional guidance about interpretability and spatial compatibility with the track layout is given in GKGN0658.

4.2.6 Where a colour light signal is configured with a junction indicator, the SSC shall:

a) Confirm the relative position of the signal head and junction indicator equipment and the values of dimensions ‘a’, ‘b1’ and ‘b2’ shown in Figure 3.

b) Decide whether a blue pivot light is necessary to improve the readability of the junction indication.

![Figure 3](Uncontrolled When Printed)

Junction indicator configuration (example shows position 1 indication)
Signal Sighting Assessment Requirements

Rationale

G 4.2.6.1 A consistent proportional appearance helps drivers to associate the colour light signal aspect and junction indication as part of the same signalling display.

G 4.2.6.2 Where the horizontal configuration is used, the relative position of the junction indicator (positions 1 to 6) and the signal head helps the driver interpret whether the route set is a right or left hand diverging route.

G 4.2.6.3 The relative positions of the signal aspect and junction indicator pivot light help the driver to interpret which route is set at the junction. A blue pivot light should be recommended by an SSC only to reinforce this positional relationship.

Guidance

G 4.2.6.4 This requirement is relevant to militating against compatibility factors C4, C6 and C15.

G 4.2.6.5 Historical practice has been to use the vertical configuration, wherever possible, to maintain consistency.

G 4.2.6.6 The horizontal configuration has been used only by exception, where it is necessary either to overcome physical constraints or if there is no other way of providing adequate readability. In this case, the pivot light should be positioned adjacent to the red aspect so that it is near to the centre of the driver’s field of vision.

G 4.2.6.7 The values assigned to dimensions ‘a’, ‘b1’ and ‘b2’ should take account of the misreading risk that arises when either:

a) Simultaneously illuminated displays overpower each other.

Or

b) Associated displays are too far apart.

G 4.2.6.8 Where a junction signal is also a splitting distant signal, the junction indicator should be positioned above the primary head.

G 4.2.6.9 Further guidance about signal aspect and route indication combinations and junction indication positions 1-6 is given in GKN0658.

4.2.7 Where a colour light signal or a position light signal is configured with an alphanumeric route indicator, the SSC shall confirm the relative position of the signal and indicator equipment and the value of dimensions ‘a’ and ‘b’ shown in Figures 4 and 5.
**Signal Sighting Assessment Requirements**

**Rationale**

G 4.2.7.1 A consistent proportional appearance helps drivers to associate the lit signal aspect and route indication as part of the same signalling display.

**Guidance**

G 4.2.7.2 This requirement is relevant to militating against compatibility factors C4, C6 and C15.

G 4.2.7.3 The values assigned to dimensions ‘a’ and ‘b’ should take account of the misreading risk that arises when either:

a) Simultaneously illuminated displays overpower each other.

Or

b) Associated displays are too far apart.

---

**Figure 4** Alphanumeric route indicator configuration (colour light signal)

**Figure 5** Alphanumeric route indicator configuration (position light signal)
## Signal Sighting Assessment Requirements

### G 4.2.7.4
Because the main stop aspect is positioned as close as possible to the centre of the driver's field of vision, the left or right hand position of the route indicator is dependent on which side of the line the signal is positioned.

### G 4.2.7.5
Where a colour light junction signal is also a splitting distant signal, the route indicator is provided with the primary head.

### 4.2.8
When an independent PLS is to be added to a signalling layout that includes existing independent PLSs that present a different form of PLS ON aspect, the SSC shall confirm that drivers will not observe the different forms of PLS ON aspect at the same time during train movements.

**Rationale**

**G 4.2.8.1** Some existing signalling systems include independent shunting signals that present a PLS ON aspect incorporating a white pivot light. A signalling layout that included a mixture of types is associated with compatibility factors C6 and C15.

**Guidance**

**G 4.2.8.2** If existing position light signals are proposed to be replaced with assets that comply with GKRT0058, the SSC should recommend which additional position light signals should be replaced to maintain a consistent aspect appearance and provide a distinct boundary between the different types of PLS ON aspect.

### 4.3 Semaphore signalling assets

#### 4.3.1
Semaphore signals incorporating signal arms that do not comply with the parameters set out in GKRT0057 shall be provided only when the SSC confirms that it is beneficial to maintain consistency with an existing lineside signalling system.

**Rationale**

**G 4.3.1.1** Some existing lineside signalling systems incorporate lower quadrant semaphore signals. In this case, providing a signal of similar appearance and operation militates against factor C15.

**Guidance**

**G 4.3.1.2** No further guidance is provided.

#### 4.3.2
Semaphore signals incorporating multiple arms or discs that meet the requirements of GKRT0057 shall be configured in accordance with Figure 6.
Figure 6  Semaphore signal arm spacing

Rationale

G 4.3.2.1  A consistent proportional appearance helps drivers to distinguish which semaphore signal aspect is being presented and interpret which route is set.

Guidance

G 4.3.2.2  This requirement is relevant to mitigating against factor C6. Also, the dimensions provide for physical clearance when signal arms are operated to the OFF position.

G 4.3.2.3  The dimensions shown in Figure 6 are consistent with the standard mechanical signalling equipment drawings produced by British Rail.
Semaphore signals incorporating signal arms that do not comply with the parameters set out in GKRT0057 may use different configuration dimensions.

The metric dimensions quoted are imperial equivalent dimensions. Table G 3 provides conversion details.

<table>
<thead>
<tr>
<th>Metric value</th>
<th>Imperial equivalent value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1830 mm</td>
<td>6 feet</td>
</tr>
<tr>
<td>1680 mm</td>
<td>5 feet 6 inches</td>
</tr>
<tr>
<td>1070 mm</td>
<td>3 feet 6 inches</td>
</tr>
<tr>
<td>760 mm</td>
<td>2 feet 6 inches</td>
</tr>
</tbody>
</table>

Table G 3 Metric : imperial equivalent dimensions relevant to semaphore signals

Where an alphanumeric route indicator is provided at a semaphore main stop signal, the SSC shall confirm the relative position of the signal and indicator equipment and the value of dimensions ‘a’ and ‘b’ shown in Figure 7.

Figure 7 Example of an alphanumeric route indicator at a semaphore signal

Rationale

A consistent proportional appearance helps drivers to associate the semaphore signal arm and route indication as part of the same signalling display.

Guidance

This requirement is relevant to mitigating against compatibility factors C4, C6 and C15.

Dimension ‘b’ should take account of:

a) The optimal position of the signal arm to support both long distance and close-up readability.

b) The drivers’ line of sight when the train is approaching and stopped at the signal.

Further guidance about the 8° viewing cone, which is relevant to this requirement is given in Appendix F.
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4.3.4 Where an alphanumeric route indicator is provided with a shunting disc signal, the SSC shall confirm the relative position of the signal and indicator equipment and the value of dimensions ‘a’ and ‘b’ shown in Figure 8.

![Figure 8 Example of an alphanumeric route indicator at a shunting disc signal](image)

Rationale
G 4.3.4.1 A consistent proportional appearance helps drivers to associate the semaphore signal arm and route indication as part of the same signalling display.

Guidance
G 4.3.4.2 This requirement is relevant to militating against compatibility factors C4, C6 and C15.
G 4.3.4.3 Because the signal aspect is positioned as close as possible to the centre of the driver's field of vision, the left or right hand position of the route indicator is dependent on which side of the line the signal is positioned.
G 4.3.4.4 An indicator mounted directly above the shunting disc is preferred for signals mounted at a low level. It is permissible for the route indicator to be positioned slightly behind the signal to optimise readability.

4.4 Co-acting signals and indicators

4.4.1 A co-acting signal or indicator shall be provided only where it is necessary to achieve close-up readability.

Rationale
G 4.4.1.1 A co-acting signal or indicator presents duplicate displays in order to optimise short-range readability; however, it also adds complexity to the lineside signalling system and therefore has the potential to adversely affect driveability.

Guidance
G 4.4.1.2 Co-acting signals and indicators should be provided only where it is impracticable to achieve short-range readability without compromising long-range readability.
Signal Sighting Assessment Requirements

G 4.4.1.3  If a co-acting signal or indicator is required only for trains starting from rest or a low speed, an asset that is designed for short-range viewing might be simpler and easier to install in a position best suited for the circumstances.

G 4.4.1.4  When a co-acting signal is to be provided, the SSC should consider where to position any route, subsidiary or supplementary indications. The SSC should determine which part of the signal the driver will be observing at the time the additional indications are to be observed.

4.4.2  A signal comprising primary and co-acting displays shall not present a junction splitting distant aspect.

Rationale

G 4.4.2.1  Splitting distant signals present proceed aspects using two adjacent signal heads. A co-acting splitting distant aspect might be misread, particularly if one of the signal heads becomes obscured or does not present a lit display.

Guidance

G 4.4.2.2  No further guidance is provided.

4.4.3  The primary element of the co-acting signal or indicator shall present all of the signal aspects and indications that are relevant to long-range readability.

Rationale

G 4.4.3.1  The driver of the approaching train will read the primary equipment first in order to obtain the information needed to control the train on the approach to the signal or indicator.

Guidance

G 4.4.3.2  Subsidiary / shunting signal aspects and route indications should only be omitted from the primary signal if the co-acting equipment, on its own, provides the MRT for those displays.

4.4.4  The co-acting part of the signal or indicator shall meet both of the following:

a) Duplicate the display presented by the primary signal and indicator equipment.

b) Present any additional displays that are relevant only to close-up viewing.

Rationale

G 4.4.4.1  As the train approaches the asset, the driver of the approaching train will read the co-acting part when it becomes more conspicuous than the primary equipment. A similar display appearance helps the driver to associate the primary and co-acting parts of the asset.

Guidance

G 4.4.4.2  The co-acting signal and indicator performance should be sufficient to support close-up viewing.
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G 4.4.3 It is permissible for co-acting signal equipment to be positioned on the opposite side of the line to which the primary equipment applies. The lateral separation should take account of the likelihood that the driver could misread part of the asset as applicable to another line.

4.4.5 The longitudinal separation of the primary and co-acting equipment shall not exceed 2 m.

Rationale

G 4.4.5.1 The 2 m longitudinal separation is intended to help the driver associate the primary and co-acting part of the same asset.

Guidance

G 4.4.5.2 Since the position of a stop aspect defines the limit of MA, there is a need to maintain a clear point beyond which a SPAD can be said to have occurred. It is therefore preferable to keep the pair of assets as close as practicable, longitudinally.

4.5 Banner repeater indicators

4.5.1 A banner repeater indicator shall be provided only if any of the following criteria apply:

a) An SSC has decided that a banner repeater indicator should be provided on the approach to a main stop signal to achieve the MRD.

b) An SSC has decided that a banner repeater indicator should be provided on the approach to a main stop signal to eliminate or militate against a specific compatibility factor(s).

c) A signal overrun risk assessment has recommended that a banner repeater indicator should be provided as a signal overrun risk control.

d) Where early availability of MA information on the approach to a main stop signal would facilitate improved train performance.

Rationale

G 4.5.1.1 A banner repeater indicator can benefit train operations by making MA information available before the driver can read the repeater signal aspect; however, it also adds complexity to the lineside signalling system and therefore has the potential to adversely affect driveability. Banner repeater indicators should be provided only where they provide an overall benefit.

Guidance

G 4.5.1.2 Regarding a), the requirement for a banner repeater is confirmed only after the SSC has determined the MRT and MRD values for the asset being assessed. Before recommending a banner repeater indicator to achieve the MRD, the SSC should plot the signal obscuration using an obscuration diagram and consider alternative options, including those set out in G 3.2.1.8. If the banner repeater signal has been identified as benefitting only trains that have already been cautioned by previous signal aspects, then the MRD should be specified using the assessed speed appropriate to those trains.

G 4.5.1.3 Regarding b), a banner repeater indicator is relevant to elimination or mitigating against compatibility factors A8, C3, C10 and C11. For example:

a) For factor A8, a banner repeater indicator makes MA information
Signal Sighting Assessment Requirements

available to the driver at the train stopping position. A banner repeater indicator in a station platform is also relevant to the train dispatch process if it presents the ‘signal OFF’ indication to platform staff.

b) For factor C3, a banner repeater indicator positioned within a tunnel or other very dark section of line might improve readability of the signal ahead with a bright background.

c) For factor C10, a banner repeater indicator can help a driver to read the correct signal in a set of parallel signals.

d) For factor C11, a banner repeater indicator makes MA information available before a driver is able to read the signal aspect.

G 4.5.1.4 Regarding c), the following are examples of circumstances where a banner repeater indicator can be used to militate against signal overrun risk by making information about the limit of MA information available before the driver is able to read the signal aspect, which provides more time for the driver to stop the train:

a) Start-on-yellow signal overrun risk (SOY-SPAD) arises when a train is dispatched towards a signal presenting a stop aspect and the driver concentrates on accelerating the train.

b) Where a diverging junction is signalled with approach control from yellow at the junction signal, signal overrun risk arises at the first signal on the diverging route if the driver anticipates a proceed aspect.

G 4.5.1.5 Regarding d), the decision to provide a banner repeater to facilitate improved train performance should take account of the timetable and the likelihood that train movements will conflict. A banner repeater can help to keep trains moving more quickly by making MA information available before the driver can read the signal proceed aspect, having passed the previous signal presenting a cautionary aspect. This can be of particular benefit on a mixed traffic line or if some trains have relatively poor acceleration.

G 4.5.1.6 A banner repeater may be provided specifically for one type of train where it is being used to provide a performance benefit; in this case attainable speed for that train type may be used to calculate the MRD of the banner repeater indicator.

4.5.2 A splitting banner repeater indicator shall be provided only where it is necessary to convey MA and routing information to the driver before the train reaches a position from where the junction signal can be read.

Rationale

G 4.5.2.1 A splitting banner repeater indicator can benefit train operations by making MA and routing information available to the driver sooner; however, it also adds complexity to the lineside signalling system and therefore has the potential to adversely affect driveability.

Guidance

G 4.5.2.2 Further guidance on when drivers need to obtain routing information is given in RIS-0703-CCS (when published).

4.5.3 The SSC shall confirm the type of banner repeater indicator to be provided, either:
Signal Sighting Assessment Requirements

a) 2-state banner repeater indicator.

Or

b) 3-state banner repeater indicator.
Signal Sighting Assessment Requirements

Rationale:

G 4.5.3.1 The completeness of the MA information conveyed by a banner repeater indicator depends on the equivalence of the indications with the signal aspects presented by the repeated signal.

G 4.5.3.2 Where a splitting banner repeater indicator is provided on the approach to a junction signal, the driver has to be able to associate both indicator heads to read the indication. If a 3-state splitting banner repeater indicator is provided, the driver could read the green banner OFF indication on its own, and misinterpret which route is set.

Guidance

G 4.5.3.3 A 2-state banner repeater indicator only provides sufficient MA information to allow the driver to distinguish between a stop aspect and a proceed aspect.

G 4.5.3.4 A 3-state banner repeater indicator is capable of repeating all of the signal aspects within a 3-aspect sequence, but in 4-aspect signalling areas it does not allow the driver to interpret which cautionary aspect is presented.

G 4.5.3.5 2-state and 3-state banners should not be intermixed because the white banner OFF indication conveys different MA information, which can increase the likelihood of misinterpretation.

G 4.5.3.6 3-state banners can increase the risk of misinterpretation if the green indication is misread as a green signal aspect. This typically arises at night, in complex layouts where compatibility factors B2 or C13 are present.

G 4.5.3.7 The readable distance for all banner signals is where the driver can distinguish the alignment of the banner arm. This is typically 250 m from the indicator.

G 4.5.3.8 Visibility of a 3-state banner repeater indicator can be of benefit to train performance because the driver is able to use the banner indication colour (green or white) to interpret whether the next signal is presenting a green or a cautionary aspect before the banner arm is readable.

G 4.5.3.9 Further guidance about 2-state and 3-state banner repeater indications is given in GKGN0658.

4.5.4 The SSC shall confirm the infrastructure position of the banner repeater indicator.

Rationale

G 4.5.4.1 The purpose of the banner repeater indicator is to increase the reading time available to the driver by making MA and routing information available before the driver is able to read the repeated signal.

Guidance

G 4.5.4.2 The preferred position of the banner repeater indicator is at readable distance from the repeated signal because this avoids an interruption to readability, as shown in Figure G 4.
Signal Sighting Assessment Requirements

The banner arm position is distinguishable

Direction of travel

Reading point of signal

Point at which the colour of the lit display is distinguishable

Figure G 4  Example of a banner repeater indicator (preferred configuration)

G 4.5.4.3  The banner repeater indicator should be positioned on the approach to the reading point of the signal only if the SSC decides that this would be of benefit by significantly increasing the RRD.

G 4.5.4.4  It is good practice to aim for an interruption not exceeding 3 s. The SSC should assess the impact of excessive interruption on the train driving task.

4.5.5  Where a splitting banner repeater indicator is provided, the SSC shall confirm the relative position of the indicator heads and the values of dimensions ‘a’ and ‘b’ shown in Figure 9.

Figure 9  Example splitting banner repeater indicator layout
Rationale
G 4.5.5.1 A consistent proportional appearance helps drivers to distinguish the splitting banner repeater indication. If the two indicators are too close to each other, the splitting banner repeater indication might not be distinguishable enough at long distances. If the indicators are too far apart, a driver might misread two separate indications applicable to different lines.

Guidance
G 4.5.5.2 A value of $b < 2r (+ 10\%)$ would be more difficult to read.

G 4.5.5.3 Further guidance about splitting banner repeater indications is given in GKGN0658.

4.6 Indications presented at stop boards

4.6.1 Where a TPWS indicator is provided with a stop board, the indication shall be presented below the part of the sign that presents the operating instructions.

Rationale
G 4.6.1.1 The stop sign is the most restrictive part of the display and is positioned to optimise its readability. A consistent TPWS indication position helps drivers to associate the indication with the stop board and is relevant to mitigating against factor C6.

Guidance
G 4.6.1.2 The TPWS indication may be repeated in another position away from the stop board, for example, adjacent to driver operated trackside token exchange equipment, in order to provide drivers with an indication that the token equipment has operated correctly before returning to the driving cab.

4.6.2 Where a TPWS indicator and a points indicator are provided together at a stop board, the points indicator shall be:

a) Horizontally aligned with the TPWS indicator.

b) Positioned so that the flashing red light is presented closest to the driver's line of sight.

Rationale
G 4.6.2.1 The flashing red light is more restrictive than the TPWS indication and is positioned to optimise its readability. A consistent indication position helps drivers to associate the indication with the stop board and is relevant to mitigating against factor C6.

Guidance
G 4.6.2.2 Compliance with GKRT0058 section 2.4 means that the flashing red and flashing blue lights are not displayed at the same time.
4.7 Buffer stop lights

4.7.1 The SSC shall confirm:

a) The lateral position of the buffer stop lights relative to the centre of the buffer beam.

b) The infrastructure position if the buffer stop lights are not provided at the buffer stop.

c) The red or white buffer stop light colour.

Rationale

G 4.7.1.1 The selected buffer stop light position should take account of the compatibility factors at that location, for example:

a) Obscuration of the buffer stop, which typically arises where there is a curved approach or where the rolling stock operated on the route is fitted with a centre gangway connection in front of the driving cab.

b) Misreading by drivers of trains on an adjacent line.

c) Consistency of appearance at that location and on the route.

G 4.7.1.2 The buffer stop lights can be used to indicate the limit of the train movement on the approach to a buffer stop. If the buffer stop is preceded by a sand drag, the buffer stop lights should be positioned at the start of the sand drag. Buffer stop lights positioned behind the buffer beam are a causal factor of buffer stop collision risk.

G 4.7.1.3 The buffer stop light colour is a compatibility factor mitigation measure. The decision to provide red or white buffer stop lights is therefore dependent on the signal sighting assessment, including the assessment of other signals in the vicinity.

Guidance

G 4.7.1.4 There is no requirement specifying the RRD or BRT of a retro-reflective buffer beam and buffer stop light combination. The buffer stop light position helps to optimise the readable distance.

G 4.7.1.5 It is good practice to position the buffer stop light between the left and right hand running rails. The default position where cab sight lines are not obscured by infrastructure or rolling stock features (such as a centre gangway) is above the centre of the retro-reflective buffer beam.

G 4.7.1.6 Red buffer stop lights are preferred because red displays are consistent with all other displays denoting the limit of MA. The SSC should take account of the compatibility factor that the colour is used to militate against, for example:

a) Misreading by drivers of trains on other lines.

b) Consistency of appearance at that location and on the route.

G 4.7.1.7 Drivers of trains on adjacent lines should not be exposed to non-applicable red lights within the 8° cone.
Signal Sighting Assessment Requirements

4.7.2 The vertical position of the buffer stop lights shall comply with Figure 10.

![Figure 10 Buffer stop light vertical position](image)

**Rationale**

G 4.7.2.1 The retro-reflective buffer beam and buffer stop light combination enhances the readability of the buffer stop. A consistent proportional appearance helps drivers to locate and correctly judge the distance to the buffer stop.

**Guidance**

G 4.7.2.2 Design requirements for buffer stop infrastructure, including the parameters applicable to buffer beams are set out in GCRT5021.

### 4.8 Lineside operational signs

**Guidance**

G 4.8.1.1 Numerals or text characters on lineside operational signs should be large enough to be readable when viewed from the RRD and should subtend a visual angle of around 20 minutes (20') of arc.

G 4.8.1.2 Since the line of sight and the plane of the lineside operational sign form a right angle, simple trigonometry can be used:

\[
 h = \text{RRD} \tan a
\]

Where:

- \( h \) = one half of the character height
- \( a \) = half of the subtended angle (10')

G 4.8.1.3 The following is an example showing that a 624 mm character height is needed for a sign that needs 4 s MRT at 60 mph (26.82 m/s):

\[
\text{RRD} = v(\text{max}) \times t \quad (26.82 \text{ m/s} \times 4 \text{ s})
\]

\[
\text{RRD} = 107.3 \text{ m}
\]

\[
 h = \text{RRD} \tan a
\]

\[
 h = 107.3 \tan 10' = 312 \text{ mm}
\]

\[
2h = 624 \text{ mm (character height)}
\]
Appendix A Compatibility Factors that Prevent Reliable Reading

A.1 General
A.1.1 The content of this appendix is required by clause 2.7.6.

A.2 Insufficient or excessive product visibility or readability performance

Rationale
G A.2.1.1 Insufficient product performance would mean that the displays are not capable of being reliably read from the MRD. Excessive performance could be a cause of other compatibility factors such as A5, C13 and C15.

Guidance
G A.2.1.2 A2 is present if the performance of the asset does not match the application in which it is used.

G A.2.1.3 GKRT0057 and GIRT7033 set out the assessment requirements that are used to confirm that a new or modified product is capable of achieving the visibility and readability performance set out in its product specification, if it is used as intended. Products that meet these requirements should be capable of generating lineside signalling system displays that are visible and readable if they are used in accordance with their design specification.

G A.2.1.4 The SSC should refer to the product specification(s) to confirm that the asset is suitable for the particular application.

G A.2.1.5 Readability performance is sometimes specified in terms of meeting a standard performance category requirement. GKGN0657 gives guidance about their use; however, the requirement to specify performance using only these categories is not mandated in a Railway Group Standard.

G A.2.1.6 If an asset is made up of multiple parts that present a display combination(s), the SSC should consider the impact of performance on the readability and interpretability of each display.

G A.2.1.7 If the asset being assessed has a different performance capability compared with other similar assets in the same geographical area, the assessment should include the effect of this variation on the driver’s ability to reliably read the displays.

A.3 Vertical obscuration occurs during the reading time

Rationale
G A.3.1.1 Flashing lit aspects and indications obscured by regularly spaced vertical obscuration(s) would make a steady display appear to flash and further fragment a flashing display. A steady display that has the appearance of a flashing display might be misinterpreted by a driver.

Guidance
G A.3.1.2 A3 is present if a lit signal aspect or indication is obscured by regularly spaced vertical obscuration(s) that changes the appearance of a steady aspect or indication to look like a valid flashing aspect or indication.
Signal Sighting Assessment Requirements

G A.3.1.3 The SSC should aim to achieve a design where no multiple vertical obscuration is present within the MRD of a lineside signalling asset that is capable of displaying a flashing display.

G A.3.1.4 Where A3 cannot be eliminated, options for militating against A3 include:
   a) Reconfiguring the asset and / or the features to alter the frequency of vertical obscuration(s).
   b) Supplementing route knowledge so that drivers will be more likely to recognise 'false' flashing displays.

A.4 Featureless approach to a stopping point

Rationale
G A.4.1.1 Drivers need visual cues to understand the distance to the stopping position.

Guidance
G A.4.1.2 A4 is present if the approach to the lineside signalling asset is featureless making it difficult to judge speed and distance when stopping.
G A.4.1.3 A4 is relevant to any lineside signalling asset that presents a stop signal aspect or an indication that requires the driver to stop the train.
G A.4.1.4 A tunnel is an example of a featureless environment where a driver might be affected by a lack of feedback about the environment. Long tunnels can have two slightly different effects:
   a) The lack of landmarks might make it difficult to judge how far the train has travelled through the tunnel. The exit and any assets located beyond it could appear unexpectedly.
   b) A train could accelerate within a long tunnel without the driver realising. The lack of visual cues removes an important indicator of train speed.
G A.4.1.5 Many rail environments become featureless at night, when features such as the apparent asset size and the degree of convergence of the rails are more difficult to see. This can be exacerbated by the presence of a lit display if the light source decreases the driver’s dark adaptation.
G A.4.1.6 When judging distance or speed, a person typically uses both environmental features and properties of their visual system. Vertical features (for example, trees, posts, signs and buildings) are the most helpful.
G A.4.1.7 Providing additional visible features such as countdown markers can militate against A4. Countdown markers are provided as a sequence of three signs on the approach to a stop signal. They are usually equally spaced (approximately 100 m apart), with the last marker approximately 100 m from the applicable signal.

A.5 Reflections and glare
Signal Sighting Assessment Requirements

Rationale

G A.5.1.1 Reflections can alter the appearance of a display so that it appears to be something else.

Guidance

G A.5.1.2 A5 is present if direct glare or reflected light is directed into the eyes or into the lineside signalling asset that could make the asset appear to show a different aspect or indication to the one presented.

G A.5.1.3 A5 is relevant to any lineside signalling asset that is capable of presenting a lit signal aspect or indication.

G A.5.1.4 The extent to which excessive illumination could make an asset appear to show a different signal aspect or indication to the one being presented can be influenced by the product being used. Requirements for assessing the phantom display performance of signalling products are set out in GKRT0057 section 4.1.

G A.5.1.5 Problems arising from reflection and glare occur when there is a very large range of luminance, that is, where there are some objects that are far brighter than others. The following types of glare are relevant:

a) Disability glare, caused by scattering of light in the eye, can make it difficult to read a lit display.

b) Discomfort glare, which is often associated with disability glare. While being unpleasant, it does not affect the signal reading time directly, but may lead to distraction and fatigue.

G A.5.1.6 Examples of the adverse effect of disability glare include:

a) When a colour light signal presenting a lit yellow aspect is viewed at night but the driver is unable to determine whether the aspect is a single yellow or a double yellow.

b) Where a colour light signal is positioned beneath a platform roof painted white and the light reflecting off the roof can make the signal difficult to read.

G A.5.1.7 Options for militating against A5 include:

a) Using a product that is specified to achieve high light source: phantom ratio values.

b) Alteration to the features causing the glare or reflection.

c) Provision of screening.

A.6 Excessive or insufficient illumination in the environment

Rationale

G A.6.1.1 Excessive illumination can make it difficult to read the presented display. Insufficient illumination can make it difficult to read a non-lit sign or indicator in conditions of darkness.

Guidance

G A.6.1.2 A6 is present if illumination could dazzle the driver while trying to read the lineside signalling asset or reduce the contrast ratio.
Signal Sighting Assessment Requirements

G A.6.1.3 The human eye’s sensitivity to light increases as the brightness of a light source increases. The brighter a light source, the further the distance from which it can be seen. However, humans see objects not just because of their absolute brightness, but also by their contrast with the surrounding environment.

G A.6.1.4 Where a lineside signalling asset is located close to a powerful light source, the apparent brightness of the display will be reduced, which can make it harder to identify and distinguish. Similarly, a backboard that is smaller than usual would reduce the apparent contrast between the display and its background.

G A.6.1.5 Dark adaptation of the eye at night leads to increased luminance sensitivity. However, this may result in the driver being more likely to be dazzled by a signal where there is too much light entering the eye. Dazzle can be a particular problem with light-emitting diode (LED) light sources that have a higher luminous intensity than filament lamps.

G A.6.1.6 A driver who has been dazzled by a light source will show a range of simple reactions such as squinting, blinking and gaze aversion. It can also take the driver several seconds to recover and might cause after-images. In particular, a red aspect can result in a green after-image. While this should not impact on the MRT for any one signalling asset, it is important to establish that a driver has enough time to recover before reading the next one.

G A.6.1.7 Visual bleaching: On exiting from a dark environment (such as a long tunnel) the driver’s vision is dark adapted. During the day it will take time to adapt to bright light. Until the eyesight is properly light adapted, signal aspects and indications can appear to be ‘bleached out’. The time taken for a driver to adapt will depend on the amount of time spent in the dark, which is a function of tunnel length and train speed.

G A.6.1.8 Increasing the reading time of signalling assets affected by visual bleaching will be of little benefit if the additional reading time is within the dark environment.

G A.6.1.9 A related effect is that of partial adaptation, which results if there are dark and bright areas within a visual field: adaptation to the bright area means that the sensitivity of the entire eye is affected. Bright signals can make it difficult to read other items within the visual field, such as instruments. This will not have an effect on signal reading per se, but does raise general safety issues.

G A.6.1.10 Options for militating against A6 include:

a) Providing more time for the driver to adapt to the bright conditions by repositioning the asset further away from the dark environment or reducing the approach speed. RSSB research report HEL 2003b suggests that if a driver spends an extended time in a tunnel then the first signalling asset should be no less than five seconds running time beyond the tunnel exit.

b) Provision of repeater equipment.

c) Provision of a sighting board, screen or hood that increases the contrast ratio.

G A.6.1.11 Further guidance on human eyesight is given in Appendix F.
A.7 Inadequate cab sight lines from moving trains

Rationale

G A.7.1.1 The driver should be able to read lineside signalling displays using direct observation without having to leave the normal driving position.

Guidance

G A.7.1.2 A7 is present if the lineside signalling asset is not visible from the normal driving position in the cabs of one or more of the rolling stock types that can approach.

G A.7.1.3 A7 is relevant to any lineside signalling asset approached by a moving train.

G A.7.1.4 If A7 is present on the approach to the asset being assessed, vision plots should be used to confirm that the lineside signalling asset is positioned within cab sight lines.

G A.7.1.5 Options for militating against A7 include:

   a) Repositioning the asset so that the displays are within cab sight lines.
   b) Provision of a repeater.

G A.7.1.6 Further guidance about cab vision plots is given in Appendix H.

G A.7.1.7 Requirements for cab sight lines are set out in GMRT2161.

A.8 Signalling asset not visible from train stopping position

Rationale

G A.8.1.1 The driver should be able to read lineside signalling displays using direct observation before the train starts to move, without having to leave the normal driving position.

Guidance

G A.8.1.2 A8 is present if the lineside signalling asset is not visible from the normal driving position when the train has stopped (for example, at a car stop sign).

G A.8.1.3 A8 is relevant to:

   a) Any lineside signalling asset where a driver needs to read the display when the train is stationary, either because it always starts from rest or has stopped in response to the signal aspect or indication and will restart.
   b) Displays that are read in combination with the signal aspect display by a stop signal.

G A.8.1.4 Compliance with Table 1 is relevant to militating against A8.

G A.8.1.5 Options for militating against A8 include:

   a) Removal of the obscuration.
   b) Changing the asset position.
   c) Changing the train stopping position.
Signal Sighting Assessment Requirements

d) Provision of a repeater or co-acting asset.
e) Provision of a platform stop marker.

G A.8.1.6 The position of platform stop markers should take account of train length, platform length and the position of assets that need to be read after the train has stopped (for example, monitors, mirrors and platform starting signals).

A.9 Incompatibility with station duties

Rationale
G A.9.1.1 The driver should have enough time to perform all required duties.

Guidance
G A.9.1.2 A9 is present if the driver must perform station duties at the same time as reading the lineside signalling asset, and the position of the lineside signalling equipment makes this task difficult.

G A.9.1.3 A8 is relevant only to lineside signalling assets that need to be read by the driver of a passenger train at a station stop.

G A.9.1.4 Signals and indicators encountered while entering or leaving a station may coincide with driver activities, such as passenger announcements. Driver tasks such as driver only operation (DOO) duties and setting up the automatic train protection (ATP) system increase the likelihood that a driver will forget to check the lineside signalling system.

G A.9.1.5 Options for militating against A9 include:

a) Repositioning train dispatch equipment and the signalling asset to facilitate doing the signal reading and station duties at the same time.

b) Supplementary response time.

c) Changing the driver’s duties.

A.10 Incompatibility with train headlights

Rationale
G A.10.1.1 The readability of lineside operational signs is dependent on external illumination.

Guidance
G A.10.1.2 A10 is present if the headlight beam does not illuminate the sign.

G A.10.1.3 A10 is relevant if the readability of a lineside operational sign is dependent on its illumination by the train headlight.

G A.10.1.4 The SSC confirms that lineside operational signs are positioned and aligned so that the information is readable using the train headlight.

G A.10.1.5 GIRT7033 sets out further requirements for lineside operational signs, including the requirements for achieving reflectivity performance.

G A.10.1.6 GMRT2149 sets out further requirements on train headlights.
Appendix B  Compatibility Factors that Require Supplementary Response Time (SRT)

B.1 General
B.1.1 The content of this appendix is required by clause 2.7.6.

B.2 Multiple lineside signalling assets of similar appearance in view
B.2.1 The MRT shall include one second SRT.

B.3 Three or more lineside signalling assets of similar appearance in view
B.3.1 The MRT shall include 0.35 second SRT per lineside signalling asset, unless the SSC confirms that an alternative option is sufficient to militate against B3.

Rationale
G B.3.1.1 SRT provides the driver with extra time to correctly identify the target signal.

Guidance
G B.3.1.2 B2 is present if at any time during the BRT, more than one signalling asset face of the same type as the asset being assessed is visible from the normal driving position.

G B.3.1.3 B3 is present if the asset being assessed is one of a set of lineside signalling assets that contains three or more lineside signalling assets with a similar appearance, in total.

G B.3.1.4 Other lineside signals, indicators or operational signs that are also visible could be mistakenly associated with the driving task, so the driver has to do the additional task of selecting the correct lineside signalling asset for the line from those that are available.

G B.3.1.5 Visual search times increase when amounts of irrelevant information in a scene increase and when degrees of similarity between relevant and irrelevant items increase.

G B.3.1.6 Non-targets can be ignored or at least only partially processed most readily when they differ in colour, size or form from the actual target. The more lineside signalling assets of a similar appearance there are, the longer and more difficult the task of identifying the correct lineside signal, indicator or operational sign.

G B.3.1.7 B2 and B3 are relevant to any signal or indicator that can present multiple indications (lit vs. unlit counts as multiple), where association with the line is important (that is, the driver needs to take action in response to the indication) and where it is possible for more than one of the same type of asset to be seen during the approach.

G B.3.1.8 B2 and B3 are not always relevant to assets that present a fixed signal aspect or indication because the driver uses route knowledge and the asset simply acts as a marker.

G B.3.1.9 The number of parallel lineside signalling assets to be assessed may take account of visual differentiation due to variation in vertical positioning or lateral spacing.

G B.3.1.10 Appendix F, Figure G.29 shows an example of six signals presented in the field of vision where vertical staggering is used to aid correct identification.
Signal Sighting Assessment Requirements

G B.3.1.11 Figure G.5 shows an example of five signals presented in the field of vision where there is a wider spacing between signals 13 and 15. In this example the SRT, which takes account of the mitigation provided by the different spacing, is 1.35 s comprising:

a) 1 s to militate against B2 because there are multiple colour light signals in view.

b) 0.35 s to militate against B3 because three signals (9, 11 and 13) are evenly spaced. If all five signals were evenly spaced, the SRT would be 2.05 s (0.35 applied three times).

Figure G 5 Example of factors B2 and B3

G B.3.1.12 Where multiple signals are in combination with a complex track layout incorporating crossovers, a change of line may occur on the approach to the target signal, which makes the line association process more difficult. In addition, the advantage of presenting a consistent signal position on successive gantries will be lost. In this case, extra SRT is needed to militate against B3.

G B.3.1.13 Additional or alternative options to militate against B2 and B3 include:

a) Line identifiers. Where provided, they should be applied to all parallel lines, be consistently positioned, present images that can be interpreted by drivers and be consistent with any alphanumeric route indications presented on the route.

b) Staggering the height of adjacent displays.

c) On bi-directional lines, positioning contra-direction signals on the right hand side of the line to which they apply.
Appendix C Other Compatibility Factors that may Affect Signal Sighting

C.1 General

C.1.1 The content of this appendix is required by clause 2.7.6.

C.2 Complex asset

Rationale

G C.2.1.1 Complex assets present displays that convey more than one type of information. Drivers require more time to read, interpret and assimilate multiple pieces of information.

Guidance

G C.2.1.2 C2 is present if the asset being assessed is made up of a combination of parts that generate a display combination (for example, a signal aspect and route indication, splitting distant signal).

G C.2.1.3 C2 is relevant to any lineside signalling asset that generates a display combination (for example, a junction signal aspect and route indication combination, a junction splitting distant aspect).

G C.2.1.4 RSSB research report HEL 2003b identifies that complex signals take longer to read. A junction signal with two routes would typically require 1.1 s SRT and an extra 0.3 s should be added per additional available route.

G C.2.1.5 This assumes the driver is familiar with the route. If a driver is not familiar with the route, the time taken to recall relevant information cannot be predicted. This is an issue of driver skill, and training, rather than mitigation via additional reading time.

C.3 Low asset to background contrast

Rationale

G C.3.1.1 Drivers target their visual search towards objects with the expected shape and characteristics of a lineside signalling asset. If the asset does not contrast well with the background, then it will not be conspicuous and the driver might require more time to detect it.

Guidance

G C.3.1.2 C3 is present if the asset being assessed has a low contrast ratio with the background so that the overall asset does not stand out well.

G C.3.1.3 C3 is relevant where a driver needs to search for a lineside signalling asset from a significant distance.

G C.3.1.4 Lineside signalling assets are most visible when viewed head on. Background contrast can reduce the visibility of lineside signalling assets when viewed on a curved approach. The presence of a powerful light source near a signal would have a similar effect.

G C.3.1.5 Poor background contrast will increase the time required for drivers to search for, detect, recognise and associate the lineside signalling asset with the line.

G C.3.1.6 Further information on the topic of contrast sensitivity is set out in Appendix F.
Signal Sighting Assessment Requirements

G C.3.1.7 Options to militate against C3 include:
   a) Changing the asset type (for example, providing a colour light signal instead of a semaphore signal).
   b) Reconfiguring the asset to increase the contrast.
   c) Changing the background.
   d) SRT, historically 0.5 s has been used.

C.4 Non-preferred asset or display position relative to the line

Rationale
G C.4.1.1 Drivers tend to target their visual search towards the expected positions for lineside signalling assets. Assets installed in a non-preferred position may take longer to detect than usual.

Guidance
G C.4.1.2 C4 is present if the asset being assessed is installed outside of the preferred area for position or in an inconsistent position compared to previous assets.

G C.4.1.3 C4 is relevant to all lineside signalling assets installed away from the preferred or expected position relative to the line (for example, a signal positioned on the right hand side of the line).

G C.4.1.4 One second SRT has been historically used to militate against C4; however, if the asset position requires the driver to change their point of gaze from the train’s direction of travel in order to view the signal (this may happen when the driver is required to look across a curve, particularly if this is at the end of a long straight), 1.4 s SRT is typically used.

C.5 Low display contrast

Rationale
G C.5.1.1 In order to read a signalling system display, the driver needs to be able to quickly and easily distinguish between the display and the background. If there is insufficient contrast this may take more time than usual.

Guidance
G C.5.1.2 C5 is present if the contrast between the display being assessed and the background (housing or background scene) is low, so the display does not stand out well.

G C.5.1.3 C5 is relevant to all signal aspects and indications that need to be read from a significant distance where a response needs to be made before passing the signal.

G C.5.1.4 Further information on the topic of contrast sensitivity is set out in Appendix F.

G C.5.1.5 Options to militate against C5 include:
   a) Providing a backboard to increase the display contrast.
   b) Changing the background.
Signal Sighting Assessment Requirements

c) Optimising the asset alignment.
d) Providing a co-acting signal if the low contrast makes the signal difficult to read on parts of the approach.

C.6 Unusual configuration of signal aspects and indications

Rationale
G C.6.1.1 Drivers conduct a visual search for objects with a particular appearance. This includes the expected configuration of signal aspects and indications. If the configuration differs from the usual expectation, then the search may be slower with an increased chance of missing the signal.

Guidance
G C.6.1.2 C6 is present if the signal aspects and indications are in a configuration that differs from what drivers expect to see (for example, the order of the aspects is altered or displays are arranged horizontally).
G C.6.1.3 C6 is relevant to lineside signalling assets with multiple display elements that have a defined usual configuration.
G C.6.1.4 Options to militate against C6 include reconfiguring the asset to provide a more consistent appearance.

C.7 Lineside distractions

Rationale
G C.7.1.1 If there is an eye-catching distraction on the approach to the asset, a driver may look at it involuntarily and neglect to read the signalling system display or read too late. A pervasive distraction could stop a driver from reading any piece of visual information.

Guidance
G C.7.1.2 C7 is present if there are visual features in the scene approaching the lineside signalling asset being assessed that are likely to distract the driver from searching for or reading the display.
G C.7.1.3 C7 is relevant to all lineside signalling asset types.
G C.7.1.4 Visual distractions can be permanent features or transient features. Examples include:

  a) The built environment.
  b) The natural environment.
  c) People and animals.
  d) Artificial light sources.
  e) Reflected light.
  f) Display features.
  g) Road or rail traffic.
  h) Low-flying aircraft.
Signal Sighting Assessment Requirements

G C.7.1.5 Any clutter to the sides of the running line will be in the driver’s peripheral field of vision on approach to a signal, indicator or sign. Objects such as signs and signal awareness aids, traffic, or non-signal lights (for example, from a house, compatibility factors or security lights) can distract a driver from the reading task for up to 2 s.

G C.7.1.6 Where visual distractions cannot be obscured or removed, up to 2 s SRT has been historically used to militate against factor C7.

C.8 Complex background

Rationale
G C.8.1.1 Visual search is slower when a target stimulus is presented against a complex background when compared to a simple background. Therefore authorised users may need longer to detect the asset than usual.

Guidance
G C.8.1.2 C8 is present if the lineside signalling asset being assessed is viewed against a complex or cluttered background that makes it difficult to pick out the asset.

G C.8.1.3 C8 is relevant to signal aspects and indications that need to be read from a significant distance.

G C.8.1.4 Where clutter cannot be eliminated or significantly reduced, 1 s SRT has been historically used to militate against C8.

C.9 Light sources

Rationale
G C.9.1.1 There is a risk that a driver could mistake a similar looking light for the target lineside signalling asset.

Guidance
G C.9.1.2 C9 is present if there are lights within the scene during the approach to the lineside signalling asset that look similar to a lineside signalling system display.

G C.9.1.3 C9 is relevant to lineside signalling assets that present lit displays.

G C.9.1.4 Further information on the topics of luminance sensitivity and light adaptation is set out in Appendix F.

G C.9.1.5 Options to militate against C9 include:

a) Elimination through removal of the light source.

b) Provision of screening to obscure the light source.
Signal Sighting Assessment Requirements

C.10 Obscuration of lineside signalling assets within a set of parallel lineside signalling assets

**Rationale**

G C.10.1.1 Drivers use a technique of counting across to identify the correct lineside signalling asset out of a set of parallel assets. When some of the set are obscured, the driver cannot count accurately. They may need to recount, therefore requiring more time.

**Guidance**

G C.10.1.2 C10 is present if, on the approach to a set of parallel lineside signalling assets, not all of the set are in view at the same time.

G C.10.1.3 C10 is relevant to any signal or indicator that can present multiple indications (lit vs. unlit counts as multiple), where association with the line is important (that is, the driver needs to take action in response to the indication) and where it is possible for more than one of the same type of asset to be seen during the approach.

G C.10.1.4 C10 is not always relevant to assets that present a fixed signal aspect or indication because the driver uses route knowledge and the asset simply acts as a marker.

G C.10.1.5 Where there are multiple lineside signalling assets in view, the SSC should aim to achieve a design where no complete obscuration of a signal aspect or indication is present for a time exceeding any one component behaviour of the reading or interpretation tasks. This is because a complete obscuration would increase the probability of the driver committing an error while identifying which lineside signalling asset needs to be read, or while reading the lineside signalling asset itself. Even a half second obstruction could be enough for a driver to miss out a signal when counting across a gantry of parallel signals to identify the correct one, or even to misread a signal. Further guidance on this is given in Part 3, Figures G 1 and G 2.

G C.10.1.6 Where obscuration is not eliminated, SRT should be added. Guidance on a more detailed process to support the assessment of obscuration and the calculation of SRT is given in Part 3.

C.11 Obscuration of the lineside signalling asset being assessed

**Rationale**

G C.11.1.1 During the approach to a lineside signalling asset, drivers go through a cycle of reading, interpreting, assimilating, deciding, acting and reviewing. If an obscuration coincides with a part of this cycle, it could interrupt or delay the response or cause a driver error.

**Guidance**

G C.11.1.2 C11 is present if the lineside signalling asset being assessed is totally or partially obscured on one or more occasions during the MRT.

G C.11.1.3 C11 is relevant to all lineside signalling asset types.

G C.11.1.4 Regarding obscuration caused by infrastructure:

a) Where assets on platforms are positioned below the centre of drivers’ normal field of vision, the assessment should take account of the
Signal Sighting Assessment Requirements

likelihood of intermittent obscuration due to people and station operations.

b) A new or modified asset can be a cause of obscuration affecting another asset.

G C.11.1.5 Regarding obscuration caused by trains:

a) Obscuration can arise if cab sight lines are affected by vehicle design (for example, a centre gangway can affect close-up viewing). In such cases a cab vision plot should be used to confirm that the lineside signalling asset is positioned within cab sight lines. Further guidance about cab vision plots is given in Appendix H.

b) Stationary trains on adjacent lines should be treated as potential causes of obscuration. This includes trains carrying out station stops, trains or vehicles standing in loop lines or sidings, and trains standing at signals where a stop aspect is regularly encountered.

c) Moving trains can be disregarded if the SSC decides that the particular operational context means that they will not constitute a factor.

G C.11.1.6 Obscuration of track is relevant because certain elements of the signal reading task are reliant on both visibility of the signal and track. For instance, line association requires an unobstructed view of both.

G C.11.1.7 Obscuration can also arise due to features external to the railway, particularly where the approach to the asset is on a curve, for example:

a) The natural environment.

b) Built structures.

G C.11.1.8 A method used by SSCs to assess obscuration of a lineside signalling asset is shown in Figure G 6.
Signal Sighting Assessment Requirements

Asset position

No obscuration (clause 3.2.2 applies)

Zone 1

40 m

Zone 2

AWS magnet or 180 m minimum

Either:
- One total obscuration of <0.5 s at maximum train speed \( v_{(max)} \). Add 1 s SRT

Or
- Two partial obscurations of <0.5 s at maximum train speed \( v_{(max)} \) with >1 s separation

Zone 3

RRD

No obscuration (clause 3.2.2 applies)

Either:
- One total or partial obscuration of <1.5 s at permissible speed

Or
- Three total or partial obscurations of <0.66 s with >0.5 s separation and totalling no more than 1.5 s

Or
- Four total or partial obscurations of <0.33 s with >0.5 s separation

MRD (BRT + SRT)

RDR

(Not to scale)

**Figure G 6** Example obscuration acceptance criteria

**G C.11.1.9** The SSC should aim to configure lineside signalling assets so that no obscuration arises during the MRT. The SSC should recommend removal of all obscuration that can be eliminated.

**G C.11.1.10** Where obscuration cannot be completely eliminated, the SSC should assess the remaining obscuration to determine whether it introduces unacceptable risk from the driver disregarding or misreading the lineside signalling display.
G C.11.1.11 The following details should be identified and recorded to support the process for assessing obscuration that cannot be eliminated:

a) The type of obscuration(s).
b) The cause(s) of each obscuration.
c) The location of the obscuration in relation to the target asset.
d) The duration of the obscuration (in seconds), based on the permissible speed.
e) The extent of the obscuration recorded as a percentage of the signal element obscured:
   i) Partial obscuration: more than 10% of the display element is obscured.
   ii) Full obscuration: more than 30% of the display area is obscured.
f) Location specific infrastructure details such as track layout and geometry, including left and right hand curves, gradients etc.
g) The driver tasks affected by the obscuration and any additional driver tasks likely to occur at the location (such as in-cab instrumentation checks) due to the nature of the infrastructure during approach to the target signal (for example, a steep gradient).

G C.11.1.12 The acceptability of obscuration depends upon an assessment of:

a) Whether the lineside signalling asset is an isolated asset or one of multiple assets in view that may increase the likelihood of errors associated with reading across or reading through (factors B2, B3 and C10).
b) The percentage of the display that is obscured.
c) The obscuration details.
d) The point(s) at which the obscuration(s) occurs in the reading task.
e) The train driving task(s) that might be affected by the obscuration.
f) The compatibility factors introduced or affected as a result of the obscuration.

G C.11.1.13 Any obscuration that has no noticeable effect on the reading task should be acceptable without extending the MRD. A single item causing a display to be obscured by less than 10% of its surface area should have no noticeable effect on the reading task. Such obstructions typically occur on lines fitted with overhead line electrification equipment such as:

a) Catenary and contact wires.
b) Head-span and cross-span wires.
c) Registration arms and return conductors.

G C.11.1.14 If obscuration occurs in quantities that, when considered together, they obscure signal aspects or indications by more than 10%, the SSC should assess the obscuration.
Signal Sighting Assessment Requirements

G C.11.1.15 Obscuration of an isolated asset has a much lower impact than obscuration when multiple assets are in view, because there is no risk from misreading between assets (factor C10). An asset can be considered to be isolated if either:

a) It is the only asset in view of the driver.

Or

b) Any other visible assets are clearly unrelated to the target asset and the section of line the driver is operating.

G C.11.1.16 If the SSC decides that it can be assumed that authorised users will maintain the isolated asset in view for as long as possible, the MRD should be extended to reinstate the duration of the obscuration.

G C.11.1.17 Circumstances which mean that the driver might not keep the asset in view include any additional tasks the driver needs to carry out beyond those associated with the reading task. For example, if the obstruction immediately follows an in-cab instrumentation check, this could mean that the driver loses sight of the asset for more than 2 s (time to check instruments: 1.16 s + obstruction of signal: 1 s = 2.16 s).

G C.11.1.18 Options to militate against C11 include:

a) Elimination through removal of the obscuration.

b) Supplementary response time equal to or greater than the total duration of the obscuration. Further guidance on this is given in Part 3, Figures G 1 and G 2.

C.12 High driver workload

Rationale

G C.12.1.1 All tasks will take time to complete and the driver may not be able to reliably carry out the signalling system response task at the same time.

Guidance

G C.12.1.2 C12 is present if, in addition to responding to the lineside signalling asset, the driver is required to do an excessive number of tasks, or tasks of an exceptional nature, during the approach to the asset being assessed.

G C.12.1.3 C12 is relevant where the driver needs to respond to the signal aspect or indication before passing the lineside signalling asset.

G C.12.1.4 An assessment of driver workload is required in order to judge this.

G C.12.1.5 Driver workload can be increased by the effect of trainborne or trackside features.

G C.12.1.6 Examples of trainborne systems that require a driver response include electric traction system indications.

G C.12.1.7 C11 can arise if an infrastructure feature on the approach to the asset being assessed makes it more difficult for the driver to control the train speed. Examples include:

a) A significant gradient change.

b) An area of poor adhesion.
Signal Sighting Assessment Requirements

G C.12.1.8 Where high train driver workload cannot be reduced:

a) 1.2 s SRT might be sufficient to militate against C12 arising from the driver's need to check in-cab instrumentation.

b) 1 s SRT has been historically used to militate against gradient change or poor adhesion; however, extra reading time will only help where approach speeds are already low.

C.13 Other lineside signalling asset more conspicuous than the target lineside signalling asset

Rationale

G C.13.1.1 Drivers expect the most conspicuous signalling display in the scene to be the one that applies to their line. If another asset is more conspicuous than the real target, the driver is more likely to mistake this asset for the target asset.

Guidance

G C.13.1.2 C13 is present if another lineside signalling asset that is visible during the approach to the asset being assessed is more conspicuous than the asset being assessed.

G C.13.1.3 C13 is relevant where it is possible for more than one lineside signalling asset of the same type and appearance to be visible at the same time.

G C.13.1.4 The following are examples of situations where C13 may arise:

a) Where a junction signal is approach controlled when a diverging route is set and the first signal on the straightest route beyond the junction is readable on the approach to the junction signal (reading through).

b) On a multi-track route containing reverse curves, where adjacent signals on parallel lines can appear to ‘cross-over’ as the train approaches the signal.

c) Where a cross-over is located on the immediate approach to signals on parallel lines.

d) At the transition between semaphore and colour light signalling areas.

e) Where an obscuration is present and the target signal may become obscured causing another signal in the distance to become more prominent to the driver.

G C.13.1.5 The assessment of C13 should take account of:

a) The effect of other lineside signalling assets on the asset being assessed.

b) The effect of the asset being assessed on the driveability of other lineside signalling assets and drivers on other lines.

G C.13.1.6 Options to militate against C13 include:

a) Changing the relative conspicuity to eliminate the factor (for example, by changing the relative readability performance).

b) Changing the position of the other asset (for example, using a ground mounted signal) so that it is more clearly differentiated.
Signal Sighting Assessment Requirements

c) Configuring the other asset with approach-lighting controls. This should only be done where the asset does not contribute to the readability of other assets.

d) Providing SRT (0.25 s to 1 s SRT has been historically used).

e) Controlling the affecting asset to present a restrictive aspect or indication until the train has reached a point where the factor is no longer present.

C.14 Gradient change

Guidance

G C.14.1.1 Guidance on C14 is provided with C12.

C.15 Inconsistent appearance

Rationale:

G C.15.1.1 Authorised users filter their visual search in favour of targets that have the expected appearance. If the asset appearance is significantly different from that expected, a driver might miss it or take longer to detect it.

Guidance

G C.15.1.2 C15 is present if the target lineside signalling asset is significantly different in appearance to other lineside signalling assets on the route that have a similar function.

G C.15.1.3 C15 is relevant to lineside signalling assets that are provided at intervals along a route to present continuously updated information and that need to be searched for from a distance (for example, signals).

G C.15.1.4 Inconsistent appearance may arise due to the configuration of the asset, the type of product used, or the different specification of the asset compared with similar assets on the route. For example, some routes include points indicators that display a non-flashing red indication, which is non-compliant with GKRT0058. In this case, the assessment of a project to provide a new indicator should consider the cost / benefits of bringing all of the indications into compliance with GKRT0058 or whether to perpetuate the legacy design.

G C.15.1.5 Tangible differences are important to drivers and should be considered as part of the assessment. For example, colour light signals that incorporate LED displays generate signal aspects that have a tangibly different appearance to those generated by filament lamps. Both are capable of being readable and therefore should be acceptable. In this case, the signal sighting assessment is an opportunity to identify the change in appearance and the need to brief drivers and any other authorised users.

G C.15.1.6 Before using a product that generates a display with significantly different luminous intensity, size and contrast compared with similar assets on the route, it is important to understand the consequence of doing so.

G C.15.1.7 Significant variation in display size could affect the driver’s perception of the distance to the signal or indicator, particularly if indiscriminate use of the product results in frequent transitions. This might be less of a problem if a complete route is fitted with products that generate similar displays.
Signal Sighting Assessment Requirements

G C.15.1.8 A display that has a smaller display element size could result in the driver perceiving a greater distance than the distance that is actually available, particularly in the absence of other visible stimuli.

G C.15.1.9 Where a product with a different appearance is used, 1 s SRT has been historically used to militate against C15.

C.16 Unusual AWS track equipment position

Rationale

G C.16.1.1 Drivers use the AWS indication as a cue to judging the distance from a signal.

Guidance

G C.16.1.2 C16 is present if the AWS track equipment position in relation to the lineside signalling asset being assessed is unusual or inconsistent with the expectations of drivers.

G C.16.1.3 C16 is relevant to lineside signalling assets provided with AWS.

G C.16.1.4 An unusual or inconsistent AWS track equipment position is usually required for a good reason to accommodate other constraints.

G C.16.1.5 Where the AWS track equipment is not a standard distance from the signal, there are a number of dangers, including:

a) If the driver uses the AWS magnet as a marker, the risk is that a magnet that is close to a signal could lead to the driver braking late and overrunning the signal.

b) If the AWS auditory alert is used as a reminder to look for the signal, then the signal may be missed entirely.

C.17 Poor spatial compatibility with the track layout

Rationale

G C.17.1.1 The relative position of a signal aspect and the indication of route contributes to the driver’s understanding of the direction that the train will take at a diverging junction. A poor spatial relationship could be a cause of a driver misinterpreting which route is set.

Guidance

G C.17.1.2 C17 is present if the position of one or more displays within the asset does not correspond with the direction the train will take at a diverging junction.

G C.17.1.3 C17 is relevant at signals that present an indication of route.

G C.17.1.4 Requirements for the SSC to determine the relative position of signal aspects and route indications are set out in Part 3.

G C.17.1.5 Options for militating against C17 include:

a) Using a junction indication to convey directional information that corresponds with the direction of the divergence.
b) Supplementing a junction indication with an alphanumeric route indication to convey additional line and destination information.

G C.17.1.6 Further guidance on interpretability is given in GKGN0658 Appendix G.

G C.17.1.7 Further guidance on assessing interpretability in the context of the overall lineside signalling system is given in RIS-0703- CCS (when published).

C.18 Poor visual association with related infrastructure

Rationale

G C.18.1.1 At some locations, the train driver is required to observe that the infrastructure ahead of the train is available for a train movement before the train passes a lineside indicator or stop board. If the asset is poorly positioned, the driver would not be able to do this from the normal driving position.

Guidance

G C.18.1.2 C18 is present if the position of one or more displays is such that the train driver cannot observe the related infrastructure from the normal driving position.

G C.18.1.3 Examples of where C18 might arise include lineside signs and indicators associated with a locally monitored level crossing.

G C.18.1.4 Options for militating against C18 include:

a) Repositioning the asset to improve visual association.

b) Removing obscuration to improve the line of sight.
Appendix D Guidance on Using Comparison with a Reference System

D.1 General
D.1.1 The content of this appendix is provided for guidance only.

D.2 Introductory guidance
D.2.1 The CSM RA includes three risk acceptance principles:
   a) Use of a code of practice and assessment.
   b) Comparison with a reference system and assessment.
   c) Explicit risk estimation and assessment.

D.2.2 Part 2 of this document sets out a signal sighting assessment process that is consistent with explicit risk assessment and assessment.

D.2.3 Part 3 and Part 4 of this document set out requirements that are suitable for application as codes of practice.

D.2.4 This appendix describes some design solutions that may be suitable as reference systems.

D.2.5 A reference system is a design solution that is known to be capable of controlling the risk associated with a particular hazard, or contributes to it.

D.2.6 Before deciding to use a reference system, it is necessary to confirm, by assessment, to what extent it will control the risk. Any risk that is not sufficiently controlled using the reference system is managed using explicit risk estimation and evaluation.

D.3 Guidance on available reference systems
D.3.1 The reference systems set out in this appendix represent some designs that have been applied to a significant proportion of the GB mainline railway network and are known to result in a compatible asset. Other reference system designs may be available.

D.3.2 Using a reference system is of benefit because it:
   a) Reduces the amount of explicit risk estimation and assessment needed to support a decision that the asset being assessed is compatible with train operations.
   b) Supports consistency across the network or on the route, which militates against compatibility factors C4, C6 and C15.

D.3.3 Before deciding to use a reference system, the SSC should assess which compatibility factors are present at the asset.

D.3.4 Any compatibility factors that are not eliminated or sufficiently militated against using a code of practice or a reference system should be fully evaluated and assessed.
Signal Sighting Assessment Requirements

Performance specification:
Long-range signal: 800 m readable distance
Medium-range signal: 400 m readable distance
Short-range signal: 250 m readable distance

Display elements:
a1 – top yellow of a double yellow signal aspect
a2 – red or single yellow or green aspect

Dimensions (mm):
Display element radius = 105 (+10, -5)
X = 300 (+/- 10%)
Y 1 = 510 (+20,-10)
Y 2 = 300 (+/- 10%)
Y 3 = 180 (+/- 10%)

Figure G 7 Colour light signal head
Signal Sighting Assessment Requirements

(See also figure G 7)

Performance specification:
Readable distance performance is the same as the associated colour light signal head

Dimensions (mm):
X = 300 (+/- 10%)
Y 1 = 734 (+30,-30)
Y 4 = 550 (minimum)

Figure G 8  Junction indicator (position 1 shown)
Signal Sighting Assessment Requirements

Performance specification:
250 m readable distance

Dimensions (mm):
Y 4 = 550 (minimum)

(See also figure G 7)

Figure G 9  Standard alphanumeric route indicator (example indication ‘2’ shown)
Signal Sighting Assessment Requirements

(See also figure G 7)

**Performance specification:**
100 m readable distance

**Dimensions (mm):**
Y 4 = 500 mm (minimum)

*Figure G 10*  Subsidiary position light signal (no route indicator)
Signal Sighting Assessment Requirements

Performance specification:
100 m readable distance (PLS and MARI)

Dimensions (mm):
X = 500 mm (minimum)

Figure G 11  Subsidiary position light signal (with route indicator)

Performance specification:
250 m readable distance

Dimensions (mm)
Where display element radius ≈ 250:
a = 1000 (+/- 100)
b = 500 (+/- 50) (stepped banner repeater signal only)

Figure G 12  Splitting banner repeater indicator
Signal Sighting Assessment Requirements

Figure G 13  A colour light signal positioned on the left hand side of the line

All dimensions in millimetres
(Not to scale)
Figure G 14  A colour light signal positioned above the line
Signal Sighting Assessment Requirements

Performance
Readable distance 100 m (PLS and MARI)

Dimensions:
X and Y are defined by the structure gauge

Alignment:
Aligned towards a train standing at the normal stopping position on the approach side of the signal

Figure G 15  An independent position light signal (with route indicator)
Signal Sighting Assessment Requirements

Figure G 16  A junction splitting distant signal (left hand diverging junction shown)
Signal Sighting Assessment Requirements

![Diagram of signal sighting assessment requirements](image)

- Centre-line
- Structure gauge clearance
- Centre of image
- 2500 (+/- 100)
- Inside edge of left hand running rail
- Top of left hand running rail
- All dimensions in millimetres (Not to scale)

**Figure G 17** Lineside sign (example showing a stop board)
Appendix E  Guidance on Signal Sighting Assessment and Signal Overrun Risk Assessment

E.1  General
E.1.1  The content of this appendix is provided for guidance only.

E.2  The relationship between signal sighting and signal overrun risk assessment
E.2.1  Two assessments are applied before any change to the railway is taken into use:
   a)  Route compatibility assessment.
   b)  The common safety method for risk evaluation and assessment (CSM RA).
E.2.2  For planned changes to a lineside signalling asset, these assessments comprise:
   a)  Signal sighting assessment.
   b)  Signal overrun risk assessment.
E.2.3  The signal sighting assessment provides some of the information needed to answer some of the Vari-SPAD questions, which form part of signal overrun risk assessment.
E.2.4  The requirement for signal sighting assessment may arise either because:
   a)  The plan includes a change to a lineside signalling asset or one of its interfaces.
   b)  Application of the CSM RA identifies that the change has the potential to adversely affect signal overrun risk and signal sighting.
E.2.5  In both cases, the result should be a lineside signalling asset that is known to be compatible with train operations and evidence to support a decision that signal overrun risk is acceptable.

E.3  Compatibility factors and the Vari-SPAD questions
E.3.1  Table G 4 sets out the relationship between the signal sighting compatibility factors and the Vari-SPAD questions and risk examples set out in RIS-0386-CCS. Vari-SPAD questions that are not relevant to signal sighting are shown as ‘not applicable’.
E.3.2  If the SSC decides that a compatibility factor is not eliminated, the Vari-SPAD questions are applied during the signal overrun risk assessment workshop to determine what, if any, additional signal overrun risk control measures are needed.
Signal Sighting Assessment Requirements

<table>
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<th>Compatibility factor reference</th>
<th>Vari-SPAD question</th>
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Table G 4  Compatibility factor / Vari-SPAD question look-up table
Appendix F  Guidance on Field of Vision

F.1 General
F.1.1 The content of this appendix is provided for guidance only.

F.2 Introduction
F.2.1 This appendix aims to provide SSC members with an understanding of the capabilities and limitations of the human visual system that may be relevant when making signal sighting decisions or investigating causes of SPADs.

F.3 Vision and perception
F.3.1 Throughout this appendix, ‘vision’ refers to the actual ‘seeing’ of raw visual information, whereas ‘perception’ refers to the recognition of, or making sense of, that visual information.

F.3.2 Vision is a ‘bottom-up’, or ‘data-driven’ process determined by the physiological function of the eyes and optic nerve. Perception is a ‘top-down’, or ‘conceptually-driven’ process determined by cognitive function and influenced by knowledge and expectation.

F.3.3 Visual illusions like the ‘Necker cube’ (Figure G 18), demonstrate the distinction between ‘vision’ and ‘perception’.

In this example, the raw data of the cube (that is, the lines that make up the cube) are equally visible to the people looking at it, but the perception of the object is ambiguous. For example, people may have different interpretations regarding which way the cube is facing.

Figure G 18  The Necker cube

F.3.4 Figure G 19 shows the same cube drawn with solid walls, which resolves the ambiguity.

Figure G 19  The Necker cube with solid walls

F.4 Introduction
F.4.1 Figure G 20 is an approximation of the behavioural stages involved in the train driving task.
Signal Sighting Assessment Requirements

| Vigilance | Signal sighting is a vigilance task that requires sustained levels of attention and alertness |
| Detection | Visible features of a signal are detected in the environment |
| Recognition | 1. Signal perception – the signal’s form is identified and discriminated from surrounding objects  
2. Association with line – signal is recognised as appropriate to the driver’s route |
| Interpretation | Signal aspect is read and an appropriate response is chosen |
| Action | Driver responds to the signal |

**Figure G 20** Illustration of driver information processing during the signal reading task

F.4.2 Figure G 20 makes the distinction between vision (detection) and perception (recognition):

a) At the detection stage, the raw data are visible to the driver.
b) At the recognition stage, these data are perceived, that is, the asset form is identified and discriminated from its background and the asset is identified as applicable to a particular line.

F.4.3 Consistent with the different meanings of vision and perception, objects can vary in their ‘visibility’ and their ‘perceptibility’.

F.4.4 In terms of signal sighting, readability compatibility factors that affect visibility are those that influence asset detection, which is getting an image onto the observer’s retina.

F.4.5 Whether or not that image is then recognised as a lineside signalling asset and read accurately is determined by the perceptibility of the asset. Both visibility and perceptibility are properties of the asset, its design and its context.

F.5 **Asset visibility**

F.5.1 The effectiveness of an observer’s visual system in detecting the existence of a target asset will depend upon its:

a) Position in the observer’s visual field.
b) Contrast with its background.
c) Luminance properties.
d) The observer’s adaptation to the illumination level of the environment.

F.5.2 It is also influenced by the processes relating to colour vision, visual accommodation, and visual acuity. Each of these issues is described in the following sections.

F.6 **Field of vision**

F.6.1 The field of vision, or visual field, is the area of the visual environment that is registered by the eyes when both eyes and head are held still. The normal extent of the visual field is approximately 135° in the vertical plane and 200° in the horizontal plane.
Signal Sighting Assessment Requirements

F.6.2 The visual field is usually described in terms of central and peripheral regions: the central field being the area that provides detailed information. This extends from the central point (0°) to approximately 30° at each eye. The peripheral field extends from 30° out to the edge of the visual field.

F.6.3 Objects positioned towards the centre of the observer’s field of vision are seen more quickly and identified more accurately because this is where our sensitivity to contrast is the highest. Peripheral vision is particularly sensitive to movement and light.

F.6.4 In Figure G 21, the two shaded regions represent the view from the left eye (L) and the right eye (R) respectively. The darker shaded region represents the region of binocular overlap. The oval in the centre represents the central field of vision.

F.6.5 Research has shown that drivers search for signs or signals towards the centre of the field of vision.

F.6.6 Signals, indicators and signs should be positioned at a height and distance from the running line that permits them to be viewed towards the centre of the field of vision. This is because:

a) As train speed increases, drivers become increasingly dependent on central vision for asset detection. At high speeds, drivers demonstrate a tunnel vision effect and focus only on objects in a field of + 8° from the direction of travel.

b) Sensitivity to movement in the peripheral field, even minor distractions can reduce the visibility of the asset if it is viewed towards the peripheral field of vision. The presence of clutter to the sides of the running line can be highly distracting (for example, fence posts, lamp-posts, traffic, or non-signal lights, such as house, compatibility factors or security lights).

F.6.7 Figure G 22 and Table G 5 identify the radius of an 8° cone at a range of close-up viewing distances from the driver’s eye. This shows that, depending on the lateral position of a stop signal, the optimal (normal) train stopping point could be as far as 25 m back from the signal to ensure that it is sufficiently prominent.

F.6.8 The dimensions quoted in Table G 5 assume that the driver is looking straight ahead. Where driver-only operation (DOO) applies, the drivers’ line of sight at the time of starting the train is influenced by the location of DOO monitors and mirrors. In this case it may be appropriate to provide supplementary information alongside the monitors or mirrors using one of the following:

a) A co-acting signal.

b) A miniature banner repeater indicator.
Signal Sighting Assessment Requirements

c) A right away indicator.

d) A sign to remind the driver to check the signal aspect.

F.6.9 In order to prevent misreading by trains on adjacent lines, the co-acting signal or miniature banner repeater may be configured so that the aspect or indication is presented only when a train is at the platform to which it applies.

F.6.10 ‘Car stop’ signs should be positioned so that the relevant platform starting signals and / or indicators can be seen in the driver’s central field of vision.

F.6.11 If possible, clutter and non-signal lights in a driver’s field of view should be screened off or removed so that they do not cause distraction.

Figure G 22  Signal positioning

<table>
<thead>
<tr>
<th>‘A’ (m)</th>
<th>‘B’ (m)</th>
<th>Typical display positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.98</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1.12</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1.26</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.41</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1.55</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>1.69</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1.83</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>1.97</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>2.11</td>
<td>A stop aspect positioned 3.3 m above rail level and 2.1 m from the left hand rail is within the 8° cone at 15.44 m in front of the driver</td>
</tr>
</tbody>
</table>
Signal Sighting Assessment Requirements

<table>
<thead>
<tr>
<th>'A' (m)</th>
<th>'B' (m)</th>
<th>Typical display positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>2.39</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>2.53</td>
<td>A stop aspect positioned 5.1 m above rail level and 0.9 m from the left hand rail is within the 8° cone at 17.93 m in front of the driver</td>
</tr>
<tr>
<td>19</td>
<td>2.67</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>2.81</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>2.95</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>3.09</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>3.23</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>3.37</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>3.51</td>
<td>A stop aspect positioned 3.3 m above rail level and 2.1 m from the right hand rail is within the 8° cone at 25.46 m in front of the driver</td>
</tr>
</tbody>
</table>

Table G 5 8° cone angle co-ordinates for close-up viewing

F.7 Contrast sensitivity

F.7.1 We see objects not just because of their absolute brightness, but also by their contrast with the surrounding environment. When contrast is high, objects are more conspicuous. The contrast between an object and its background is especially important when we need to detect it from a distance.

![Example of contrast sensitivity](image)

**Figure G 23** Example of contrast sensitivity

F.7.2 In Figure G 23, the white rectangle on the left is more conspicuous than the grey rectangle on the right because it is more highly contrasted with its background.

F.7.3 Object orientation also affects our sensitivity to contrast. Targets that are normally presented (that is, at right angles) create greater contrast between themselves and their background than targets presented at oblique angles.

F.7.4 During the day, the contrast between a dark or cluttered background and a signal may be low, making signals less visible.
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F.7.5 The use of sighting boards with a low level of hardware surface gloss and a contrasting colour can enhance the contrast between signalling displays and light, or cluttered backgrounds. Research has shown that increasing the size of the backboard can also improve visibility through the increased contrast between the asset and its background.

F.7.6 White, or blue and white, borders have been used in the past to try to draw attention to problem signals. However, unless the approach speed is slow (15 mph or under) and the view is uncluttered, borders can have the opposite effect as they merely serve to reduce the apparent size of the backboard, thereby reducing contrast and visibility. This is because of the way the visual system processes light / dark boundaries. Borders can blur into their background unless they are viewed close up. In order to be seen from a distance useful to train drivers, borders would need to be impractically large (approximately 500 mm wide).

F.7.7 If the asset background is dark (such as a structure), a white coloured area located behind a black backboard will draw the driver’s eye to the asset and make it more conspicuous, only if the white area is much larger than the asset. An example is shown in Figure G 25.
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Figure G 25  Example of a white painted background to enhance signal conspicuity

F.7.8  Assets should be oriented towards the direction of approach for as much of the approach time as possible. This enhances the contrast between the asset and its background.

F.8  Luminance sensitivity

F.8.1  The brighter a light source, the further the distance from which it can be seen. Brightness refers to the luminous intensity of the light emitted from a target. Research has shown that observers are more sensitive to spots of light when background illumination is low (for example, night-time darkness).

F.8.2  The luminous intensity of all lit signal aspects and indications is part of the product specification and the requirements set out in GKRT0057.

F.8.3  The luminous intensity for lit displays has to support readability in daylight conditions. However, because lit displays appear brighter against a dark background, they may dazzle drivers in night-time conditions. This effect is exacerbated by dark adaptation. This is thought to be a particular problem with LED displays, the luminance intensity of which is greater than traditional filament bulbs.

F.8.4  It may be appropriate to consider running LED signals at reduced power at night.

F.9  Light adaptation

F.9.1  Sensitivity to light depends on the eye’s state of adaptation. The visual system takes time to adjust after a change in illumination level. The eyes are least sensitive to spots of light (for example, signal aspects) immediately after the change. Humans adapt to scotopic (monochromatic) stimuli rapidly, typically within 200 ms; however, it takes several seconds for the eyes to accurately see objects in colour, reaching a maximum sensitivity after around three minutes, and levelling off after 10 minutes.
Positioning assets close to tunnel exits should be avoided. The degree of light adaptation depends on tunnel length, whether or not there is lighting in the tunnel, and environmental conditions (brightness and direction of sunlight); but as a general rule, if a train will be in a dark tunnel for five minutes or more, lineside signals and indicators should be positioned at least five seconds beyond tunnel exits to allow a degree of adaptation to occur. For example, for a permissible speed of 60 mph, this equates to a distance of just over 134 m.

F.10 Colour vision

F.10.1 Colour vision helps an observer to distinguish between an object and its background and makes it easier to discriminate object details.

F.10.2 There are two types of visual receptor cells in the retina: cones and rods. The cones are specialised for colour vision and for sharpness of vision. There are three types of cone in the eye, which are sensitive to each of the three primary colours: red, green and blue. Many stimuli activate two or three cone types, enabling us to see other colours.

F.10.3 We are differentially sensitive to colours of different wavelengths. The human eye is most sensitive to yellow and green light, and least sensitive to blue and red light.
F.10.4 The colour appearance of an object varies depending on the conditions under which it is viewed. Coloured objects or lights can be perceived as having changed colour with changes in illumination level. At night, because of the distribution of colour receptors in the retina, small or distant objects can occasionally ‘lose’ their colour. This is a particular problem with yellow lights, which might be confused for white lights and vice versa.

F.10.5 Colour blindness is the inability to differentiate between certain colours. This is an inherited disorder and affects men more commonly than women. The most common type is red-green colour blindness. This occurs in 8 percent of males and 0.4 percent of females. It occurs when either the red or green cone cells are not present or not functioning properly. People with this disorder are not completely unable to see red or green, but often confuse the two colours.

F.10.6 Red signal aspects may be less noticeable to drivers than green or yellow signal aspects. This may give rise to ‘read-across’ or ‘read-through’ errors to less restrictive aspects, as drivers may differentially pick up the most visible signal.

F.10.7 Signal aspects may appear to be a different colour in bright sunlight. At night, there may be a risk from misreading a white non-signal light as a yellow aspect and vice-versa.

F.10.8 Signal overrun investigations consider the possibility of ‘read-across’ or ‘read-through’ to yellow and green aspects.

F.10.9 Lit signals and indicators can be fitted with hoods.

F.10.10 Signal-like lights in the driver’s field of view are screened off, wherever possible.

F.11 Afterimages

F.11.1 Afterimages are seen under a variety of conditions when one visual stimulus field is followed by a second visual stimulus field. If you stare at a shape of a given colour for several seconds, then shift your gaze away you will see a negative afterimage.
Signal Sighting Assessment Requirements

For example, stare at the red dot on the left for about eight seconds, then blink and look elsewhere at this page. A green afterimage will appear.

F.11.2 Under normal conditions, afterimages do not intrude on visual processing. However, an observer exposed to a relatively bright source of light, especially at night, may experience afterimages that may be confused with the actual signal.

F.11.3 Drivers occasionally report seeing red signals change to green when they have been staring at them for a while. It is plausible that what they might actually be seeing is an afterimage.

F.11.4 Signal overrun investigations consider the possibility that a driver’s reading of a signal aspect may have been affected by afterimages.

F.12 Visual acuity

F.12.1 Visual acuity (or spatial resolution) is the human ability to discriminate very fine or small detail, and is achieved using a part of the retina called the fovea.

F.12.2 Normal visual acuity (20/20 vision) is usually defined as the ability to resolve a spatial pattern separated by a visual angle of one minute of arc. The spatial resolution limit is derived from the fact that one degree of a scene is projected across 288 micrometres of the retina by the eye’s lens. In these 288 micrometres, there are 120 colour sensing cone cells. Therefore, if more than 120 alternating white and black lines are crowded side-by-side in a single degree of viewing space, they appear as a single grey blob to the human eye.

F.12.3 A person with normal visual acuity (that is, 20/20 vision) is just able to decipher a letter that subtends a visual angle of 5 minutes of arc (written 5’) at the eye (5’ of arc is 5/60 of a degree). It does not matter how far away something is from the eye; if it subtends an angle of 5’ of arc at the eye, then a person with 20/20 visual acuity should just be able to determine what it is. However, this is only a threshold value. Reliable letter discrimination requires a much bigger angle, for example 20’, and certainly no smaller than 16’.

F.12.4 Visual acuity is superior for objects that are presented in the central field of vision, and for objects that are highly illuminated. Visual acuity decreases as velocity between object and observer increases. However, the ability to resolve fine detail of moving targets improves rapidly with practice.

F.12.5 Drivers should be able to distinguish detailed features of signals, indicators and signs more effectively in daylight conditions than in night-time conditions, and more effectively at lower speed, than at higher speeds. Lineside signs that contain lettering or numbering are only useful to the driver if the characters can be discriminated from a distance. Assets should be located in the driver’s central field of vision.

F.13 Visual accommodation

F.13.1 The eye can only focus at one distance at any given moment. Objects at other distances will be blurred; with the degree of blur increasing the further objects are from the point of focus.

F.13.2 Focus is accomplished in the eye by changing the curvature and centre thickness of the lens, a process called accommodation. To focus on a distant object, the lens flattens, causing the refractive power of the eye to decrease. To focus on a nearby object, the curvature of the lens increases, raising total refractive power and maintaining image sharpness.
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F.13.3 The adjustment of the eye to focus on an object at one distance, and subsequently on another at a different distance, takes time. With age, our ability to accommodate near and far objects deteriorates. For example, research has shown that, on average, a 28-year-old can adjust accommodation from infinity to a fixed 25 cm viewing distance in 0.8 seconds, whereas a 41-year-old takes around two seconds to complete the same task. It is likely that accommodating continuous and rapidly changing viewing distances (such as those encountered in train driving) takes longer than this, but information on this is still very limited. Errors in accommodation are least likely when an object is well illuminated, for example, in daylight.

F.13.4 Considerations underpinning the BRT values set out in section 3.3 include the age range of drivers and how deteriorating vision can affect the ability of older drivers to focus on signals, especially at higher speeds. Older drivers may have difficulty in accommodating signals, particularly at high train speeds.

F.14 Perception of signals

F.14.1 An observer’s ability to interpret visual stimuli is influenced by knowledge and expectation.

F.14.2 The interaction between top-down and bottom-up processing is such that object size and contrast will facilitate its perception as a foreground object, and a variety of cues from the environment are used to enable judgement of distance, form, visual patterns, and position.

F.14.3 Sections F15 to F17 examine the perceptual processes that may influence a driver’s ability both to identify a signalling asset, and to accurately associate it with the appropriate route. This is particularly relevant when making signal sighting decisions about parallel signals.

F.15 Distance perception and size constancy

F.15.1 Humans are able to judge the absolute distance and relative distance of objects.

F.15.2 Absolute distance refers to the distance away from the observer that an object is located, for example, how far away a particular signal is from the train.

F.15.3 Relative distance refers to the distance between two objects, for example the distance between a line and a signal.

F.15.4 To determine an object’s distance from us or from another object, we use cues from the visual system. Monocular cues are those that only require the use of one eye. Binocular cues require the two eyes to be used together. Oculomotor cues depend on the sensation of muscular contraction of the muscles around the eye, as used in accommodation.

F.15.5 The relative size of retinal images can be thought of as a cue for distance perception. However, if you watch a person walk down a road, he or she does not appear to shrink to half size each time their distance from you doubles. The traditional view of why this is so is that the brain takes account of the perceived distance of an object and scales up perceptual size accordingly. An alternative view is that we judge the size of objects by the scale of their backgrounds.
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This is demonstrated by the picture on the left (known as the Ponzo illusion). The top white line looks larger because we are using the scale of its background to judge distance and perspective. The two lines are actually identical. The illusion is said to arise because we are applying the normal size constancy mechanism in an inappropriate situation.

**Figure G 28** The Ponzo illusion

F.15.6 Knowing how large assets are, the size of the image that an asset casts on the retina should enable the driver to assess how far away the signal is.

F.15.7 Similarly, familiarity regarding the brightness of a lit display, asset position and spacing provides the driver with distance cues.

F.15.8 The lack of visual cues present in dark conditions, for example, in a tunnel makes it more difficult for a driver to accurately judge speed and braking distance.

F.15.9 Incorrect signal intensity can exacerbate ‘read-ahead’, ‘read-through’, or ‘read-across’ if drivers misinterpret brighter signals to be nearer.

F.15.10 Uneven signal spacing confounds driver expectation and can result in signals being missed, or braking distances being misjudged. Drivers’ route knowledge should, in part, mitigate this problem.

F.15.11 The distance to signals positioned on the other side of the line may be more difficult for drivers to judge.

F.15.12 Successive signals for the same direction of traffic flow should be reasonably consistent in form. Consistency in all aspects of signal design should facilitate the driver’s ability to accurately assess the distance of signals, and subsequent association of signals with lines.

F.15.13 The provision of visual cues in the form of retro-reflective countdown markers in tunnels may be beneficial in enabling drivers to more accurately judge their speed and braking distance to a signal ahead.

**F.16 Motion parallax**

F.16.1 Motion parallax refers to the relative movement of images over the retina. If two objects are moving left to right across the line of vision at the same speed but one object is much further away, the image cast by the nearest object would move much further across the retina than would the image cast by the more distant object.
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F.16.2 Motion parallax may cause adjacent parallel signals to appear to change position as the driver rounds bends on a curved approach. A curved approach to signals can result in ‘read across’ to the incorrect signal.

F.16.3 Positioning signals on bends should be avoided. If this is not possible, efforts should be made to ensure that parallel signals can all be seen at the same time on approach to prevent ‘read across’ errors.

F.17 Pattern matching

F.17.1 Humans are very good at matching patterns, and are able to identify any anomalies in a pattern quickly and with precision. By making one part of a pattern different, its conspicuity should be greatly enhanced.

F.17.2 Changing a signal’s appearance in some way could enhance the speed with which a driver could identify it. This could be beneficial in aiding the identification of multi-SPAD signals that are positioned on a gantry of three or more parallel signals.

F.17.3 Changing the profile of a signal from adjacent parallel signals could be achieved in a number of ways. Modifying the size of the signal backboard is one suggestion; another may be the addition of a line identify sign directly above the signal. This may be particularly useful in locations where there are a large number of parallel lines and it is difficult to associate a signal with its appropriate line.

F.17.4 Staggering signals on a gantry has been the subject of some research. It has been found to be a useful cue under certain circumstances. As long as the full MRT is unobstructed for all signals on the gantry, staggering signals has been demonstrated to aid earlier sighting. However, if these sighting conditions are not met, staggering has been shown to induce ‘read-across’ errors.

Figure G.29 Example of signal staggering
Appendix H  Guidance on Cab Vision Plots

H.1  General
H.1.1  The content of this appendix is provided for guidance only.

H.2  Introduction
H.2.1  Cab vision plots assess the impact of the cab structure on lineside signalling asset visibility. The plot provides data to support SSC decisions about how close a train can approach a lineside signalling asset before the cab structure causes an obscuration.

H.2.2  The cab vision plot requirements for each project should take account of:

a)  The rolling stock operated on the route because the cab design, cab structure, seat position and adjustability vary between vehicle types.

b)  The variability in the position relative to the track of the lineside signal assets that need an assessment.

H.2.3  Cab vision plots can be developed for either:

a)  Specific lineside signalling assets.

Or

b)  All lineside signalling assets.

H.2.4  A signal sighting simulation tool may include functionality that supports the assessment of the impact of the cab structure on the visibility of signals.

H.2.5  The limitation on vision to the side is likely to be affected most by the forward / backward position of the seat, while vision above is affected by all adjustment factors. Vision plots should incorporate the range of eye positions described. The most demanding combinations are likely to be as shown below:

<table>
<thead>
<tr>
<th>Asset position</th>
<th>Driver / position</th>
</tr>
</thead>
<tbody>
<tr>
<td>To the side of the line</td>
<td>Tall driver, seat fully raised and back</td>
</tr>
<tr>
<td>Above the line</td>
<td></td>
</tr>
<tr>
<td>At ground level</td>
<td>Short driver, seat fully lowered and back</td>
</tr>
</tbody>
</table>

H.2.6  Anthropomorphic data providing statistics on body dimensions normally use a 5th percentile female as the short person and a 95th percentile male as the tall person. These figures are recommended for use in vision plots. Specific anthropometric data is available from sources such as the Open Ergonomics People-size software.

H.3  Asset specific cab vision plot
H.3.1  An asset specific plot may be quicker to complete and easier to arrange, but the output data is valid only for the assessed asset and any other similar assets located in approximately the same position relative to the track.

H.3.2  An output data include the minimum distance from the asset that the train can approach before the driver potentially loses visibility.

H.4  Generic cab vision plot
H.4.1  The generic assessment may take more time to complete and requires a more sophisticated tool, but has the benefit of wider re-use.
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H.4.2 The output data is typically presented as a diagram showing the limits of visibility through the cab windscreens, expressed in degrees of angle from the driver’s straight ahead view, both horizontally and vertically.

H.4.3 Further calculation, using trigonometry, is needed to determine the minimum distance from the asset that the train can approach before the driver potentially loses visibility.

H.5 Further research

H.5.1 RSSB research project T1026 ‘Evaluation of signs, markings and audible announcements at platforms’, is developing methods of assessment for platform signs (for example, platform stop markers) and a selection of rolling stock and platform layouts.

H.5.2 The output of this research should identify how cab vision plots can be used to optimise the position of platform signs taking account of the constraints of cab structure, seat position and adjustability, and the variations in users sitting eye heights (using anthropometric data).
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Definitions and Abbreviations

**Assessed speed**
The maximum speed that a particular category of train will approach a lineside signalling asset, taking account of the information available to the driver (for example, the signal aspect sequence).

**Asset configuration**
The designed configuration of a lineside signalling asset, including:

a) Asset element type(s).
b) Layout and alignment of asset elements.
c) Position of the asset relative to the line.
d) Position of signalling displays presented by the asset.
e) Structure.

**Asset element**
A part of a lineside signalling asset (for example, a junction indicator).

**Attainable speed**
The highest speed value that any train can approach a lineside signalling asset, taking account of acceleration performance.

**Authorised user**
A person authorised to carry out one or more operational roles defined in GERT8000 Rule Book. Authorised user roles include driver, shunter, guard and platform staff.

**Baseline response time (BRT)**
The minimum time value that can be used by the SSC to specify the MRT for a particular signalling asset type.

**Cab vision plot**
A means of identifying the restrictions to view imposed on a driver by the cab structure.

**CCS system**
The control, command and signalling system. The CCS system includes signalling, train protection, train detection and communications functionality.

**Compatibility**
An ability of two or more subsystems, or parts of them, which have at least one common interface, to interact with each other while maintaining their individual design operating state and their expected level of performance.

**Compatibility factor**
A factor presented within the railway, its environment or its operational context that has the potential to adversely affect the risk arising from the hazard: Incompatibility of a lineside signalling asset with train operations.

**Complex asset**
A lineside signalling asset made up of multiple asset elements that generate a display combination (for example, a signal aspect and route indication, splitting distant signal aspect).
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CSM RA

Display (noun)
The overall appearance of the image generated by a lineside signalling product or asset, including: signal aspects, indications, signs and images presented by platform monitors and mirrors.

Drive / train driving
The human tasks and processes necessary to control the movement of a train in accordance with operating rules and procedures.

Driveability
The ease and reliability that drivers are able to perform the train driving process in accordance with rules and procedures, throughout the range of operational and ambient conditions applicable to each train, within the operational context and while performing typical required duties.

Driveable
A capability requirement of the lineside signalling system to provide drivers with enough information to support their compliance with the train driving rules and procedures.

IM
Infrastructure manager.

Indicator
A lineside signalling asset that is capable of presenting a signalling indication.

Interpret / interpreting (signalling system displays)
The action of understanding the information conveyed by the lineside signalling display or display combination after it has been read (for example, understanding that a red aspect means ‘limit of MA’).

Interpretability
The ease and reliability with which signal aspects and indications can be interpreted by a driver throughout the range of operational and ambient conditions applicable to that feature, within the operational context and while performing typical required duties. This ranges from never interpretable to always interpretable.

Interpretable (signalling system displays)
The extent to which the information conveyed by a signal aspect or indication can be reliably interpreted, ranging from not interpretable to easily interpretable.

Lineside operational sign
A sign that conveys information needed to support the operation of trains.

Lineside signalling asset
Any of the following:

a) A lineside signal, indicator or lineside operational sign (excluding signs associated with a temporary speed restriction).

b) A mirror or monitor that forms part of a train dispatch system.

c) Switches, plungers, signs and indicators that form part of a train dispatch system and which are used by platform staff.
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**Maximum train speed \(v(\text{max})\)**
The assessed highest approach speed of any train at any time. This may be the permissible speed, the attainable speed or the assessed speed.

**Minimum readable distance (MRD)**
The readable distance value for an asset that is calculated to provide the minimum response time (MRT), taking account of the maximum train speed.

**Minimum response time (MRT)**
The assessed minimum time needed by a driver (or other authorised user) to respond to the information presented by a specific lineside signalling asset, taking account of the following human tasks:

- a) Read the display or display combination.
- a) Interpret the display or display combination.
- b) Assimilate all of the available information.
- c) Decide what action to take (if any), and when it needs to be taken.
- d) Take the action, where necessary, before the train passes the asset.

\[
\text{MRT} = \text{BRT} + \text{SRT}. 
\]

**Most restrictive display / signal aspect / indication**
The display that conveys the most restrictive information at that asset.

**Movement authority (MA)**
The permission for a particular train to run to a specific location within the constraints of the signalling system.

**Obscuration (lineside signalling asset)**
A condition where 10% or more of a single light source, group of light sources, semaphore signal arm / disc or sign that make up all or part of a signal aspect, indication or lineside operational sign is not visible for all or part of the required reading time. A partial obscuration is where between 70% and 90% is visible. Anything less than 70% visible is considered to be a complete obscuration.

**Obscuration time**
The time period associated with each obscuration experienced by the driver when the train is moving.

**Operating task**
A task directly associated with the operation of a train (for example, train driving, train dispatch, shunting).

**Operational context**
The operational features of the external environment that influence compatibility, including train operations, station operations and infrastructure operations.

**Perception**
The recognition of, or making sense of, visual information. Perception is a ‘top-down’, or ‘conceptually-driven’ process determined by cognitive function and influenced by knowledge and expectation.
Signal Sighting Assessment Requirements

Read (signalling system displays)
The process of detecting, identifying and distinguishing the relevant lineside signalling display or display combination. Reading is a precondition to a driver interpreting the information conveyed by the lineside signalling system.

Readability
The ease and reliability with which signal aspects and indications can be read by a driver throughout the range of operational and ambient conditions applicable to that hardware, within the operational context and while performing typical required duties. This ranges from never readable to always readable.

Readable (signalling system displays)
Lineside signalling displays are readable when a driver, who meets the minimum eyesight and competence requirement for their role, is able to reliably read each individual aspect or indication presented by the signalling system throughout the range of operational and ambient conditions applicable to that hardware, within the operational context and while performing their required duties.

Readable distance
The attribute of a lineside signalling asset that describes the distance range within which an authorised used can read the presented display(s).

Reading-through
A driver reading a signal aspect that does not apply to the train being operated.

Required readable distance (RRD)
The readable distance that is maintained for each lineside signalling asset. This may be equal or greater than the MRD for that asset.

RU
Railway undertaking.

Signal
A lineside signalling asset that presents a signal aspect.

Signal aspect / indication
A display of specified appearance that is used to convey a specific set of information to an authorised user (see GKRT0058).

Signal sighting
Compatibility of a lineside signalling asset with train operations.

Signal sighting assessment
The process of assessing the compatibility of lineside signalling assets with train operations.

Signal sighting committee (SSC)
A team of assessors that provides the minimum competence and information about the lineside signalling system operational context necessary to reach an informed assessment decision on what needs to be done to achieve compatibility of a lineside signalling asset with train operations.

Signal sighting form
The formal record of a lineside signalling asset, including its design configuration and readability performance.

Signalling product
A product that conforms to the requirements set out in GKRT0057 or GIRT7033.
Signal Sighting Assessment Requirements

Simple asset
A lineside signalling asset made up of one element that generates only one display at a time, all of which have similar readability performance (for example, a 4-aspect colour light signal).

Supplementary response time (SRT)
The assessed amount of extra time that the SSC adds to the BRT to determine the MRT value for a specific lineside signalling asset.

Total obscuration time
The sum of obscuration times on each signalled approach to a lineside signalling asset.

v(max)
The assessed highest approach speed of any train at any time. This may be the permissible speed, the attainable speed or the assessed speed.

Vari-SPAD
‘Variable SPAD Probability Model’. A series of structured questions used to support the signal overrun risk assessment set out in RIS-0386-CCS.

Vision
The actual ‘seeing’ of raw, visual information. Vision is a ‘bottom-up’, or ‘data-driven’ process determined by the physiological function of the eyes and optic nerve.
Signal Sighting Assessment Requirements

References
The Catalogue of Railway Group Standards gives the current issue number and status of documents published by RSSB. This information is also available from www.rssb.co.uk/railway-group-standards.

RGSC 01 Railway Group Standards Code
RGSC 02 Standards Manual

Documents referenced in the text

Railway Group Standards
GCRT5021 Track System Requirements
GCRT5212 Requirements for Defining and Maintaining Clearances
GERT8000 Rule Book
GIRT7033 Lineside Operational Safety Signs
GKRT0057 Lineside Signal and Indicator Product Design and Assessment Requirements
GKRT0058 Lineside Signal Aspect and Indication Requirements
GKRT0192 Level Crossing Interface Requirements
GMRT2149 Requirements for Defining and Maintaining the Size of Railway Vehicles
GMRT2161 Requirements for Driving Cabs of Railway Vehicles

RSSB documents
GKGN0645 Guidance on Lineside Signals, Indicators and Layout of Signals
GKGN0657 Guidance on Lineside Signal and Indicator Product Design and Assessment Requirements
GKGN0658 Guidance on Lineside Signal Aspect and Indication Requirements
HEL 2003b Human Engineering reports 'Cognitive Task Analysis for Signal Sighting Hazards' (HEL/RSSB/03862/RT1) and 'Examination of the MRT Survey Data' (HEL/RSSB/03996/RT1)
RIS-0386-CCS Rail Industry Standard on Signal Overrun Risk Evaluation and Assessment
RIS-0703-CCS Signalling Layout Assessment Requirements [in preparation, will replace some parts of GKGN0645 when published]

Other relevant documents

Railway Group Standards
GERT8040 Low Adhesion between the Wheel and the Rail – Managing the Risk

RSSB documents
Taking Safe Decisions: How Britain’s railways take decisions that affect safety

Technical Specifications for Interoperability
2012/757/EU Operation and Traffic Management TSI (OPE)