

Signal Sighting


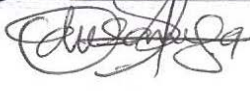
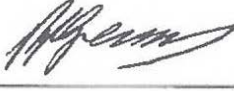
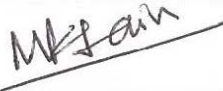
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Rail Commissioner

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1. Introduction

The Department of Planning, Transport and Infrastructure (DPTI) owns, operates and maintains the Adelaide Metropolitan Passenger Rail Network (AMPRN) under the Rail Accreditation assigned to the Rail Commissioner. This document forms part of the Engineering Management System (EMS) and is intended to ensure that the signal sighting process does not introduce any risks not deemed to meet the So Far As Is Reasonably Practicable (SFAIRP) principles under Rail Safety National Law (RSNL).

2. Purpose

This standard specifies the requirements for Signal Sighting on the AMPRN.

Application of this standard will ensure that drivers' visibility on the approach to signals is maximised.

In addition guidance on the positioning of signals and other relevant signalling information is provided.

3. Scope

This standard applies whenever signal sighting is required. There are two main reasons for instigating the signal sighting process, these are:

1. 'New Works Signal Sighting': To sight one or more new or altered signals.
2. 'Investigative Signal Sighting': To investigate actual or perceived issues associated with one or more existing signals.

The signal sighting methodology and guidance contained in this standard refers to the formal process of convening a Signal Sighting Committee (SSC), carrying out signal sighting on site, and compiling a Signal Sighting Workbook (SSW). It does not preclude the necessity for ongoing vigilance by projects and maintenance to ensure that the visibility of signals is not compromised.

This standard does not mandate retrospective signal sighting of all or any signals.

4. Related Documents

DOCUMENT NAME	DOCUMENT NUMBER
Signal Sighting Form	FO-EM-SE-985 (KNet # 10914784)

5. References

- *AS7721 Lineside Signals, Indicators and Signal Signage*
- *AS7631 Railway Infrastructure - Sighting*
- 735-A3-2008-023 Standard Right-Of-Way Cross Section (KNet # 10832968)
- 301-A2-89-2239 S.T.A Allowable Infringements Minimum Structures – 1600mm Gauge (KNet # 10075556)
- FR-AM-GE-806 Identification and Numbering of Technical Documents and Drawings

6. Acronyms

ACRONYM	FULL NAME
AMPRN	Adelaide Metropolitan Passenger Rail Network.
AWS	Automatic Warning System.
IRJ	Insulated Rail Joint
LED	Illuminated by Light Emitting Diodes (not an incandescent lamp).
SPAD	Signal Passed at Danger.
SSF	Signal Sighting Form
SSC	Signal Sighting Committee
SSW	Signal Sighting Workbook

7. Definitions

TERM	DEFINITION
Alignment	Adjustment of a signal head such that its beam of light is pointing at the Sighting Point.
Approach speed	Usually line speed but may be attainable speed.
Aspect	A legitimate visual indication given by a signal to a driver.
Attainable speed	The maximum speed that any rolling stock authorised to use a route could legitimately achieve on approach to a signal.
Back board	The part of a signal head that shrouds the aspects to eradicate distractions beyond the signal.
Blind	An independent structure intended to screen the view of a signal not applicable to drivers approaching on other lines.
Braking point	The point on the approach to a red signal that a driver must start braking in order to stop at the signal under service braking.
Call-On Class route	A route which applies to low speed moves into an occupied section, e.g. to join units in a platform or to attach a locomotive. The proceed aspect is normally displayed by a Position Light Signal (PLS).
Cant	A track geometric parameter describing the difference in height between rails on a curve. Rolling stock leans toward signals or away from signals on canted curves.
Committee Member	A competent member of an SSC.
Conflict point	A point within a route from a signal, including any overlap or overlaps, at which a conflict between two or more trains or other objects may occur. This includes, but is not limited to: facing points, trailing points, buffer stops, etc.
Curvature	A track geometric parameter describing a curve in terms of its radius in meters. Track curves cause the centre of vehicles to be offset towards signals or away from signals (centre throw). The minimum structural clearance is increased when a signal is positioned on the inside of a curve to allow for centre throw and cant.
Form (of a signal)	The combination and arrangement of those constituent components capable of displaying information to drivers that make up a signal.

Hood	The part of a signal head that shades the aspects from sources of extraneous light such as sunlight. Extended hoods may be used where extraneous light is particularly problematic.
Incandescent Signal	A signal that uses traditional incandescent lamps to produce its beam.
Investigative Signal Sighting [Committee]	Signal sighting initiated for investigative purposes, e.g. to look into driver allegations or after a SPAD. [A Committee convened for the purpose of Investigative Signal Sighting].
Lateral position (of a signal)	This measurement has two components: 1) the horizontal distance of a signal's most restrictive aspect from the centre line of the track to which the signal applies and 2) the vertical height of a signal's most restrictive aspect from the top of the nearest rail.
LED Signal	A signal that uses LEDs to produce its beam.
Longitudinal position (of a signal)	The position of a signal along the track.
Main Colour Light Signal (CLS)	The type of signal used to display medium and normal speed aspects for all main class routes.
Main Class route	A route which applies to medium or normal speed moves. The aspect is normally displayed by a Main CLS.
Miniature Route Indicator (MRI)	The type of route indicator normally used for low speed moves associated with shunt or call-on class routes. The indication is displayed in the form of small alpha-numeric characters. (Colloquially known as a 'stencil').
Minimum Reading Distance	The distance equivalent of the MRT calculated at the approach speed.
Minimum Reading Time (MRT)	The assessed minimum time required for a driver approaching a signal to: <ol style="list-style-type: none"> 1. Identify that the signal applies to them. 2. Read the signal. 3. Interpret the signal. 4. Prepare to react if necessary.
MRT Form	A form used to assess the MRT of a signal. A component of the Signal Sighting Workbook (SSW). Appendix B contains an example MRT form. An electronic copy in excel format is available from DPTI on request.
New Works Signal Sighting [Committee]	Signal sighting initiated for the purpose of finalising signalling design office derived positions of one or more signals on site. This is a standard part of the signalling scheme design process and must take place before the scheme plan is approved. [A Signal Sighting Committee convened for the purpose of new works signal sighting].
Position (of a signal)	A combination of the longitudinal position and the lateral position of a signal.
Position Light Signal (PLS)	The type of signal used to display low speed aspects for all shunt and call-on class routes.
Position Light Junction Indicator (PLJI)	The type of route indicator normally used for main class routes. The indication is given as a row of 5 white lights angled in the direction of the divergence.
Readable	Visibility in terms of reading time and reading distance.
Read-across	The phenomenon of drivers incorrectly identifying which of two or more parallel signals is applicable.

Read-through	The phenomenon of drivers seeing a signal beyond the next signal ahead and reading its aspect instead of the aspect of the next signal ahead.
Required Reading Distance (RRD)	The distance equivalent of the RRT calculated at the Approach Speed.
Required Reading Time (RRT)	The assessed MRT plus any additional reading time that can reasonably be achieved and maintained. Wherever possible MRT should be improved upon such that RRT is greater than MRT as often as possible.
Scheme Plan	A signalling design office derived scaled schematic representation of any signalling scheme design. It is based on the master signalling plan and shows new work in red and recoveries in green.
Shunt Class Route	A route which applies to low speed non-passenger moves. The proceed aspect is normally displayed by a Position Light Signal (PLS).
Sighting Boards	Sighting boards are independent structures that supplement (or replace) the back board of a signal where background light is particularly troublesome.
Sighting Point	The point at which a signal's beam is aligned.
Sight Line	The view a driver has of a signal on the approach to the signal.
Signal Passed at Danger (SPAD) ¹	Unauthorised passing of a signal displaying a stop indication as follows: <ol style="list-style-type: none"> 1. Completely missed; or 2. Driver misjudgement; or 3. Restored as train approached; or 4. Other.
Signal Sighting	Signal Sighting is the formal process of convening an SSC to sight one or more signals and produce an SSW. It can take place for two reasons: <p>'New Works Signal Sighting' to finalise the positioning of new signals on a scheme plan.</p> <p>'Investigative Signal Sighting' to investigate the effectiveness of an existing signal.</p> <p>Note: Signal sighting, as described in this standard, does not describe the ongoing requirement for continuous consideration of the effects a project may have on the sighting of signals throughout the lifecycle of the project.</p>
Signal Sighting Form (SSF)	A form used to identify the main positioning and dimensional parameters for a signal. A component of the SSW.
Signal Sighting Report (SSR)	An SSR is a transcript of the options considered by the SSC, including those accepted and those rejected, explaining how decisions were made. <p>It is very often the case that an apparently obvious solution has to be abandoned for some reason identified on site. The SSR helps the checker and reviewer to understand how the final solution was reached and, therefore, to verify that it is appropriate.</p> <p>A component of the SSW.</p>
Signal Sighting Workbook (SSW)	An SSW is the final product of the signal sighting process. An SSW is produced by the Signal Sighting Committee for each signal. The SSW for each signal contains one or more SSFs, one or more MRT forms and an

¹ AS7721 *Lineside Signals, Indicators and Signal Signage*

	SSR.
Standard Route Indicator (SRI)	A type of route indicator used for medium and normal speed moves associated with 'Main' class routes. The indication is displayed in the form of one or more large alpha-numeric characters. (Colloquially known as a 'theatre').
Target	A simulated signal used during signal sighting consisting, as a minimum, of a red aspect painted on a black background and typically mounted on a series of poles that slot together to allow different heights to be simulated.
Stop Signal	A signal or other device that can convey a stop instruction to a driver. Stop signals may be Absolute or Permissive.
Visibility	Ability to provide a clear unobstructed view.

8. The Signal Sighting Committee

8.1. General

A Signal Sighting Committee (SSC) consisting of competent signal sighting Committee Members and facilitated by the Chairperson shall be convened whenever signal sighting is required.

The SSC shall collectively hold the competencies required to make recommendations regarding the most appropriate and safest position for the signal in question and have the ability to consider the following:

1. Longitudinal and lateral positioning of signals.
2. The form of new or altered signals.
3. The alignment of signals (horizontally and vertically and for close up viewing).
4. The Required Reading Time (RRT) for signals (including allowances for any obstructions).
5. Train dispatch arrangements.
6. Maintainability.
7. Likelihood of a Signal Passed at Danger (SPAD).
8. Consequence of a SPAD.
9. The effects of gradients.
10. The effects of speed changes.
11. Route indications, aspect sequences and irregular signal spacing.
12. All types of trains authorised to use the route.
13. Structure gauge.
14. Overhead Line Equipment (where applicable).
15. Electromagnetic compatibility.
16. Local history of driver allegations, SPADs, vandalism, etc.
17. The effects of other trains on parallel tracks.
18. Track conditions, e.g. greasy rails, wet rails, leaf fall, etc.
19. Safe use of any driver operated line-side equipment.
20. Human factors.
21. Any other factor or factors that arise during preparations for formal signal sighting.

The final agreed form and position of the signal should always be better than minimum tolerances.

Signal sighting is not an exact quantitative process. Much of the input data is opinion and experience based and, therefore, subjective and qualitative in nature. An SSC must:

- Include members with appropriate knowledge and experience to provide the required input data.
- Be facilitated by the Chairperson who must make sure that the opinions and expertise of all Committee Members are considered.

The following shall be represented on the SSC:

Always:

- Railway Operations (with knowledge of train running patterns including perturbed working and knowledge of the Signaller's role and interface).
- Train drivers (with relevant route and traction knowledge and from all organisations that operate on the line).

- Signal Engineering (with knowledge of the layout and able to consider design, construction and maintenance issues). Signal engineering is normally represented by the Project Signalling Designer for new works signal sighting and/or a Signalling Engineering / Maintenance Representative for investigative signal sighting.

Not always (but as appropriate on a signal by signal basis):

- Signalling Construction.
- Track Engineering.
- Civil Engineering.
- Electrification Engineering.
- Human Factors expert (if required).
- Investigator (in case of a SPAD or other incident)
- Any other person or persons deemed appropriate by the SSC.

8.2. Roles and Responsibilities

8.2.1. Chairperson - Signal Sighting Committee

The Unit Manager, Train Operations and Manager, Signals and Control System Engineering are jointly responsible for the appointment of the Chairperson who will oversee the signal sighting process by convening and chairing the Signal Sighting Committee.

The Chairperson determines and changes, as necessary, the composition of the SSC. The Chairperson also ensures that the operational requirements of the infrastructure and the interface with the signalling system are considered.

The key objective of the Chairperson is to produce a Signal Sighting Workbook (SSW) that identifies an agreed form and position for each signal which is, in the considered opinion of the SSC, safe So Far As Is Reasonably Practicable (SFAIRP). Each SSW shall contain:

1. One or more final Signal Sighting Forms (SSFs) signed by the Chairperson and all Committee Members.
2. One or more Minimum Reading Time (MRT) Forms.
3. A Signal Sighting Report (SSR).

The Chairperson is also responsible for forwarding approved SSWs to the relevant stakeholders.

8.2.2. Unit Manager, Signals and Control System Engineering

The Unit Manager, Signals Engineering or delegate allocates resources with signals engineering expertise to the signal sighting process undertaken by the Signal Sighting Committee.

The Unit Manager, Signals Engineering or delegate shall independently review and check all signal sighting calculations in final Signal Sighting Forms (SSFs).

8.2.3. Project Manager

The Project Manager is responsible for appointing and coordinating the technical input from the following project representatives:

- Project Signalling Designer
- Project Signalling Construction Representative
- Project Civil Engineering Representative

The Project Manager is then responsible for incorporating any changes and updating the new works signalling design after the SSC has sighted the signals.

The Project Manager in consultation with The Chairperson is also responsible for arranging equipment, transport for the SSC and arranging safe site access.

8.2.4. Train Driver(s)

The Train Drivers' Representative(s) ensures that:

- Driving policy, driving practices, and train handling characteristics are considered.
- Potential distractions (internal and external) are identified and considered.
- Driver requirements are identified and considered.
- The agreed form and position of the signal allows adequate and appropriate reading time.

The Train Drivers' Representative(s) may also provide subjective opinion based information, e.g. realistic attainable speeds, likely braking performance, etc; therefore it is essential that they have experience of the route and all traction types used on the route.

It may be necessary to consult with a number of drivers outside of the SSC to identify a consensus opinion, particularly with regards to signals identified in previous complaints or incidents.

8.2.5. Project Signalling Designer

The Project Signalling Designer provides signalling information that identifies the proposed and/or existing longitudinal position and form of each new or altered signal.

For signal sighting of new works the scheme plan is provided and for investigative signal sighting the existing master signalling plan is used.

The Project Signalling Designer puts the signal into the context of the layout, e.g. gradients, braking distances, uneven signal spacing, conflicting routes, fouling point/overhang clearance, overlaps, AWS positions, position of IRJ (in consultation with the Unit Manager, Track and Civil Engineering) and failure modes, etc.

The Project Signalling Designer identifies any current non-compliances, e.g. under-braking, excessive over-braking, deficient reading times, etc.

The Project Signalling Designer ensures that the SSC's proposals conform to signalling standards.

8.2.6. Project Signalling Construction Representative

The Project Signalling Construction Representative considers the constructability and testing & commissioning of the signal with regard to track access, any staging works that may be required, etc.

8.2.7. Project Civil Engineering Representative

The Project Civil Engineering Representative advises on the positioning constraints relating to the construction of the signal structure including its

base/foundation. They are also responsible for advising on all other matters relating to the civil engineering infrastructure that may affect the positioning of the signal, e.g. structure gauge, the track sub-structure, drainage, culverts, etc.

The Project Civil Engineering Representative may be requested to provide existing and/or proposed site records if appropriate.

The Project Civil Engineering Representative agrees any changes required to accommodate signal sighting that affect civil engineering infrastructure.

8.2.8. Signals Maintenance Manager

The Signals Maintenance Manager or delegate considers the maintainability of the signal with regards to track access, etc.

The Signals Maintenance Manager or delegate agrees any changes required to accommodate any signal sighting that affects maintenance of signalling infrastructure.

8.2.9. Unit Manager, Track and Civil Engineering

The Unit Manager, Track & Civil Engineering or delegate considers the position of the signal in relation to the track and its interface with the substructure. They advise on any track parameters that may affect the visibility or positioning of the signal, e.g. cant, gradient, track alignment and IRJ positioning (co-ordinating with Project Signalling Designer) etc.

The Unit Manager, Track & Civil Engineering or delegate may be requested to provide existing and/or proposed site records if appropriate.

The Unit Manager, Track & Civil Engineering agrees any changes required to accommodate any signal sighting that affects track infrastructure.

8.2.10. Unit Manager, Overhead Engineering

The Unit Manager, Overhead Engineering or delegate identifies the types and positions of any electrification equipment that may interfere with sight lines from the Required Reading Distance (RRD) to the signal. They also advise on any electrification clearances.

The Unit Manager, Overhead Engineering or delegate may be requested to provide existing and/or proposed site records if appropriate.

The Unit Manager, Overhead Engineering or delegate agrees any changes required to accommodate any signal sighting that affects electrification equipment.

8.2.11. Human Factors Expert

Human Factors Experts advise on the 'man-machine' interface e.g. the psychology involved in drivers' reaction and decision making processes; statistical/evidential analysis and behavioural trends, etc. They take a system-wide 'umbrella view' of the system/driver interface.

Human Factors Experts can be particularly useful where the likelihood of a SPAD is high or during actual SPAD investigations. Where Human Factors expertise is required it may be appropriate to consult a Human Factors Expert outside of the signal sighting process and use the information

collected as an input to the SSC or it may be appropriate to include a Human Factors Expert in the SSC.

Human Factors Experts also advise on training and defensive driving techniques.

8.2.12. Any Other Person or Persons Deemed Necessary by the Signal Sighting Committee.

The SSC must be flexible enough to ensure that appropriate experts can be called upon as necessary. For example, on occasion it may be necessary to consult with a third party (e.g. road authorities where new bridges impinge on visibility or positioning, electricity suppliers where power lines may interfere with positioning or visibility of a signal, etc). This may be done by the Chairperson outside of the SSC; the information collected would then be used to input to the SSC. Alternatively, it may occasionally be prudent to include the third party in the SSC.

9. The Signal Sighting Process

9.1. General

9.1.1. New Works Signal Sighting

New works signal sighting should take place to finalise the position and form of signals shown on a project developed signalling scheme plan.

New works signal sighting should take place as early as possible in the design process to ensure that the SSC has maximum flexibility to adjust a signal's form and position to achieve maximum possible visibility and readability and to reduce risks associated with the signal to So Far As Is Reasonably Practicable (SFAIRP). A final signal sighting should be carried out prior to commissioning the signalling system by the SSC to finalise and sign off the required SSF.

9.1.2. Investigative Signal Sighting

Investigative signal sighting takes place where the integrity of an existing signal is called into question either from a driver complaint or actual incident (such as a SPAD or a signal reverting to danger in front of a train).

Investigative signal sighting should take place as soon as possible after the complaint or incident. It should, So Far As Is Reasonable Practical (SFAIRP), take place under the same conditions as the complaint or incident, e.g. time of day, weather, etc.

There are two elements to investigative signal sighting.

1. Investigation: Evidence gathering to help identify possible causes and input to a solution.
2. Solution: Identify recommendations based on the evidence gathered.

Investigation

The SSC should produce an 'as-is' SSF identifying the actual existing parameters at the time of the complaint or incident, (e.g. form, position, sighting point, available reading distance, etc).

The 'as-is' SSF should be compared to the existing SSF (where available) to identify any discrepancies in the actual state of the signal at the time of the

complaint/incident and the designed state of the signal as recorded on the existing SSF.

The production of an 'as-is' SSF will often be part of a wider evidence gathering exercise, particularly during SPAD Investigations, e.g. driver interviews, test trains, etc. The wider process is not defined by this standard.

Solution

The SSC should sight the signal as if it were a new signal using the existing longitudinal position, lateral position and form of the signal as preferred parameters.

The SSC should consider, and give high priority to, any recommendations from the Investigation element.

A new SSF should be produced identifying consensus parameters for the signal along with any recommendations to achieve the identified Required Reading Distance.

The new SSF should incorporate all recommendations on how to bring the signal up to standard and to an acceptable safe state.

9.2. Prior to going on site

The Chairperson in consultation with Project Manager shall convene the SSC and arrange site access.

Prior to signal sighting, draft SSFs and draft Minimum Reading Time (MRT) forms shall be produced identifying known/proposed parameters (approach speed, longitudinal position, lateral position, form, etc).

Approach speed shall normally be line speed. Where the attainable speed of all trains approaching a signal is less than line speed the SSC shall arrange for the authorisation of the use of attainable speed when calculating Required Reading Time (RRT).

A unique configuration control number shall be allocated to each SSW. Configuration control numbers shall be requested in accordance with *FR-AM-GE-806 Identification and Numbering of Technical Documents and Drawings*.

9.3. Marking Up On site

It may be beneficial to 'mark-up' the proposed position of new signals based on the draft SSFs and MRT forms prior to convening the full SSC (particularly when there are several signals to sight).

SSFs and MRT forms may be provisionally completed during marking-up.

9.4. The Signal Sighting Committee

9.4.1. Set up the Target

For new works signal sighting, a simulated signal, known as the target and showing at least the most restrictive aspect, shall be erected at the proposed position of the signal. For investigative signal sighting the target is the signal to be investigated.

9.4.2. Assess MRT Using the MRT Form

The Chairperson shall facilitate a debate with and between the Committee Members until consensus is reached on the most appropriate and safest

possible form and position of the signal. The discussion shall include consideration of the hazards on the MRT form and any other perceived hazards.

The MRT shall be 8 seconds. This value shall be assessed upwards using the MRT form. Where reasonably practical, hazards should be eliminated. Where hazards cannot be eliminated additional reading time shall be added.

The SSC shall use the scheme plan (for new works signal sighting) or the existing master signalling plan (for investigative signal sighting) as the basis for their discussion and assessment of each signal.

Other inputs may be introduced by the SSC as appropriate, e.g. a SPAD report, SPAD statistics, overrun risk assessment, details of a driver's complaint, etc.

The SSC shall consider all physical interfaces that may affect the visibility of the signal as well as anything that may interfere with a driver's concentration whilst approaching the signal.

The SSC shall consider the signal in the context of the layout with regard to SPAD risk and overrun risk mitigation.

The SSC shall also consider other equipment in the vicinity of the signal including, but not limited to, ATP, AWS, signage etc.

A designated note taker should record the substance of the SSC's discussion with particular regard to recording how decisions were made for input into the Signal Sighting Report (SSR).

9.4.3. Identify Achievable Reading Distance

Calculate the Minimum Reading Distance (MRD) using the MRT and the Approach Speed – enter these on the SSF.

Measure any reading distance that is already available, this is the Available Reading Distance – enter this on the SSF.

Measure any additional reading distance that is readily available or can easily be made available (e.g. by clearing vegetation). This is the Achievable Reading Distance – enter this on the SSF.

Where Achievable Reading Distance is less than MRD the SSC should attempt to eliminate hazards from the MRT form or provide additional reading distance (e.g. by clearing further vegetation) until an achievable MRD can be derived. Where it is not possible to achieve MRD by any reasonably practicable means then the signal may need to be repositioned vertically, horizontally or longitudinally. Any change of position or form shall be ratified by the Project Signalling Designer.

While measuring the Achievable Reading Distance, check for and record interruptions and note remedial actions required (e.g. vegetation clearance).

The use of a periscope to more accurately represent the driver's eye-level is recommended for viewing the target.

9.4.4. Define RRD and RRT

If the Achievable Reading Distance is at least equal to Minimum Reading Distance (MRD), it becomes the Required Reading Distance (RRD). However, if the specified visibility of any route indicator is less than MRD then the RRD is the specified visibility of the route indicator – Enter the specified visibility of any route indicator and RRD on the SSF.

Required Reading Time (RRT) is the time equivalent of RRD calculated using the Approach Speed – enter this on the SSF.

RRT shall not be less than 8 seconds.

9.4.5. Complete and Sign the Draft SSF

The Chairperson, in consultation with the SSC, shall complete all parts of the draft SSF and draft MRT form on site.

When all Committee Members are satisfied, they shall sign the completed draft SSF to indicate their acceptance of the proposed details.

9.5. After Going on Site

If remedial action is required before the readability of a signal can be confirmed (e.g. vegetation clearance), then the Committee shall agree a date to reconvene as soon as possible.

If the signed draft SSF is not suitable for use as the final SSF then the SSC shall arrange for a final SSF to be produced and signed by all Committee Members within 2 weeks.

The final signed SSFs shall be independently checked by a person competent to verify any calculations and that the position and form of the signal complies with standards.

The SSC shall produce, review and approve all SSWs.

Appendix A Signal Sighting Form - MRT

MRT Form	Signal Number	
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Signalbox / Control Centre	
Signal Number	
Approach Speed	kph

Risk ID	Risk	Notes	Increase in Reading Time - Guidance	Assessed Increase in Reading Time
1.0	Position, Form, Readability and Visibility			
1.1	Target aspect is on a signal of complex or unusual form.	e.g. any signal with a route indicator	1s	
1.2	Signal is viewed against a complex background	Consider eliminating the risk by providing a larger back board or standalone Sighting Board	1s	
1.3	Possibility of read-through to a signal beyond the target signal	SSC shall consider the likelihood of read-through	0.25s to 2.00s	
1.4	Non-standard positioning of signal	e.g. non-standard vertical and/or horizontal positioning, right-hand positioned	0.75s to 1.25s	
2.0	Parallel Signals			
2.1	2 or 3 parallel signals of which target is one	Apply 2.1 or 2.2, whichever is appropriate, NOT both	0.1s per signal	
2.2	4 or more parallel signals of which target is one		0.35s per signal	
2.3	Parallel signals on a curved approach where a signal, other than the target signal, can appear brighter than the target signal			
2.4	The target signal is one of 2 or more parallel signals which are not in view together from 8 seconds on approach to the signal		1s	
3.0	Approach to Signal			
3.1	AWS in non standard position		0.5s	
3.2	AWS not fitted to target signal or not fitted to a cautionary signal in the aspect sequence on approach to the target signal.		1s	
3.3	Significant rising gradient then becoming level or falling with the approach to the target signal		1s	
3.4	Irregular spacings between signals on the approach to the target signal	Under overtaking as well as underbraking. Signals in aspect sequences leading to target signal at red higher risk than signals leading only to target signal showing proceed aspect	0.75s to 1.25s	
3.5	Unusual or complex aspect sequences on the approach to the target signal at danger	e.g. mixed numbers of aspects; mixed types of route indicator; flashing yellow; preferred/non-preferred routes; etc	1s min to 2s	
3.6	Acceleration towards a hazard	e.g. increase in line speed on approach to stop or cautionary aspects	1s	
3.7	Lineside distractions (e.g. lineside signs, station stops, level crossings, pedestrian mazes) in the vicinity of signals in the aspect sequence leading to the target signal	Consider ways of eliminating the risk	1s	
3.8	1 interruption of no more than 1 second at line speed between 180m and 40m on approach to signal	Can the interruption be eliminated?	1s	
3.9	Up to 3 interruptions each being no greater than 0.5 second at line speed from MRD to 180m on approach to signal	Can any or all of the interruptions be eliminated?	0.5s per interruption	
4.0	Other Risks			
4.1	Other risks that can be mitigated by increasing the Reading Time of the target signal (e.g. dark/light adaption time (e.g. signals immediately outside tunnels), traffic on other lines, history of slippery rails, etc)	Specify:		
		Specify:		
		Specify:		
		Specify:		
		Specify:		

Sample Only
KNet 10914784

Number of Risks Present (n)			0
Arithmetic Sum of Reading Time Increases (i)			0.0 s
Increased Reading Time to be Applied	$=i(1+(n-1)/30)^{(n+1)}$		0.0 s
Absolute minimum Reading Time			8 s

Minimum Reading Time (MRT)	s
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Minimum Reading Distance (MRD)	m
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Signal Sighting Form	Signal Number
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Hot spot clock position or LED quadrant		Versine (Measured with 17m Chord)	0 mm
Electrification screen(s) required		Curve radius ($=C^2/8V$ where C = Chord Length, V = Versine) or from Track Long Section (whichever is lowest)	0 m
Length of hoods		Is the signal ground mounted (i.e. no part of the structure is greater than 1065mm above rail level)	No
Size of backboard		Minimum offset centre line of track to any part of structure	2135 mm
Top of base		Regauging allowance	mm
Sighting Point - distance on approach		Construction tolerance	mm
Sighting Point - height above rail level		Minimum allowable clearance to any part of structure	2135 mm

<p style="text-align: center; margin: 0;">Sketch drawn facing towards</p>	<p style="text-align: center; margin: 0;">Minimum clearances to be allowed when signal is on the inside of a curve</p> <table border="1" style="width:100%; border-collapse: collapse; font-size: small;"> <thead> <tr> <th colspan="2">Curve Radius</th> <th colspan="2">Minimum Clearance</th> </tr> <tr> <th>From (m)</th> <th>To (m)</th> <th>Ground Mounted</th> <th>Others</th> </tr> </thead> <tbody> <tr><td>200</td><td>249</td><td>1890</td><td>2325</td></tr> <tr><td>250</td><td>299</td><td>1850</td><td>2285</td></tr> <tr><td>300</td><td>349</td><td>1830</td><td>2265</td></tr> <tr><td>350</td><td>399</td><td>1810</td><td>2245</td></tr> <tr><td>400</td><td>449</td><td>1800</td><td>2235</td></tr> <tr><td>450</td><td>499</td><td>1790</td><td>2225</td></tr> <tr><td>500</td><td>549</td><td>1780</td><td>2215</td></tr> <tr><td>550</td><td>649</td><td>1770</td><td>2205</td></tr> <tr><td>650</td><td>799</td><td>1760</td><td>2195</td></tr> <tr><td>800</td><td>999</td><td>1750</td><td>2185</td></tr> <tr><td>1000</td><td>1299</td><td>1740</td><td>2175</td></tr> <tr><td>1300</td><td>1999</td><td>1730</td><td>2165</td></tr> <tr><td>2000</td><td>3999</td><td>1720</td><td>2155</td></tr> <tr><td>4000</td><td>8000</td><td>1710</td><td>2145</td></tr> <tr><td>Over 8000</td><td></td><td>1700</td><td>2135</td></tr> </tbody> </table>	Curve Radius		Minimum Clearance		From (m)	To (m)	Ground Mounted	Others	200	249	1890	2325	250	299	1850	2285	300	349	1830	2265	350	399	1810	2245	400	449	1800	2235	450	499	1790	2225	500	549	1780	2215	550	649	1770	2205	650	799	1760	2195	800	999	1750	2185	1000	1299	1740	2175	1300	1999	1730	2165	2000	3999	1720	2155	4000	8000	1710	2145	Over 8000		1700	2135
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Longitudinal dimension tolerance +/- 0.5 metres. Lateral dimension tolerance +/- 50 millimetres

Appendix C Signalling and Signal Sighting Guidelines

1. Signal Classification

Signals on the AMPRN are designated as either 'Absolute' or 'Permissive'.

1.1. Absolute Signals

Absolute signals are signals which cannot be passed at danger without the driver obtaining permission from Train Control.

A signal is designated as Absolute if there are facing points or at least one conflict point in any of the routes from the signal. Any other signal may be deemed Absolute for safety or operational purposes. The SSC shall consider the appropriateness of the design office's designation and may recommend that a Permissive Signal be reclassified as an Absolute Signal.

Absolute Signals are identified by a white square reflectorised marker plate showing a black letter 'A'. The plate is positioned vertically below the Main Colour Light Signal (CLS) head but above any subsidiary signal.

The SSC shall consider the most appropriate position for each signal's plate and identify it on the SSF.

1.2. Permissive Signals

Permissive Signals are signals which may be passed at danger after having stopped at the signal for 1 minute and reported by the driver to train control in accordance with the relevant Rule Book sections.

A signal is designated Permissive if there are no points or conflict points in any route from the signal. The SSC shall consider the appropriateness of the design office's designation and may recommend that a Permissive Signal be reclassified as an Absolute Signal.

Permissive Signals are identified by a white circular reflectorised marker plate showing a black letter 'P'. The plate is positioned diagonally to the right below the Main CLS head but above any subsidiary signal.

The SSC shall consider the most appropriate position for each signal's plate and identify it on the SSF.

2. Form of Signals

2.1. General

The form of each signal shall be made up of standard type-approved signal heads and route indicators. Elements of signals shall normally be arranged in standard positions in relation to each other and to the line to which they apply.

The form of new and altered signals shall be considered with regard to:

- Consistency along the line.
- Technology types.
- The relative position of elements of a signal.
- Lateral position of signals.
- Choice of junction signalling method.
- Type of route indicator.
- The relative positions of parallel signals.

Conflicting criteria shall be assessed in terms of risk, i.e. whichever is most likely to reduce the likelihood of a SPAD shall take precedence, e.g. an LED signal may overpower an incandescent signal in rear leading to risk of read-through, therefore, an isolated LED signal may not be appropriate in this circumstance.

The form of each signal shall be as simple as possible given the number and type of routes to be signalled. Successive signals along a line shall be reasonably consistent in form.

Route indicators shall give drivers an unambiguous indication of the route set.

The SSC shall consider the order in which elements of a signal will become visible to drivers, e.g. signals should be positioned such that any provided route indicator comes into view at the same time as, or before, the main signal aspect.

As a minimum the sketch of a signal's form on the SSF must include two key dimensions:

1. The lateral offset to the centre of the signal's most restrictive aspect from the centre line of the track to which it applies.
2. The vertical height of the centre of the signal's most restrictive aspect from the top of the nearest rail.

How the sketch is produced is not important so long as it is clear and unambiguous (i.e. a hand drawn sketch, a stick diagram produced in Microsoft Word/Excel or an imported CAD produced drawing are all equally valid methods of producing sketches).

The Chairperson is responsible for ensuring that equipment is available that can achieve these parameters whilst not infringing upon the structure gauge.

2.2. Signal and Route Indicator Types

2.2.1. Main Colour Light Signal

All Main Class route aspects shall be displayed by Main CLS heads, this includes red, yellow and green aspects. CLSs may be 1-aspect, 2-aspect or 3-aspect.

3-aspect heads shall normally be used. The SSC may recommend a different configuration of head than that shown on the scheme plan so long as it is capable of showing the required aspects (e.g. if the SSC believes that the fixed red at the end of a line where signals are generally displayed by 3-aspect heads would be more easily read by drivers if it was displayed by a 3-aspect head instead of a 1-aspect head or a buffer stop light).

2-aspect Main CLSs may be used in red/green or red/yellow configurations.

Red/yellow 2-aspect signals are used to protect the final signalled route on a line, e.g. on the approach to terminus stations.

1-aspect (fixed red) signals are used to terminate any Main Class route beyond which there is no forward route, e.g. at platforms where trains turn back and from which there is no onward route, etc.

At terminus stations where trains terminate at or approaching buffer stops, it is permissible to use an approved buffer stop light.

Main CLS heads shall normally be mounted vertically.

2.2.2. Subsidiary Position Light Signal

Subsidiary PLSs are also known colloquially as 'shunt signals' or 'low speed signals'.

1-aspect PLSs shall be provided as subsidiary signals at any Main CLS from which there is one or more Shunt or Call-On Class routes. They shall be used to display the slow speed proceed aspect for all Shunt and Call-On Class routes.

Subsidiary PLSs shall normally be mounted below and in line with the red aspect of the Main CLS head and below the Absolute identification plate.

The RRD for Subsidiary PLSs is the specified visibility of the PLS or the length of the approach track, whichever is shortest.

2.2.3. Independent Position Light Signal

Independent PLSs are also known colloquially as 'dwarf signals' or 'ground shunt signals' (though they need necessarily be ground mounted).

2-aspect PLS shall be used independently where there are Shunt Class routes from signals with no Main Class routes. They shall be used to display the stop and low speed proceed aspects for all Shunt Class routes.

Independent PLS are often ground mounted for structure gauge clearance purposes, however, consideration should be given to the visibility of the signal on approach and whilst standing at the signal. If visibility is improved by mounting the signal on a post then the SSC may recommend this.

The RRD for Independent PLSs is the specified visibility of the PLS or the length of the approach track, whichever is shortest.

2.2.4. Position Light Junction (Route) Indicator

PLJIs are also known colloquially as 'feathers'.

PLJIs shall normally be used to provide routing information for all Main Class routes in association with a Main CLS. They shall not be used to provide routing information for Shunt or Call-On Class routes.

PLJIs shall normally be used on all mainline junction signals protecting junctions where passenger trains run.

The SSC may recommend that a Standard Route Indicator (SRI) is used in place of a designed PLJI so long as the resulting RRT is greater than 8 seconds.

PLJIs can indicate up to six routes from one signal, positions 1-3 diverging to the left and positions 4-6 diverging to the right. Positions 1 and 4 shall normally be used for the first turn out in either direction regardless of any perceived 'sharpness' of the turnout. positions 2 and 5 shall normally be used only for a second turn out in either direction, and positions 3 and 6 shall normally be used only for a third turn out in either direction.

Where parallel signals require PLJIs the SSC should consider the possibility of confusion if the same position (1-6) is used to indicate different destinations from parallel signals. If this risk is considered to be high then the SSC may recommend that other more appropriate type of indicator be used.

PLJIs shall normally be mounted directly above the Main CLS head with which they are associated.

PLJIs shall not normally be used where the RRD of the route indicator is greater than the specified readability of the particular type of PLJI to be used.

2.2.5. Standard Route Indicator

SRIs are also known colloquially as 'theatres'.

An SRI may be used in place of a PLJI to provide routing information for Main Class routes in association with a Main CLS where there is perceivable benefit in providing drivers with a positive description of the route to be taken. They shall not be used to provide routing information for Shunt or Call-On Class routes.

SRIs are typically used where junctions are complex, e.g. on the approach to stations to identify which platform a train is signalled into or in a yard or depot to identify which line a train is signalled onto.

The SSC may recommend that a PLJI is used in place of a designed SRI.

SRIs shall normally be mounted directly above the Main CLS head with which they are associated.

SRIs shall not normally be used where RRD is greater than the specified visibility of the particular type of SRI to be used.

2.2.6. Miniature Route Indicator

MRIs are also known colloquially as 'stencils'.

MRIs shall be used to provide routing information for all Shunt and Call-On Class routes in association with an Independent or Subsidiary PLS. They shall not be used to provide routing information for Main Class routes.

MRIs shall be used wherever there is more than one route from an Independent or Subsidiary PLS.

MRIs shall normally be mounted directly above the PLS head with which they are associated.

MRIs shall not normally be used where the RRD is greater than the specified visibility of the particular type of MRI to be used.

2.3. Other Equipment

2.3.1. Numbering of Signals and Identification Plates

All signals shall carry a uniquely numbered signal identification plate mounted below all signal heads, route indicators and the Absolute/Permissive plate. Class "A" refractorised material or equivalent shall be used for the signal numbers.

The SSC may recommend that a different number, other than the designed number, should be used, e.g. if they consider that the allocated number may cause confusion with other similarly named equipment during communications.

As signal numbers are derived from the longitudinal position of the signal, the SSC may need to propose new signal numbers if they move a signal.

Signal numbers shall consist of three or four figures. The first two figures represent the kilometreage along the line and the next consecutive kilometre figure shall be used once past the mid-point within the kilometreage. The next figure is a unique line identifier (1 for the Belair line, 3 for the Noarlunga/Tonsley/Seaford line, 5 for the Outer Harbour line, 6 for the Grange line, 7 for the Gawler line). The last figure is the number of the signal sequentially in the series within the kilometreage using odd numbers for down direction signals and even numbers for up direction signals, e.g. the second up direction signal in kilometre 7 to 8 on the Noarlunga Line would be numbered 734; the fourth down direction signal in kilometre 22 to 23 on the Gawler Line would be numbered 2277.

2.3.2. Signs that Provide Information to Drivers

Line-side signs that provide information to drivers shall meet the same visibility and readability criteria as signals both during daytime and at night and shall be subject to signal sighting.

The sign, but not necessarily the wording on the sign, shall be readable by the driver for the RRT.

2.3.3. Platform Equipment

All elements of signals that act as platform starting signals shall be readable by drivers in the normal driving position of any train authorised to use the route from all normal stopping positions.

Signals controlling departure from platforms shall normally be positioned such that any station staff (e.g. dispatcher), can see them. Where this is not

possible, consideration should be given to providing 'OFF' indicators on platforms where dispatchers are regularly used.

Where platform starting signals are positioned lower than normal, the likelihood of people on the platform obscuring the signal shall be taken into consideration.

Any part of a structure on a platform shall be at least 2750mm above the platform.

Car stop boards and driver only operation mirrors/monitors shall not normally be placed within 25m of a platform starting signal.

2.3.4. Countdown Markers

It is permissible to provide countdown markers on the approach to signals. Countdown markers shall be provided as a series of three signs, 100m apart, with the last 100m from the signal.

Countdown markers should only be used in exceptional circumstances, e.g. where drivers have identified that it is difficult to judge distance on the approach to a particular signal or after a SPAD wholly or partially attributed to this cause.

2.3.5. Signal Reminder Signs

It is permissible to provide signal reminder signs on the approach to signals where there is a significant risk of drivers forgetting that they may be approaching a signal at danger (e.g. due to distractions between signals such as a station stop).

Signal reminder signs shall only be used in exceptional circumstances, e.g. where a significant number of drivers have independently identified a particular signal as being a risk or where historical evidence suggests that risk is significant.

The position of any signal reminder signs shall be selected such that drivers, having been reminded that they may be approaching a signal at danger, can stop at the signal.

Signal reminder signs shall themselves be subject to the full signal sighting process.

2.3.6. Braking Markers

It is permissible to provide braking markers on the approach to signals where there is excessive spacing between a caution aspect and the associated stop aspect such that drivers need to judge when to start braking independently of the signalling system as this leads to risk of overrunning.

Braking markers shall only be used in exceptional circumstances, e.g. where signal spacing is greater than 200% of minimum braking (i.e. greater than 100% over braked), where a significant number of drivers have independently identified a particular signal as being a risk or where historical evidence suggests that risk is significant.

Braking markers shall themselves be subject to the full signal sighting process.

2.3.7. Back Boards, Sighting Boards, Hoods and Blinds

It is permissible to use sighting boards, larger backboards and/or extended hoods to increase the visibility and/or readability of signals so long as the method adopted does not represent a health and safety hazard, is maintainable and does not affect the visibility or readability of any other signals.

It is permissible to use blinds to obscure the view of a non-applicable signal to drivers approaching on a non-applicable line where there is a risk of drivers misreading the signal as applicable to their line. Blinds shall not represent a health and safety hazard, shall be maintainable and shall not affect the visibility or readability of any other signals.

2.3.8. Line Identifiers

The use of line identifiers on parallel lines to reduce the possibility of drivers confusing which signal applies to them is permissible.

3. Visibility and Readability**3.1. Specified Visibility of Signals and Route Indicators.**

Main CLSs are typically designed to be visible from 600-1000m on approach.

PLJIs are typically designed to be visible from 600-1000m on approach.

SRIs are typically designed to be visible from 150-400m on approach.

MRIs are typically designed to be visible from 100-150m on approach.

PLS are typically designed to be visible from 100-200m on approach.

The SSC shall refer to manufacturer's details to ensure that all proposed equipment is visible at the assessed reading distances.

3.2. Readability**3.2.1. General**

Signals shall be readable for the RRT by drivers approaching on any line to which they apply.

The absolute MRT of 8 seconds is increased where the probability of misread (including, but not limited to: disregard, read-through, read-across, confusion due to complexity, etc) is higher than normal. Examples of where this applies include, but are not limited to, the following:

1. The time taken to locate an applicable signal is longer than normal (e.g. because the signal is viewed against a complex background or it is mounted on a gantry with other signals).
2. The time taken to read and interpret the information presented by a signal is longer than normal (e.g. because the signal has more than one element).
3. Where other signals or coloured lights in the drivers line of site may be brighter or become visible first (e.g. parallel gantry signals on a curve can lead to risk of 'read-across', LED signals ahead of an incandescent signal on a straight stretch of line can lead to risk of read-through – particularly at night).
4. Trains on other lines that may obscure signals for a period of time.

5. Driver duties that may distract from reading and reacting to the signal (e.g. where there are signs or a station stop between the RRD and the signal).
6. Other factors that may influence the control of the train (e.g. gradient changes or changes in line speed).
7. Driver habits that may affect action and reaction (e.g. where drivers habitually approach an approach released signal expecting it to change).
8. Other distractions or risks (e.g. starting against yellow from a station stop – in this case, providing additional reading time for the signal ahead of the station starter may enable drivers to recover from the error).

Note: It is always preferable to remove a risk or move an obstruction rather than add reading time to mitigate it.

These risks are incorporated into the MRT form which forms the basis of the MRT assessment. Where a signal is marked-up on site prior to convening an SSC the MRT form may be filled out by the person or persons who mark up the signal. Alternatively, the MRT form may be filled out by the SSC during signal sighting. Whichever method is adopted the contents of the MRT form shall be agreed by consensus with all Committee Members.

For any signal with a Main CLS head the maximum allowable RRD is equal to the lowest specified visibility of the Main CLS head and any route indicator associated with it (any subsidiary PLS and associated route indicator are ignored).

For signals with no Main CLS head the maximum allowable RRD is equal to the lowest specified visibility of the PLS and any route indicator associated with it.

In exceptional circumstances it is allowable to extend RRD to a point where a signal's route indicator can be seen to be lit but not necessarily read so long as the RRD is not greater than the specified visibility of the signal associated with the route indicator (e.g. where an SRI is used with a Main CLS instead of a PLJI on approach to a terminus station).

RRD shall not be greater than the distance to the signal in rear.

If the assessed MRD is greater than maximum RRD then the signal must be reassessed and risks eliminated to reduce MRD below maximum allowable RRD or repositioned to a location where an achievable RRD can be derived.

Where different routes to a signal have different line speeds (or attainable speeds) it may be appropriate to signal sight each route for its appropriate reading time. In this case the SSW shall include an MRT form and SSF for each route.

Successive signals in the same direction of traffic shall be reasonably consistent in their positioning such that drivers' viewing angles are reasonably constant and drivers do not have to hunt for signals.

Where trains start from rest (e.g. terminus starter signals or PLSs from which trains always start from rest) RRD need not be ascertained.

Signals shall normally be readable by drivers in their normal cab driving position stopped at all normal stopping positions. High reading times should be treated with caution as they may add to read-through and read-across risks. RRT should never extend back before the previous signal.

3.2.2. Interruptions and Obstructions

Any obstructions that interrupt the continuous visibility of the signal shall be identified and measured.

So far as is reasonably practicable there should be no interruptions to the driver's view of a signal for the RRD. The Committee shall recommend removal of any obstructions that can reasonably be eliminated.

There shall be no interruptions to the visibility of a signal for the final 40m on approach to the signal.

There shall be no more than one interruption between 180m and 40m on approach to the signal. The interruption shall not exceed 0.5 seconds at line speed. Where there is an interruption between 180m and 40m on approach to the signal, 1 second additional reading time shall be added on the MRT Form.

There shall be no more than three interruptions cumulatively adding up to 1.5 seconds at line speed, with no individual obstruction greater than 0.5 seconds at line speed, from 180m to MRD on approach to the signal. Where there are interruptions in this zone the SSC should endeavour to eliminate them. Where such interruptions cannot be eliminated the SSC should consider adding more reading time on the MRT Form (up to 1 second is recommended).

Interruptions up to 1 second each at line speed are allowed from MRD to RRD on approach to a signal but the SSC should endeavour to eliminate them. Where these interruptions cannot be eliminated the SSC should consider adding more reading time on the MRT Form.

Trains passing on adjacent lines are not considered to be interruptions except where they regularly come to a stand, e.g. stations stops, loop lines, sidings, or signals where trains often stop.

3.3. Alignment

Signals shall normally be aligned such that the centre of the beam of the most restrictive aspect is aligned to a point 2500mm above the left hand running rail at the sighting point.

3.4. Sighting Point

The sighting point for signal sighting purposes shall normally be:

1. 8 seconds at line speed on the approach to a main CLS
2. 70m for subsidiary and independent PLSs.
3. 25m on the approach to a signal with no routes leading up to it.

It is the responsibility of the SSC to assess whether or not these normal sighting points are appropriate. Examples of where normal sighting points may not be appropriate include, but are not limited to, the following:

1. Where the curvature or gradient of a line would mean that the beam of a signal aligned to a point 8 seconds on approach would be difficult to see either further out or closer to the signal.
2. Terminus station starter signals where trains stop much further than 25m from signals.

The agreed sighting point shall be recorded on the SSF for all signals.

3.5. Close-up Viewing

All elements of a signal shall be readable from the driving cab at all points from 40m on approach to the signal to the closest point at which a driver would be expected to bring a train to a stand at the signal at danger.

The SSC shall assess the requirement to provide any device(s) to aide close-up viewing of a signal (e.g. 'hot-strip' or LED head with close-up viewing quadrant). The SSC shall recommend a suitable orientation of the close-up viewing device which shall be recorded on the SSF.

4. Positioning

4.1. General

Signals are initially positioned by the design office on a scheme plan with regards to braking distances and to achieve headways.

Minor moves are permissible to maximise reading time. Where significant moves are necessary, the signalling designer shall assess the effects on the rest of the layout before agreeing a new position at which the signal can be sighted (this may not be possible on site).

Signals shall be positioned to be visible and readable to a driver in clear weather conditions by day and by night at line speed or, where appropriate and agreed with the Unit Manager, Signals Engineering or their delegated representative, at attainable speed for the RRD. Any use of attainable speed shall be recorded on the SSF. The process, by which it was agreed to use attainable speed, and an explanation of how the attainable speed was derived, shall be recorded in the SSR.

4.2. Longitudinal Positioning

Signals shall be positioned longitudinally to maximise visibility subject to the requirements of the layout. Longitudinal positioning of signals is initially determined by the Project Signalling Designer. Wherever possible the SSC shall position the signal at its designed longitudinal position.

Stop signals shall normally be positioned such that trains will not come to a stand, wholly or partially:

- On viaducts
- On steep gradients
- Where contamination on the rail may exist (leaves, other debris)
- In tunnels
- Across level crossings
- Across pedestrian crossings
- With only part of the train in a platform

Where signals are to be positioned at locations where trains may stop regularly or may stop for long periods of time consideration should be given to the potential for the signal to cause an environmental nuisance to line side neighbours. For example an exit signal from a depot from which many trains depart early in the morning should not be located close to any houses adjacent to the depot.

Where lines running parallel to each other are signalled in the same direction and drivers can see signals for both lines, signals shall normally be located parallel to each other at the same longitudinal position. Signals are considered parallel if they are within 5m of each other longitudinally. Exceptionally, and subject to SPAD risk assessment, parallel signals may be displaced by up to 20m.

On lines running parallel to each other which are signalled in the same direction and where signals are provided on one line, parallel signals shall normally be provided on all lines signalled in the same direction.

The requirement for parallel signals may be waived where reduced capacity bi-directional signalling is in operation subject to risk assessment.

On parallel lines signalled in the same direction, consideration should be given to aiding drivers to identify which signal applies to them. Examples include use of line markers above or below signals and staggered heights for signals on a gantry.

Separate routes running parallel to each other are not considered to be parallel when considering the provision of parallel signals. An example of such a situation is ARTC lines running parallel to AMPRN lines where it would not be necessary to provide parallel AMPRN signals parallel to ARTC signals though, in this case, the SSC should consider providing blinds where ARTC signals may cause confusion to AMPRN drivers.

4.3. Lateral Positioning

4.3.1. Horizontal

Signals – General

All parts of signal structures shall be positioned to have at least the minimum structural clearance to any adjacent tracks. Allowance shall be made for curvature, cant and track movement. At least minimum electrical clearance shall be provided between any part of the electrification system (fixed or mobile) and any part of the signal structure.

Where a signal is positioned on the inside of a curve, minimum structural clearances shall be increased as identified in Table 4.3.1. The amount that the minimum clearance increases by is dependent on the radius of the curve. The radius should be measured on site and compared to the track design radius (where available); the lower radius of the two shall be applied to identify the new minimum clearance from Table 4.3.1.

Signals, including Independent PLSs used as shunt signals, shall generally be positioned to the left of the track (in the direction of travel) to which they apply. They shall be positioned to minimise the likelihood of drivers confusing which track they apply to.

Signals – Other Than Ground Mounted

Signals shall normally be positioned with the centre of the most restrictive aspect offset horizontally 3000mm from the centre line of the track to which the signal applies.

Signals may be positioned further than 3000mm from the track to which they apply to improve visibility providing this does not increase the likelihood of misreading the signal on approach and providing close up viewing is maintained.

In exceptional circumstances, e.g. where sighting cannot be achieved by any other reasonable means, signals may be positioned closer than 3000mm from the centre line of the track to which they apply.

No part of any signal structure (other than ground mounted) shall be closer than 2135mm (adjusted for curvature, see table 4.3.1) from the centre line of any track.

Signals – Ground Mounted

Ground mounted signals shall normally be positioned such that the nearest part of the structure to the track is 1700mm from the centre line of the track to which the signal applies.

No part of any ground mounted signal structure shall be closer than 1700mm (adjusted for curvature, see table 4.3.1) to the centre line of any track.

Table 4.3.1: Minimum clearances from track centre line to any part of a signal structure positioned on the inside of a curve.

Radius of Curve Towards Signal (m)	Adjusted Minimum Clearance (mm)	
	Non-Ground Mounted	Ground Mounted
200 – 250	2325	1890
251 – 300	2285	1850
301 – 350	2265	1830
351 – 400	2245	1810
401 – 450	2235	1800
451 – 500	2225	1790
500 – 550	2215	1780
550 – 650	2205	1770
650 – 800	2195	1760
800 – 1000	2185	1750
1000 – 1300	2175	1740
1300 – 2000	2165	1730
2000 – 4000	2155	1720
4000 – 8000	2145	1710
Over 8000	2135	1700

Signals above the structure gauge, e.g. those carried on cantilevers or gantries, shall normally be positioned so that the centre of the most restrictive aspect is 1700mm to the left of the centre line of the track to which the signal applies.

Consideration shall be given to providing drivers with a consistent view of signals along a track. Mixing gantries, cantilevers and posts, and/or mixing heights and offsets can contribute to the misreading of signals by drivers hence such practice is not acceptable to DPTI.

Signals may be positioned on the right-hand side of the track to which they apply but only if prior approval is given by DPTI and the following criteria are met:

1. The likelihood of SPAD is not increased.
2. The signal is readable by drivers of all traction types that use the track from the normal stopping positions of trains.
3. There is no track immediately to the right such that drivers on the track to the right might wrongly associate the signal with their track. Note: tracks separated by a platform meet this criterion.
4. It is absolutely necessary to position signals to the right of the track due to lack of structural clearance or in order to achieve MRT.
5. Where signals are right-hand positioned on bi-directional track they shall be consistently positioned, i.e. they shall not change from one side to the other along the track.

4.3.2. Vertical

Signals – Other Than Ground Mounted

The most restrictive aspect of signals should normally be positioned 4200mm above rail level.

Where necessary, to provide adequate visibility, it is permissible to position the most restrictive aspect up to 5500mm or less than 4200mm above rail level so long as it does not infringe on the structural gauge clearance or the overhead traction structure clearance requirements and the following are considered with conclusions recorded in the SSR:

1. Risk of read-through.
2. Readability on approach to the signal.
3. Readability when close up to the signal.
4. The difficulty that a driver may have in relating a signal to the track to which it applies.
5. Risk of read-across where signals are parallel.
6. Potential background problems, e.g. sunlight, street lights, etc (particularly for signals above 4200mm).

Signals – Ground Mounted

Ground mounted signals shall normally be positioned such that the highest part of the structure is 1065mm above top of rail level. No part of any ground mounted signal shall be greater than 1065mm above top of rail level.