

Ref:	NR/L3/SIG/20047
Issue:	1
Date:	1 June 2012
Compliance date:	16 September 2012

Level 3

Management Of Safety Related Reports For Signalling Failures Appendix

Endorsement and Authorisation

Endorsed by:



Les Vere, Working Group Chair

Authorised by:



Edward Rollings, Steering Group Chair

Accepted for issue by:



Mick McManus, National Standards Manager

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Published and Issued by Network Rail, Kings Place, 90 York Way, London. N1 9AG.



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User information

This Network Rail standard contains colour-coding according to the following Red–Amber–Green classification.

Red requirements – *No deviations, could stop the railway*

- **Red requirements shall** always be complied with and achieved.
- Red requirements shall be presented in a red box **with the word “shall” or expressed as a direct instruction**.
- Accountability for the efficacy of red requirements lies with the Professional Head/Standard Owner.
- Red requirements are monitored for compliance.
- Corrective actions shall be enforced if deviations are discovered through functional checks (e.g. engineering verification visits, audit or Operations Self-Assurance).

Amber requirements – *Controlled deviations, approved risk analysis and mitigation*

- **Amber requirements shall** be complied with unless deviation has been approved in advance.
- Amber requirements shall be presented with an amber sidebar **and with the word “shall” or expressed as a direct instruction**.
- Accountability for the efficacy of these requirements lies with the Professional Head/Standard Owner, or their nominated Delegated Authority.
- Amber requirements are monitored for compliance.
- Deviations **may** be permitted. Deviations are approved by the Standard Owner or through existing Delegated Authority arrangements.
- Corrective actions shall be enforced if **non-approved** deviations are discovered through functional checks (e.g. engineering verification visits, audit or Operations Self-Assurance).

Green – *Guidance*

- Guidance is based on good practice. Guidance represents supporting information to help achieve **Red** and **Amber** requirements.
- Guidance shall be presented with a dotted green sidebar **and with the word “should” (usually in notes) or as a direct instruction**.
- Guidance is **not mandatory** and is not monitored for compliance.
- Alternative solutions may be used. Alternative solutions do not need to be formally approved.
- Decisions made by a competent person to use alternative solutions should be backed up by appropriate evidence or documentation.

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Issue record

Issue	Date	Comments
1	June 2012	Transfer of NR/L2/SIG/10047 Issue 14 appendix "B" and "C" to this issue.

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 16 September 2012.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the issue of any relevant Network Rail standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

Reference documentation

Reference	Title
GE/RT8047	Reporting of Safety Related Information
GK/RT0210	Asset Management for the Safety of Signalling and Operational Telecommunication Systems and Equipment
NR/GN/TEL/10117	Competence Management Systems for work on Control & Communication Systems
GE/RT8106	Management of Safety Related Control, Command and Signalling (CCS) System Failures
NR/L3/SIG/10046	SINCS for Network Rail Management
NR/L3/TEL/0023	Management of SINCS Records for Telecoms Assets
NR/L2/INV/002	Accident and Incident Reporting and Investigation
NR/L3/TRK/1202	S&C systems-Flat bottom full depth switches-Management of fixed stretcher bar assemblies, lock stretcher bar assemblies, fastenings and associated defects
NR/L2/SIG/19811	FMS for Network Rail Fault Management
RSPG-2E-Levxngs	Railway Safety Principles & Guidance part 2 section E O.R.R. Guidance on level crossings
NR/L2/SIG/10157	Signal Sighting
NR/SP/SIG/11231	Signal Maintenance Testing Handbook
NR/L3/TRK/7002	Reporting of Permanent Way Failures And Incidents
NR/L2/SIG/10047	Management Of Safety Related Reports For Signalling & Telecoms Failures

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1 Purpose

This document contains the hazard index system and the MCF (Monitored common failures) of safety related failures of signalling equipment and services, owned by Network Rail or provided by third parties for railway operational purposes.

The hazard index system directly relates to NR/L2/SIG/10047 Management of Safety Related Reports For Signalling and Telecoms Failures

2 Scope

This Network rail standard specifies the:

- Hazard index system
- MCF

For the management of safety related reports for all signalling failures for equipment and services provided by Network Rail Company or third parties (including bought in equipment or services).

Where Network Rail agrees to manage equipment not belonging to Network Rail or away from Network Rail infrastructure, the arrangements described in this document shall also be applied to such equipment.

This specification meets the requirements of Group Standard [GE/RT8106](#).

3 Definitions

Accident Unplanned, uncontrolled event giving rise to death, injury, ill health, damage or other loss.

Control, Command and Signalling System Systems used for authorising and safeguarding the safe operation of trains, and communication systems provided for safety purposes in the direct operation of the railway. (GE/RT8106)

Failure Unplanned situation that arises when a system does not perform as intended.

Failure Rating (F) This indicates the seriousness of any High or Low Risk Failure and will assist the engineer in defining priorities. The value of the rating can be from 0 to 12, including the adjustment factor is defined in tables 3 & 4.

FMS Fault Management System, a national failure recording system (or suite of interconnected systems) for the recording and analysis of failures.

FMS Central The national fault recording system operated by Network Rail.

FMS Local A Fault Management system running at the data inputting site known as the Integrated Control Centre (ICC).

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Fundamental Cause	A primary deficiency or prevailing condition which permitted a direct act, omission or equipment fault to lead to a failure.
Hazard	The potential to do harm, including ill health and injury; damage to property, plant, products or the environment; production losses or increased liabilities.
Hazard Index (H)	Index of possible events linked to a numerate method of indicating the scale of Hazard applicable to any Failure or Incident. The ratings are combined to provide a single Hazard index. $H = L \times (F \text{ or } I)$ (Where values exist for F and I use only the higher one of the two).
High Risk	The effect of a failure of equipment where no other part of the control, command and signalling system provides acceptable protection. (GE/RT8106)
ICC	Integrated Control Centre
Incident	Unplanned event which increases risk, or causes death, injury, ill health, damage or other loss; where signalling malfunction cannot be ruled out as contributory factor or cause (includes misunderstanding of equipment by user leading to incident)
Incident Rating (I)	This indicates the seriousness of any incident arising from a situation where signalling equipment malfunction cannot be ruled out as a contributory factor or cause. The value of the incident rating can be from 0 to 9, including the adjustment factor is defined in tables 2 & 3.
Line Speed	The maximum speed at which a vehicle can travel safely over a portion of line. The Line speeds are published in the relevant route sectional appendix.
Location Rating	This offers an indication of the potential for damage or injury resulting from any particular failure or incident based on where it occurs. The value of this rating can range from 1 to 19.
Low Risk	The effect of a failure of signal or telecommunications equipment where an acceptable level of protection is maintained (by the control, command and signalling system or by procedures) even though safety is degraded by the failure. (GE/RT8106)
Maintainer	The organisation responsible for the day to day maintenance or Route Asset Management (or equivalent) of the Signalling equipment or systems.
MCF	Monitored Common Failure. A group of failures of a common nature.
Negligible Risk	The effect of a failure of signalling or telecommunications equipment that does not directly increase the risk to persons or the operational railway. (GE/RT8106)

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Negligible Non Op Risk	All signalling & telecoms failures which do not fall into any of the other risk categories. Applies to all assets operating outside of design parameters and does not fail. Includes failures identified by condition monitoring. (EXAMPLE- First filament failure or slow moving points)
Not A Fault Risk	All signalling & telecoms failures which are Not A fault.
Operational Telecommunications Equipment and Systems	Network Rail telecommunications equipment and services associated with the following ;- Lineside signals, point operation, level crossings, train detection, communications systems at sub-surface stations, radio communications used for the direct operation of the railway, communications to emergency services, communications to electrical control rooms, electric traction supervisory systems (SCADA), communications used for the direct operation of the railway.
ORR	Office of Rail Regulation
Peak Service intensity	The maximum amount of trains per hour that pass a given point when searched within a 24 hour period. This information is used in the calculation of the SINCS location rating, the amount of trains that pass a given location can be found using the TRUST (Train RUnning System for Tops) TSIA enquiry for the particular location.
Period	For the purpose of this specification, this shall be four weeks as defined by Network Rail.
RAIB	Rail Accident Investigation Branch.
Reviewer	Principal Asset Performance Specialist (SP&C) (or a delegated representative) not involved in the day to day maintenance of the infrastructure and able to take an overview of Signalling & Telecoms failure management.
RIDDOR	Reporting of Injuries, Diseases & Dangerous Occurrences Regulations.
SFI	Signalling Failure Investigation
Signalling Equipment and systems	Network Rail's control and communications systems used to control the safe passage of trains and provide information as to train location associated with, for example: Signal and point equipment, level crossing control and protection equipment, train describers, axle box detectors, axle counters, track circuits and their associated control systems.

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SINCS	Signalling Incident System - A national system within FMS for the recording and analysis of high and low risk failures, Signalling & Telecoms wrong side failures and incidents. Should SINCS be replaced by a new system, with similar functionality, at some time in the future, any reference in this document to SINCS shall be deemed to refer to the new system from its commissioning.
SINCS File	All reports, test results, investigation findings and printouts used to sign off (actual, proved or disproved) wrong side failures and incidents.
SMIS	Safety Management Information System - a computer database containing details of events reported by or on behalf of Railway Group members.
SRTF	Safety Related Telecommunications Failure. A failure which reduces the protection normally provided by the Telecoms infrastructure and increases the risk of an Incident.
TMT and FIH	Telecoms Maintenance Testing and Failure Investigation Handbook.
TFI Guide	Telecoms Failure Investigation Guide.
TMT (Test) Plan	Telecoms Maintenance Test Plan.
Wrong Side Failure (WSF)	A failure which reduces the protection normally provided by the signalling & telecoms infrastructure and therefore increases the risk of an incident.

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4 Hazard Index System (Signalling)

The Hazard Index system defined in tables 2 and 4 applies to High Risk and Low Risk Failures and Incidents. The system aims to establish a numerate method of indicating the hazard factors applicable to any such Failure or Incident.

There are three ratings (Location, Failure and Incident) used to calculate the single hazard Index figure. All of these details will be shown on the Failure records.

NOTE Not all failure and incident modes exactly match the categories given in tables 2 and 4. The nearest category should be adopted where a failure or incident does not exactly match.

5 Ratings

Each of the three ratings can be obtained as follows:-

Location Rating :-

Select the highest applicable rating from each group, and add the ratings together to obtain the Location Rating.

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Category	Rating
Line Speed (of the track concerned or, if rated higher, any track that could be affected):-	
Less than 45 mph	1
45 - 60 mph	2
61 - 75 mph	3
76 - 90 mph	4
91 - 100 mph	5
101 - 110 mph	6
111 - 120 mph	7
Over 120 mph	8
Peak Service Intensity (on the track concerned or, if rated higher, any track that could be affected):-	
Where a level crossing is involved / concerned use the sum of the peak service intensity of each line.	
Less than 3 trains per hour	0
3 - 6 trains per hour	1
7 - 12 trains per hour	2
Over 12 trains per hour	4
Layout complexity (include all tracks that could be affected):-	
Totally within sidings	0
Running lines included:-	
Up to 2 parallel lines or siding	0
More than 2 parallel lines	1
Complex layout (7 point ends or more)	2
Route Environment	
Open	0
Cutting	1
Station or embankment	2
Tunnel or viaduct	3
Line Type	
Freight only	0
Passenger	1
Passenger with bi-directional running (including single line and multiple track configurations where SIMBIDS is in operation)	2

Table 1 – Location Rating

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6 Location Adjustment

Where a high or low risk failure, or an incident, allows a train to proceed along the track (i.e. following a signalling irregularity, there may be a derailment or a similar event) and the line characteristics change as the train proceeds, it MAY be necessary to consider the location rating at the point of maximum danger, rather than the location where the incident occurs. For instance, a derailment may occur in the open, but the train continues derailed into a cutting. Unfortunately, there can be no fixed rule for this. Coding has to be carefully applied.

7 Failure Rating :-

Select the highest applicable rating from table 4. Include any relevant Adjustment Factors from table 3.

The Failure Mode or Consequence list has been assembled to allow easy access to Failure Rating, it will also show whether the Failure category has a MCF identity assigned.

SINCS records are used for RIDDOR reporting. RIDDOR requires each instance of a signalling failure meeting RIDDOR criteria to be reported. This means that high or low risk failure of (say) a track circuit after leaf fall should be entered into SINCS each time it is reported – for as long as the equipment remains in service. In the special case of a Track Circuit, this Specification does allow the Failure Rating of the wrong side failure to be entered at a reduced level, once 'Special Working' has been introduced. If the equipment is signed out of service as a form of protection, reporting of failure into SINCS is not mandatory. However, if a failure has nothing to do with the signing out, for example equipment not under test is accidentally found to have a wrong side failure during a T3 Possession, then such a failure shall be entered into SINCS.

NOTE Some failures shown in table 4 are negligible risk (N). These are not entered into SINCS; they are included in the tables for guidance only.

NOTE From time to time, evidence of non-reporting of failures and incidents has emerged, presumably in order for Key Performance Indicator targets to be 'met'. Network Rail relies on FMS and SINCS to manage its business. Non-reporting can result in Network Rail making erroneous decisions. Non-reporting is both dishonest and dangerous and cannot be tolerated in any organisation, without or within Network Rail.

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Where an incident occurs, the following table should be applied using the relevant adjustment factor (as required to a maximum of 9):-

INCIDENTS - create an incident record where signalling malfunction cannot be ruled out as contributory factor or cause (includes misunderstanding of equipment by user leading to incident)			
		Incident Rating	
	Collision or train runs into obstruction (does not include human or animal)	6	
	Derailement fouling another running line	4	
	Derailement not fouling another running line	2	
	Train proceeds along wrong/single line irregularly	3	
	Collision or train runs into a human or animal at a level crossing that should have prevented gaining access to the railway (i.e. it is not reasonable to protect against dogs, cats and badgers, but horses, cows and humans are supposed to be prevented from gaining access by gates and full barriers). Includes humans ignoring protection at telephone or warning sign protected level crossings. Excludes collision or train running into an animal or human gaining access on a crossing with no protection arrangements. Refer to Track standard NR/L3/TRK/7002 for any collision or train running into an animal or human gaining access on plain line	5	
	Reported 'Near Miss' or an injury at a level crossing with signalled protection arrangements (Including crossings fitted with signs only)	3	
	Member of public in collision with level crossing barriers, no train involved, no allegations against signalling, no danger arises. Damage to the equipment may or may not occur (No SINCS entry required).	0	
	Allegation against signalling or level crossing – enter as failure with appropriate failure rating.		
	Road vehicle damages level crossing equipment where there is no allegation of maloperation of the crossing equipment but danger arises	3	

Table 2 – Incident Table

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The 'Adjustment Factor' shall be added to failures or incidents as appropriate.

Add the relevant adjustment factor from the following table to the Failure or Incident

Rating when necessary ;-

ADJUSTMENT FACTORS			
		Factor	
	Fatalities involved	+3	
	Hazardous load involved	+3	
	Fault due to design/installation/testing error	+2	
	Fault is "wrong side" (high or low risk) ONLY whilst Technicians are testing, with the Technicians protecting railway operation and the infrastructure. For example, replacing the fuse on a failed detection causes a short duration reverse detection vice the correct normal before the fuse blows again.		
	Failure Rating 8 or 9	-4	
	Failure Rating 6 or 7	-3	
	Failure Rating 5	-2	
	Failure Rating 2, 3 or 4	-1	
	Failure Rating 1	0	
	Fault is intermittent and of short duration, and /or unlikely to mislead (mechanical signal arm fallen off in darkness, signal lamp still lit. or power failure during no-train period)	-1	

Table 3 – Adjustment Factor

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Table 4 – Hazard index

SYSTEM	Failure Mode or Consequence	Risk	F	MCF.
SIGNAL				
MULTIPLE ASPECT COLOUR LIGHT SIGNALS	Incorrect aspect displayed - Y, YY, G vice R (previous signal at G)	H	8	
	Incorrect aspect displayed - Y, YY, G vice R (previous signal at Y or YY)	H	7	
	Incorrect aspect displayed - Y, YY, G vice R (no previous signal, such as leaving terminal platform)	H	6	
	Incorrect aspect displayed - YY, G vice Y	H	4	
	Incorrect aspect displayed - G vice YY	H	2	
	Multiple main aspects displayed to driver	H	2	
	Incorrect aspect displayed - YY, G vice sub/shunt	H	6	
	Incorrect aspect displayed - Y vice sub/shunt	H	4	
	Incorrect aspect displayed - sub/shunt vice R (note: applies where interlocking requires signal at red aspect i.e. sub/shunt on)	H	4	
	Flashing aspect sequence displayed vice more restrictive aspect sequence	H	4	
	No danger aspect - failed signal fitted with AWS - signal in rear at proceed aspect	H	4	4
	No danger aspect - failed signal not fitted with AWS - signal in rear at proceed aspect	H	4	
	No danger aspect - failed signal fitted with AWS - signal in rear held at danger	L	1	3
	No danger aspect - failed signal not fitted with AWS - signal in rear held at danger	H	2	
	No proceed aspect - failed signal fitted AWS - signal in rear at YY or G aspect	L	2	4
	No proceed aspect - failed signal fitted with AWS - signal in rear held at danger	L	1	3
	No proceed aspect - failed signal fitted AWS - signal in rear at Y aspect ("Lamp or control" MCF 3, no lamp or control MCF 4)	L	1	3 or 4
	No proceed aspect - failed signal not fitted AWS - signal in rear at proceed aspect	L	2	

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SYSTEM	Failure Mode or Consequence	Risk	F	MCF.
SIGNAL				
MULTIPLE ASPECT COLOUR LIGHT SIGNALS (Cont)	No proceed aspect -failed signal not fitted with AWS – signal in rear held at danger	L	1	
	Lens Broken/Missing, White light displayed, signal at 'green'	L	1	
	Lens Broken/Missing, White light displayed, signal at 'yellow or double yellow'	H	4	
	Lens Broken/Missing, White light displayed, signal at 'red'	H	3	
	Signal able to clear with less than 2 lamps lit in 5 or 3 lamp Junction Indicator	H	5	
	Signal able to clear with 2 lamps lit in 5 lamp Junction Indicator	L	1	
	Signal able to clear with Route Indicator not displayed when required (RI lamp proved)	H	5	
	Signal able to clear with Route Indicator not displayed when required (RI lamp not proved)	N	0	
	Signal able to clear with Incorrect Junction Indicator or Route Indicator displayed if less restrictive	H	5	
	Signal able to clear with Incorrect Junction Indicator or Route Indicator displayed if more restrictive	N	0	
	Route Indicator aspect partially displayed outside design criteria with associated signal clear - Route Indicator lamp proved	H	5	
	Stencil not lit with associated signal clear, indicator lamp proven in aspect	H	3	
	Stencil not lit with associated signal clear, indicator lamp not proven in aspect	N	0	
	Main signal of Main/Co-Acting arrangement not displaying an aspect	L	2	
	Co-acting signal of Main/Co-Acting arrangement not displaying an aspect	L	2	
	Signaller Unable to replace or maintain signal at danger by Signal Replacement Switch	L	2	
	Signaller unable to replace or maintain signal at danger due to defective/broken button WHERE SIGNALLER REQUIRES TO PROVIDE PROTECTION	L	1	6

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SYSTEM	Failure Mode or Consequence	Risk	F	MCF.
SIGNAL				
MULTIPLE ASPECT COLOUR LIGHT SIGNALS (Cont)	Signaller unable to replace or maintain signal at danger due to any other reason WHERE SIGNALLER REQUIRES TO PROVIDE PROTECTION	H	4	
	Signaller unable to replace or maintain signal at danger, no train involved and not required to provide protection to a possession such as a T3	N	0	
	First Filament Failure. (Not a wrong side failure, but shall be recorded in FMS for failure analysis and management).	M	0	

*NOTE Junction Indicators consist of a line of white lamps usually displayed above the associated signal. Route Indicators, which could be Theatre/Stencil/Fibre optic or LED types may be displayed by way of a single lamp, multiple lamps, fibre optic assembly or LED's. **EXAMPLE** "UB" (Up Branch) or "4" (Platform 4).*

SYSTEM	Failure Mode or Consequence	Risk	F	MCF
SIGNAL				
FIXED DISTANT BOARD	Fixed Distant Board missing or Obscured fully - No AWS fitted	H	4	
	Fixed Distant Board missing or Obscured fully - AWS fitted	H	2	

SYSTEM	Failure Mode or Consequence	Risk	F	MCF
SIGNAL				
ETCS BOARDS/MARKERS	Block marker missing/obscured fully	H	4	
	Cab signalling board missing or obscured fully	H	4	
	Shunt limit marker missing/obscured fully	H	2	
	Shunt exit marker missing/obscured fully	H	2	

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SYSTEM	Failure Mode or Consequence	Risk	F	MCF
SIGNAL				
GROUND POSITION LIGHT	No red and no pivot aspect displayed - 3 lamp type signal	H	2	10
	No red or no pivot aspect displayed - 3 lamp type signal	L	1	10
	No reds displayed - 4 lamp type signal	H	2	10
	One red only displayed - 4 lamp type signal	N	0	
	White pivot lamp not lit when off - 4 lamp type signal	N	0	
	LED Signal with 3 LED modules, right hand ('pivot') capable of displaying red or white – apply failure ratings as 4 lamp type			
	Unable to replace or maintain signal at danger WHERE SIGNALLER REQUIRES TO PROVIDE PROTECTION	H	2	
	Unable to replace or maintain signal at danger, no train involved and not required to provide protection to a possession such as a T3	N	0	
	Signal off, when it should be on (note: applies where interlocking requires signal on)	H	3	
MECHANICAL SIGNAL STOP/DISTANT	Section signal not restoring to 'ON' - arm not proved in controls, Signaller not provided with a repeater	H	7	
	Section signal not restoring to 'ON' - arm not proved in controls, Signaller provided with a repeater	H	2	
	Section signal not restoring to 'ON' - arm proved in controls	L	1	
	Other signal not restoring to 'ON' - arm not proved in controls, Signaller not provided with a repeater and signal not visible from signal box	H	4	
	Other signal not restoring to 'ON' - arm proved in controls or Signaller provided with a repeater or signal visible from signal box	L	1	
	No light displayed during hours of darkness - light not proved in controls and no repeater provided and signal not visible from signal box	H	2	2
	No light displayed during hours of darkness - light proved in controls or signaller provided with a repeater or signal visible from signal box	L	1	2
	No light displayed during hours of daylight	N	0	
	Signal arm/spectacle casting missing	H	2	

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SYSTEM	Failure Mode or Consequence	Risk	F	MCF
SIGNAL				
MECHANICAL SIGNAL STOP/DISTANT(Cont.)	Signal spectacle glass missing, signal displaying a white light in darkness.	L	1	
	Signaller unable to observe non-repeated signal from controlling point due to being Obscured fully (for example, by vegetation)	L	1	
MECHANICAL SIGNAL SHUNT / CALLING ON	Signal not restoring to 'ON' - arm not proved in controls and no repeater provided and signal not visible from signal box	H	5	
	Signal not restoring to 'ON' - arm proved in controls or signaller provided with a repeater or visible from the Signal box	L	1	
	Shunt - no light displayed during hours of darkness - light not proved in controls and no repeater provided and signal not visible from signal box	H	2	21
	'Shunt' - no light displayed during hours of darkness - light proved in controls or signaller provided with a repeater or signal visible from signal box	L	1	21
	'Calling on' - no light displayed during hours of darkness - light not proved in controls and no repeater provided and signal not visible from signal box	L	1	21
	'Calling on' - no light displayed during hours of darkness - light proved in controls and no repeater provided and signal not visible from signal box	L	1	21
	No light displayed during hours of daylight	N	0	
	Signal arm, spectacle casting or disc missing	H	2	
	Signaller unable to observe non-repeated signal from controlling point due to being Obscured fully (for example, by vegetation)	L	1	
BANNER MECHANICAL	lamp out during darkness - lamp not proved in controls	L	2	
	lamp out during darkness - lamp proved in controls	L	1	
	Lamp out - during daylight	N	0	
FIBRE OPTIC/ LED BANNER	'ON' aspect not displayed, not proven in signal controls in rear	L	2	19
	'ON' aspect not displayed, proven in signal controls in rear	L	1	19
	'OFF' aspect not displayed	N	0	