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NR/L3/SIG/11231

NR/SMTH/Part/05

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NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part/05		
Index – Wrong Side Failure and Incident Investigation		
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NR/SMTH/Part05/Module/S01		
Wrong Side Failure Testing Principles		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

1. Principles

- 1.1 All reported wrong side failures shall be investigated and be treated as being genuine until proven otherwise.
- 1.2 Reports of wrong side failures often occur during unusual operating conditions.
- 1.3 After the Test Guide(s) have been selected, it is usually necessary to define the suspect circuit or circuits. The suspect circuit is not always obvious.
- 1.4 Following a Test Guide might find a wrong side failure that is still present but, if the fault is not present at the time of testing, only by carrying out the full range of steps on the correct circuit can a hidden wrong side failure be found.
- 1.5 It is then necessary to determine which circuit or circuits should have prevented the wrong side failure from happening, (where Solid State Interlockings are in use it is not normally necessary to select a suspect circuit).
- 1.6 In the event of a serious incident or accident, the arrangements for investigation might need to be changed, particularly if the Police are involved.
- 1.7 The procedure for the investigation process is summarised as a flow chart in [NR/SMTH/Part05/Module/S21](#) (Failure and Incident Testing Flowchart).

END

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Wrong Side Failure Testing Competence		
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1. Competence

- 1.1 This module details the additional competency requirements to undertake WSF investigations.

Level 1 Staff (L1)

- 1.2 Authority to undertake SFI investigations shall typically be granted by the S&TME on the recommendation of the SM(S) and after successful completion of the approved training course.
- 1.3 Where response teams are provided, these teams shall include SFI Level 1 competent staff member for the duration of each shift.
- 1.4 SFI level 1 staff can be used to assist with management of Wrong Side Failures.

Level 2 Staff (L2)

- 1.5 As per Level 1 plus additional experience either:
 - a) As a leader of a team investigating failures on site at first instance and preparing reports for consideration by others, or
 - b) As a SM(S) or member of a technical support team who has regularly attended failures, provided advice or endorsement of other people's actions, or
 - c) With detailed relevant technical knowledge of the equipment in the locality gained by such activities as signal works testing, design or installation.
- 1.6 The Level 2 staff shall be certified as SMTH testers.
- 1.7 Level 2 staff are typically a SM(S) or manager of Level 1 staff, or member of a technical support group.

Level 3 Staff (L3)

- 1.8 A Level 3 shall have knowledge of Signalling Maintenance Testing and Failure and Incident Testing procedures.
- 1.9 They shall be certified SMTH Testers or be approved by the Route Engineer (Signalling), Principal Route Engineer [Signalling] or equivalent.
- 1.10 Level 3 staff are typically Signal Engineers with a higher level of technical expertise, such as the S&TME or members of the teams supporting the Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalent.

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- 1.11 Access to a competent SFI Level 3 is not normally needed at the onset of SFI testing, but staff should have access to SFI Level 3 competent staff when required.

END

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Single Obvious Cause - Exempted Failures		
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1. Exempted (Level 1) Failures

1.1 When a single, obvious cause of failure is found and confirmed, the following failures types require only a Level 1 sign back:

- a) Failure of any filament/LED signal lamp.
- b) Failure of level crossing filament/LED lamp.
- c) Signallers panel lamps/LEDs.
- d) Failure of a lamp holder (life expired, wear and tear).
- e) SPT or level crossing telephones, unless there is any doubt as to the cause of the failure or the failure.
- f) AWS permanent magnet missing or faulty.
- g) Failure of a transformer, transformer/rectifier or rectifier.
- h) Failure of a fuse/MCB.
- i) Failure of a timing device.
- j) Failure of an audible warning device (except level crossings).
- k) Failure of a primary cell.
- l) Failure of an electronic or mechanical flashing device.
- m) Failure of a filament changeover relay.
- n) Failure of barrier / gate mechanisms / hydraulics (where the failure can be restored by simple adjustment or 'like-for-like' replacement).
- o) Failure of any equipment caused by vandalism (providing destructive testing is not required to resolve the failure).
- p) Failure of a mechanical signal to return to the 'ON' position due to an obstruction, extreme weather conditions or simple adjustment of other mechanical equipment.
- q) Failure caused by loss of electrical supply from an Electricity Supply Company and no standby facility has been provided.

END

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NR/SMTH/Part05/Module/S04		
Management of Track Circuit Wrong Side Failures		
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1. Scope

This module provides guidance on the categorisation, investigation and sign back of track circuits following potential Wrong Side Failure or Remote Conditioning Monitoring (RCM) Alarm/Alert.

2. Categorisation of Track Circuit Failures

2.1 Track Circuit Showing Clear When Occupied (SCWO)

A track circuit is considered to have failed wrong-side if the interlocking fails to correctly detect a train or the Signaller's indication does not show the passage of a train. Typically, this is reported by the Signaller, but in certain circumstances this might not be immediately evident.

Examples of evidence where the interlocking might have failed to detect a train include:

- a) Reports from Signallers.
- b) Reports from Drivers.
- c) Out of sequence alarms on a workstation or train describer.
- d) Occurrences logged on event recorders.
- e) Evidence from Technicians' terminal downloads.
- f) Interrogation of digital EBI track receivers.

In each case above, these shall be treated as Wrong Side Failures and investigated.

2.2 Track Circuit RCM Alert or Alarm

RCM alarms and alerts of short duration are not definitive evidence that a track circuit Wrong Side Failure has occurred.

Track circuit systems (which include the first repeat relay or equivalent electronic control) have features which prevent incorrect and intermittent operation of the TR being detected by the interlocking.

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RCM events lasting less than 300ms where:

- a) the track circuit current has risen above the track clear level whilst a train is traversing the track circuit (occupied-clear-occupied or slow to clear event), or
- b) where the track circuit current has failed to fall below the track occupied current (slow to occupy event),

shall not be treated as a wrong side failure as it can be assumed that the interlocking has not reacted.

These events shall be classified as a Negligible Risk Failure as defined in NR/L3/SIG/20047 and actioned as an RCM alarm in line with route processes.

NOTE: *These alarms are a precursor that a Wrong Side failure of the track circuit might be imminent and should be actioned (e.g. Arrange for Rail Head Treatment).*

Where the duration of the events in a) and b) above has exceeded 300ms, these shall be assumed to be a Wrong Side Failure unless there is evidence that the interlocking has not responded.

NOTE: *Evidence whether the interlocking has responded includes event recorder downloads, downloads from control systems or Technicians' terminals.*

Where RCM systems have identified rail head contamination effects of any duration and it can be proved that the interlocking did not respond, these are not be classified as a wrong side failure.

NOTE: *For track circuit RCM to provide a robust control in the management of Track Circuit Wrong Side Failures, it is essential that it is working, calibrated correctly and monitored by competent staff.*

2.3 Interlocking Controls

In some locations, interlocking controls are in place to prevent the interlocking responding to intermittent or false operation of a track relay (e.g. SSI Sequence Proving or Red Proving).

Where these controls are in place, the SFI investigation shall consider if these controls were breached and if a Wrong Side Failure has occurred.

NOTE: *These controls are specific to location and shall be confirmed by the local SFI Level 3.*

NOTE: *Special consideration should be given to absolute block controls which might differ between Signal boxes.*

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2.4 Special Working

Where the Signaller is protecting the line and not relying on the track circuit as described in TS11 clause 15.2, track circuit SCWO events shall not to be classified as Wrong Side Failures and do not require investigation.

These incidents shall continue to be recorded in FMS and Operations Controllers shall confirm with the Signaller the use of TS11 and record in the FMS record notes. No SINCS record is required.

If there is any doubt as to whether the Signaller has been protecting the line, these incidents shall be classified as Wrong Side Failures and investigated in line with SFI procedures.

3. Management of a Potential Track Circuit Wrong Side Failure

The flowchart (Figure 1) and the corresponding guidance describes the process to be followed when classifying, investigating and signing back track circuit wrong side failure events.

3.1 Report of a Potential Wrong Side Failure

Potential track circuit WSF reported by the Signaller, a Driver, by interlocking event recorders / Technician terminals, or by Remote Condition Monitoring systems shall be investigated.

3.2 Evidence of a Potential Wrong Side Failure

Track circuit Wrong Side Failures occurring where the interlocking has responded or where the Signaller's indication does not show the passage of a train shall be treated as a WSF and investigated.

Evidence of whether the interlocking has responded includes event logging of interlocking functions, downloads from Technicians' terminal; out of sequence alarms on a workstation or train describer; interrogation of digital EBI track receivers.

Where no RCM is fitted, this shall be treated as a Wrong Side Failure unless positive interlocking evidence is provided and / or interlocking controls are confirmed to be in place and working.

3.3 Authorisation to Treat the Rail Prior to Confirming Contamination

The principle of SFI is to preserve evidence of a wrong side failure and investigate thoroughly to establish the root cause. This can lead to restrictive methods of working being applied for long periods of time coupled with additional risk with sending staff to site.

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Track circuit RCM provides comprehensive real-time asset status information and can be used to improve failure investigation and rectification of rail head contamination events.

Rail head contamination can be seen on RCM traces and can be seen to improve following treatment of the rail.

The SFI Level 3 can authorise the rail head to be treated without sending staff to site. This authorisation is subject to the following conditions:

- a) Track circuit RCM is fitted and working.
- b) The SFI Level 3 has assessed the traces and confirmed that these are indicative of rail head contamination.
- c) There is evidence to support a likely rail head contamination event.

Typical evidence which support likely rail head contamination event has occurred include:

- a) The time of year (i.e. Autumn).
- b) The geographic location is susceptible to railhead contamination events (e.g. history of leaf fall issues, lightly used line etc).
- c) Weather conditions (e.g. recent high winds).
- d) The type of train (e.g. light engines, class 158's).
- e) Rerailing.

Where the track circuit has Failed Wrong Side or assumed to have failed Wrong Side the Signaller shall be instructed not to rely on the track circuit until they are informed otherwise.

The SFI Level 2 shall arrange for information to be collected to support the investigation, sign back and closure of the fault report and SINC's file. As a minimum this shall include steps N1 to N12 from Wrong Side Failure Test Guide [NR/SMTH/Part08/T002](#).

3.4 Arrange for Rail Head Treatment

Rail head treatment processes differ across Routes and Regions. Treatment can consist of use of rail head treatment trains (RHTT) or manual rail head treatment.

Prior to and following treatment, RCM traces and interlocking monitoring shall be continually monitored to check for improvement or deterioration.

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It is possible for isolated TC WSF events to occur (e.g. the first train of the day or specific train formations). This could be due to the contamination being on the wheel sets rather than the track circuit.

Where this is the case, RCM traces can improve to a point where they could be signed back into use without treatment.

This shall only be permitted with the authority of the SFI Level 3 and following review of RCM traces for subsequent trains.

3.5 SFI Level 2 to Review Testing Requirements

The SFI Level 2 shall determine any further testing necessary from:

- [NR/SMTH/Part08/T025](#) (Wrong Side Failure Test Guide: Track Circuit Rail Head Contamination – Remote Condition Monitoring (Not Fitted)) or
- [NR/SMTH/Part08/T026](#) (Wrong Side Failure Test Guide: Track Circuit Rail Head Contamination – Remote Condition Monitoring (Fitted)), for rail head contamination or
- [NR/SMTH/Part08/T002](#) (Wrong Side Failure Test Guide: Track Circuits), for other TC WSF scenarios.

NOTE: The SFI Level 2 should collate evidence to determine if the fault has been found and the treatment has been effective prior to sign back. In the absence of RCM, the remaining steps in [NR/SMTH/Part08/T025](#) support this decision.

3.6 SFI Level 2 Review

The SFI Level 2 shall review evidence collected to determine if the fault has been found.

Where RCM is fitted, the SFI Level 2 shall assess the RCM trace to confirm that it shows an improvement following rail head treatment and/or passage of similar train stock and size.

Where the trace returns to normal, this is evidence that the fault has been found and the track circuit can be relied upon.

Where track circuits are handed back in the leaf fall season, RCM traces and interlocking monitoring shall be continually monitored to check for deterioration and to determine if further rail head treatment is required.

Where rail head treatment does not result in improvement to the RCM trace, this is an indication that there is another problem with the track circuit which shall be investigated.

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Where there is no RCM coverage, the SFI Level 2 shall determine if the evidence presented from the SFI testing in [NR/SMTH/Part08/T025](#) (for rail head contamination scenarios) or [NR/SMTH/Part08/T002](#) (other TC WSF scenarios) has demonstrated that the fault has been found.

3.7 Positive Evidence the Interlocking responded as intended

Where the RCM alarm/alert shows an event, which is longer than 300ms in duration, the SFI Level 1 shall check to see if the interlocking responded.

Evidence of whether the interlocking has responded includes event logging of interlocking functions, downloads from Technicians' terminal; out of sequence alarms on a workstation or train describer; interrogation of digital EBI track receivers.

3.8 Interlocking Controls in Place

Interlocking controls are specific to location and shall be confirmed by the SFI Level 2.

Where implemented, SSI sequence proving as described in SSI8003-82 hold the TPR function down in the interlocking for a set time prior to clearing unless the track circuits are shown to operate in sequence.

NOTE: *These controls are documented on scheme plans and in control tables.*

3.9 SFI Level 2 Sign Back

The SFI Level 2 shall confirm that the investigation evidence supports the conclusion after testing and rectification (e.g. rail head contamination and that the treatment has been effective).

Where RCM is fitted the SFI Level 2 should confirm that the trace has returned to normal prior to sign back. Where the trace shows no improvement and has not returned to normal, further treatment / investigation shall be undertaken and the track circuit shall not be signed back for use.

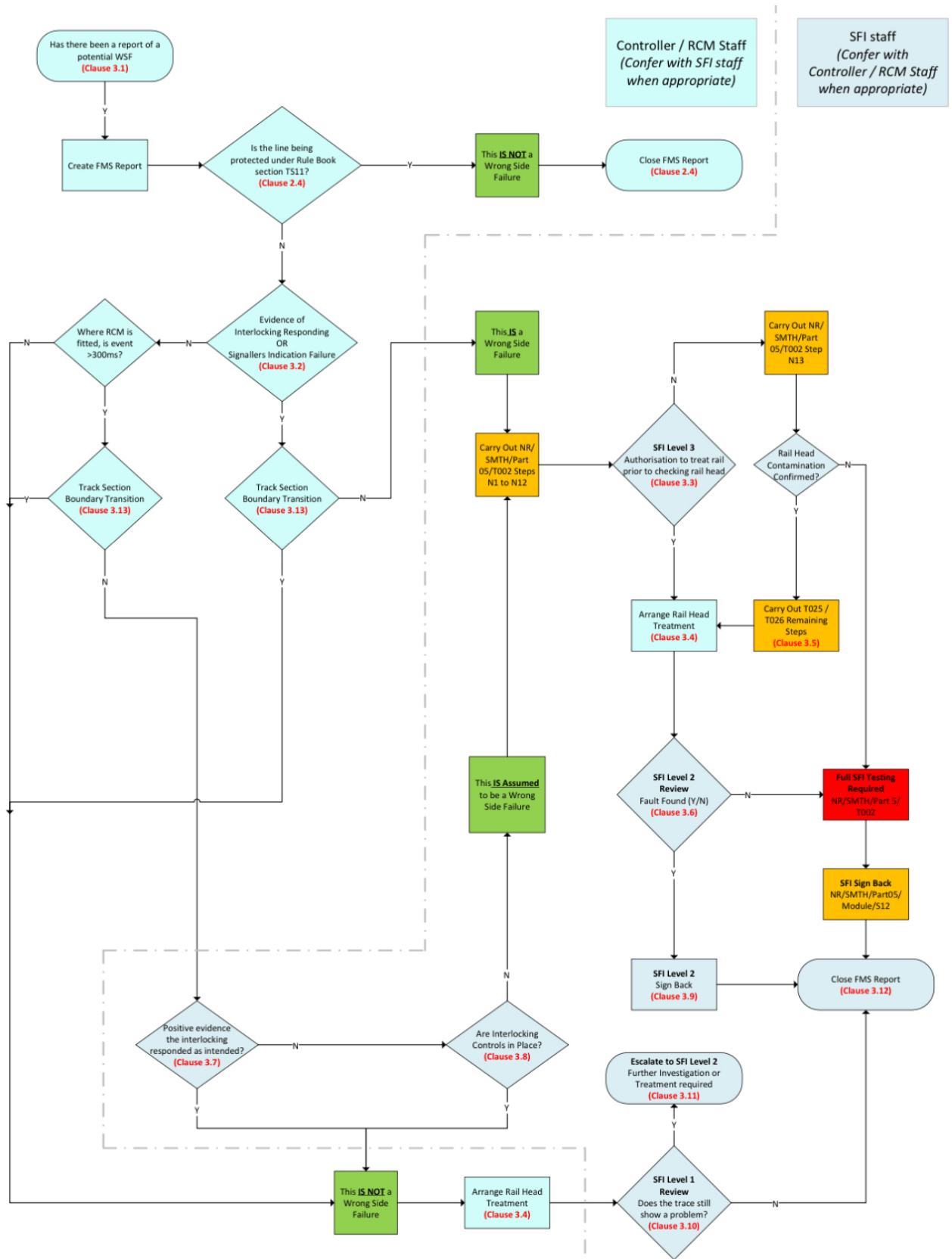


Figure 1 – Track Circuit Management Flowchart

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3.10 SFI Level 1 Review

The SFI Level 1 shall confirm the RCM trace shows an improvement following rail head treatment and/or passage of similar train stock and size. Where the trace returns to normal the track circuit can be relied upon however close monitoring shall be undertaken to watch for degradation.

NOTE: *There is a competency requirement in the hand back of signalling faults. SFI Level 1 might need to consult with others while reviewing RCM traces (e.g. CCT's, Flight Engineers, SFI Level 2).*

3.11 Further Investigation Required

Where no improvement in RCM trace following Rail Head Treatment this is either an indication that there is another problem with the track circuit which shall be investigated, or the treatment has not been effective.

The SFI Level 1 in discussion with the SFI Level 2 shall determine any further investigation or treatment required.

3.12 Closure of Failure Report

Where SFI Level 2 or Level 3 sign back is required, the following evidence shall be supplied and appended to the FMS report to support closure of the failure and associated SINCS file:

- a) SFI Level 2 or 3 report / statement.
- b) II RCM traces.
- c) Extract of evidence from interlocking loggers or Technician's terminal.

Where an event is considered to be NOT a wrong side failure, RCM traces shall be to be appended to the relevant FMS record as evidence.

3.13 Track Section Boundary Transition

Track Section Boundary Transitional Track Circuit Showing Clear While Occupied events where;

- a) The abutting Track Section remains occupied, and
- b) The event is less than 1s duration.

shall not be treated as a wrong side failure as it can be assumed that the interlocking has not reacted.

These events shall be classified as a Negligible Risk Failure as defined in NR/L3/SIG/20047 and actioned as an RCM alarm in line with Route processes.

NOTE: *These events are a precursor that a Wrong Side Failure of the track circuit might be imminent and should be actioned (e.g. Arrange for Rail Head Treatment)*

END

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Protecting the Line		
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1. Protecting the Line

- 1.1 It is the Signaller's duty to protect the line. It is **NOT** the duty of Signal Technicians to provide protection by disconnecting signals or track circuits.
- 1.2 Signalling Technicians shall inform the Signaller of the protection required to minimise the risks associated with the wrong side failure.
- 1.3 Disconnections or adjustments to equipment to assist traffic flow can be requested by operations staff. This is only permitted with the authority of the S&TME, only when any investigation testing affected by such disconnections has been completed.
- 1.4 Any disconnections shall be recorded, and arrangements made to restore them as soon as the reported failure has been rectified and other circumstances allow.
- 1.5 Where an incident does not involve any failure of the signalling system, or allegation of failure, Signalling Technicians shall co-operate fully with the operations staff, providing advice on the benefits and risks of the protection proposed.
- 1.6 Further information on the giving of releases is contained in [NR/GI/B003](#) (Releases and Restoration).

END

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Wrong Side Failure Testing Procedure		
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1. Testing Procedure

1.1 Testing shall only be carried out once line protection arrangements have been agreed with the Signaller.

1.2 Before testing commences, all the available facts and evidence shall be assessed and together with additional reports and information such as from the:

- a) Driver.
- b) Signaller.
- c) Intelligent infrastructure.
- d) Technicians terminal.
- e) Train describer stepping records.
- f) Other witnesses.
- g) Facing train cameras.
- h) Station cameras.

From this information, the possible causes should be identified, and the relevant Test Guide(s) selected and applied to any suspect circuit(s). The Test Guides detail the tests required for investigating each possible cause.

1.3 The testing shall also include the identification of requirements for recreating the circumstances of the incident.

1.4 The Test Guides are comprehensive but are not necessarily in the correct test sequence for every investigation.

1.5 Tests considered most relevant to the reported problem or observed symptoms shall be carried out first.

1.6 Testing shall include associated equipment and circuits which could have led to the failure.

1.7 Always consider other possibilities beyond the 'obvious' cause.

1.8 It is important that those exercising L2 and L3 sign-off of investigations, confirm that the way a failure is reported to the Technicians carrying out the investigation, has not influenced their thinking about what needs to be disproved.

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1.9 Testing shall be carried out in two distinct stages Non-destructive tests followed by Destructive tests.

Non-destructive tests

1.10 Carried out or directly supervised by the Tester and can involve:

- a) Visual examination of equipment.
- b) Taking measurements or readings without disturbing or disconnecting the equipment or its wiring, or without affecting the electrical characteristics of the system.

1.11 Independent confirmation of fault diagnosis is required.

1.12 All conditions that existed at the time of failure shall be recorded by questioning and observation.

1.13 Where it is not possible to perform a test, which is designated as 'non-destructive' without risk of disturbing equipment/wiring, then this shall be recorded, and the test conducted during the 'destructive testing' phase instead.

1.14 Doors can be opened, but equipment covers can only be removed by persons competent to do so, and then only if no disturbance to the equipment/wiring or disarrangement of locking would occur.

Destructive tests

1.15 Carried out by the Tester these tests can sometimes alter the electrical, mechanical or physical state of the equipment.

1.16 This disturbance might make a repeat of the fault impossible.

1.17 Destructive tests shall be authorised by an SFI level 2 or 3 and independent confirmation of fault diagnosis is required.

2. Deferred Testing

2.1 Testing shall only be deferred if:

- a) Requested by a Network Rail Operations Manager and endorsed by the Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalent, and
- b) For the Railway to operate safely, it shall always be assumed that the wrong side failure report is genuine, and
- c) The S&TME records the names of those involved in this decision.

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3. Testing Methods

- 3.1 If the circumstances allow, try to repeat the equipment operations that led to the reported failure. This can include dropping track circuits to recreate the effect of a passing train or actually observing a train through a section.
- 3.2 This allows equipment to be operated but can cause the destruction of evidence about its state, such as relay positions, and therefore shall be undertaken at an early stage of destructive testing.
- 3.3 Any such tests shall be done with the Signaller's authority and after consideration of any risks involved.
- 3.4 Equipment shall be signed out of use before test straps are used.
- 3.5 Test straps shall be removed and accounted for before equipment is made available for use.
- 3.6 Seals shall not be broken during testing.
- 3.7 Connecting test instruments to vital signalling systems has the potential to create wrong side failures. Unwanted connections can arise via internal instrument circuits and these might be far from obvious.
- 3.8 Specialist test equipment shall only be connected to vital signalling equipment by competent staff.

4. Defined Tests

- 4.1 Particular care is required when carrying out a [WIRE COUNT](#) especially at some older installations.
- 4.2 Wire counting is therefore specified as a destructive test within the Test Guides.
- 4.3 Wiring with poor terminations and/or insulation degradation or wiring trapped against metallic or moving equipment can cause faults and is easily disturbed.
- 4.4 In some cases, the removal of covers to allow inspection of wiring within trunking might also disturb faults. It might be necessary to consider this activity as a destructive test carried out after an [INSULATION TEST](#) of the wiring.

END

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Evidence - Data Loggers and Condition Monitoring Systems		
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1. Data Loggers and Condition Monitoring Systems

1.1 Where equipment has built-in and/or portable event recording or condition monitoring, arrangements shall be made to recover and protect any data.

1.2 This requirement is identified in the Test Guides as; 'Check any relevant system terminal printout and remove any recording media for checking'.

1.3 Many styles of data recording are used to monitor signalling equipment, such as, but not limited to:

- a) SSI Technician's Terminal.
- b) IECC.
- c) ARS.
- d) Computer Based Interlockings.
- e) VHLC.
- f) Trackwatch.
- g) Intelligent Infrastructure systems.
- h) HABD.
- i) Axle counter systems.
- j) SPT recordings.
- k) Event recorders.
- l) Other types of event or condition monitoring equipment.

1.4 The recording time on the logging/monitoring system shall be verified or calibrated against a known base time.

NOTE: *If the time system is controlled by the Anthorn transmitter, alterations to the time are not possible.*

1.5 The Tester shall verify that the relevant functions are recorded correctly by the system, e.g., when track circuits become occupied or clear, or signals change aspect.

This need not entail additional testing of the functions as these will be tested as part of the investigation, but should establish that the monitor was capable of accurately recording the events associated with the reported failure or incident.

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- 1.6 Confidence in the equipment can be conferred by checking that events both before and after the incident are recorded in a logical order.
- 1.7 Removable storage media shall be withdrawn in a timely manner post incident and analysed to provide a focus for testing activities or in some cases provide data which indicates the cause of the failure / incident.
- 1.8 The data shall be recovered in accordance with the instructions for the respective equipment.
- 1.9 Data shall be collected from all relevant sources even if the equipment is not implicated in the failure as it might provide additional information.
- 1.10 Consideration shall be given to removal of voice recording media.
- 1.11 Following a serious incident, it is important to impress on the Investigating Officer that a copy of the SSI and IECC files shall be taken before the recording media itself is removed into police custody.

END

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Escalation Procedure		
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1. Escalation Procedure

1.1 The Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalent shall confirm that the correct levels of authority have been applied and documented at the various stages of the investigation.

These are to be based on the three levels of competence defined in [NR/SMTH/Part05/Module/S02](#) (Wrong Side Failure Testing Competence).

1.2 All other reportable wrong side failures shall be escalated to the Level 2 Tester as soon as possible.

This would normally be done before testing starts so that a second independent mind considers the symptoms and agrees the required degree of testing.

1.3 The Level 2 Tester shall be independent of the actual testing and not physically involved.

1.4 If a fault is found during non-destructive testing, independent confirmation shall be required from a Level 2 Tester that the fault found, accounts for the reported failure, and that all the relevant testing has been carried out.

1.5 If the Level 2 Tester agrees the failure has been identified, carry out repairs as soon as possible.

1.6 The equipment is to be signed back into use in accordance with the matrix in [NR/SMTH/Part05/Module/S12](#) (Sign Back Matrix).

1.7 If no fault has been found, permission shall be sort from the Level 2 Tester to move to the destructive testing phase.

1.8 If a fault is found during destructive testing, independent confirmation shall be required from the Level 2 Tester that the fault found accounts for the reported failure and that relevant testing has been carried out.

1.9 If the Level 2 Tester agrees the failure has been identified, carry out repairs as soon as possible.

1.10 At each of the above stages, the Level 2 Tester shall confirm that the items listed under 'Other Considerations' have been tested.

1.11 If no fault is found after testing, a Level 3 Engineer, independent of the actual testing to date, shall decide what further action is to be taken.

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NR/SMTH/Part05/Module/S08		
Escalation Procedure		
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- 1.12 The Level 2 Tester and Level 3 Engineer shall always confirm if any steps have been omitted and verify that the reason for not carrying out the steps were valid and have not reduced the effectiveness of the testing.
- 1.13 If any doubt exists with the failure investigation or findings, the wrong side failure shall be escalated to a required level of expertise or authority at any time.
- 1.14 Additional testing resources might be considered necessary to complete the testing and reduce timescales.
- 1.15 Following an investigation, the Level 3 Engineer shall pass any necessary details to the Route Infrastructure Control if more than one stakeholder or engineering discipline is involved in the incident.
- 1.16 It is the responsibility of the Route Infrastructure Control to share details of no fault found after testing, in accordance with RIS-0707-CCS (Clause 2.2.3.3).

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S09		
Record Keeping		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

1. Keeping Records

- 1.1 It is important to record all relevant information. Notes shall be made at the time of observation. Even if these notes are rewritten later, it is important to retain the original notes in accordance with company policy.
- 1.2 Priority shall be given to information that might quickly disappear. Any information given by members of the public shall be recorded with particular care as their terminology might not have the same meaning as railway terminology.
- 1.3 In addition to the specific information requested in the Test Guides the following shall be recorded:
 - a) Train identity, formation and vehicle number.
 - b) Train driver's name and depot.
 - c) Signaller's name.
 - d) Names of any other staff or public involved.
 - e) Witness information (staff/public).
 - f) Details of Protection arrangements made.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S10		
Test Result Reporting		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

1. Test Result Reporting

- 1.1 All staff involved in the investigation of failures shall, when reporting rectification, provide the following test results as a minimum:

General

- a) The Tester's name, Test Guide used and SMTH Log Sheet number.
- b) The items of equipment that were replaced and why they were replaced. Details shall include the manufacturer, the date of last service (if known), serial numbers, mod states, any other references such as pin code, type, etc.
- c) Environmental conditions depending on the nature of the failure / incident, e.g. rail head condition, ballast condition, weather conditions at the time of the failure / incident, position of the sun relevant to the affected equipment.

Signal Lamp/LED Failures

- d) Lamp type and make, (e.g. SL35).
- e) Lamp voltage.
- f) If lamp voltage was adjusted, then the voltage before and after adjustment is required.
- g) Batch number if available and last changed date.
- h) LED module type and nature of failure.

Track Circuit Failures

- i) Drop shunt value.
- j) Pick-up shunt value.
- k) Rail volts feed and relay end.
- l) Relay coil volts.

Point Failures

- m) FPL Test results.
- n) Detection Test results.

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TPWS Failures

- | o) Any fault indications displayed by the various modules.

AWS Failures

- | p) S&P meter readings for Electro and Permanent Magnets.

Cables Failures

- | i) Lowest insulation resistance reading core to core.
- | q) Lowest insulation resistance reading core to earth.

Blown Fuses

- | r) Current rating of fuse.
- | s) Current in circuit (measure AC and DC separately).

Changing Equipment

- | t) Test Plan used.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S11		
Signing Back, Using the Sign Back Matrix and Feedback		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

1. Signing Back

1.1 The equipment shall not be made available for use until those who are investigating are satisfied with the results and conclusions of the testing undertaken.

1.2 Any undue pressure or coercion prior to or during the testing shall be reported to an independent party, for example the Regional Engineer / Route Engineer or equivalent, Network Rail Testing & Commissioning Engineer, Close Call process, CIRAS, etc.

1.3 When work is completed and the equipment is in working order, the equipment shall be signed back as available for use in accordance with the Rule Book.

1.4 The decision whether to accept the equipment for use in normal service is the responsibility of the Network Rail operations staff.

2. Use of the Sign Back Matrix

2.1 Where no fault is found, a higher level of authority shall be required.

As a minimum:

a) Exempted failures listed in [NR/SMTH/Part05/Module/S03](#) (Single Obvious Cause - Exempted Failures) require the authority of a Level 1 Tester.

b) Other protected or unprotected wrong side failures require the authority of a Level 2 Tester.

2.2 Except where stated in [NR/SMTH/Part05/Module/S12](#) (Sign Back Matrix), Level 2 authority shall be required for signing back wrong side failures where the fault has been found and Level 3 where no fault is found.

2.3 If additional technical advice is sought from another technical expert, that technical expert is not expected to take over responsibility for signing the asset back into service. This also applies should details of the failure be discussed in relation to operational or performance issues.

2.4 A dash in the “fault found” or no “fault found indicates” the failure example is not wrong side and there requires no sign back level.

3. Feedback to the Organisation/Individual who Reported the Fault

3.1 Wherever possible, the Infrastructure Fault Control can provide feedback to the organisation / individual who originally reported the wrong side failure (e.g. the Signaller, or the Train Operating Company in respect of a report from a driver).

3.2 In the case of SPAD investigation, feedback is mandated in NR/L1/OPS/010.

END

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NR/SMTH/Part05/Module/S12		
Sign Back Matrix		
Issue No: 02	Issue Date: 04/03/2023	Compliance Date: 03/06/2023

1. Authority Level - Sign Back Matrix

SIGNALS		
All Types		
Failure Mode or Consequence	Fault Found	No Fault Found
Aspect sighting of all signal types degraded by sunlight	L1	L1
Aspect sighting of main signal degraded by means other than sunlight	L1	L1
Aspect sighting of subsidiary or shunt signal degraded by means other than sunlight	L1	L1
Aspect sighting of main signal obscured	L1	L1
Aspect sighting of subsidiary or shunt signal obscured	L1	L1
Phantom aspect – which is, or is capable of being interpreted as being, less restrictive than the correct aspect at the time.	L2	L3
Phantom aspect – which is, or is capable of being interpreted as being, more restrictive than the correct aspect at the time	L1	L2
Broken / Missing Lens / Spectacle Glass	L1	L1
Main Colour Light Signal		
Failure Mode or Consequence	Fault Found	No Fault Found
No danger aspect – failed signal fitted with AWS/TPWS – signal in rear held at danger	L1	L1
No danger aspect – failed signal not fitted with AWS/TPWS – signal in rear held at danger	L1	L1
No proceed aspect – failed signal fitted with AWS – signal in rear held at danger	L1	L1
No proceed aspect – failed signal not fitted with AWS – signal in rear held at danger	L1	L1
Signal able to clear with non-lamp proved RI not displayed when it should be	L1	L1
Signal able to clear with lamp proved RI not displayed when it should be	L2	L3
Main signal of main / co-acting arrangement not displaying an aspect	L2	L2
Co-acting signal of main / co-acting arrangement not displaying an aspect	L2	L2
Unable to replace or maintain signal at danger by signal post replacement switch	L2	L2
Unable to replace or maintain signal at danger due to broken button	L1	L2
Filament failure where the auxiliary filament takes over	L1	L1
Fixed Distant Board		
Failure Mode or Consequence	Fault Found	No Fault Found
Fixed distant board missing or obscured – No AWS fitted	L1	L2
Fixed distant board missing or obscured – AWS fitted	L1	L2
Position Light Signal		
Failure Mode or Consequence	Fault Found	No Fault Found
No red and no pivot aspect displayed – 3 lamp type, signal	L1	L1
No red or no pivot aspect displayed – 3 lamp type, signal	L1	L1
No reds displayed – 4 lamp type, signal	L1	L1
Only one red displayed – 4 lamp type, signal	L1	L1
No proceed aspect displayed	L1	L1
Position Light Junction Indicator		
Failure Mode or Consequence	Fault Found	No Fault Found
Proceed aspect given with less than 3 lamps lit in a 5 lamp PLJI	L1	L2
Proceed aspect given with 3 or 4 lamps lit in a 5 lamp PLJI	L1	L1

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SIGNALS		
Incorrect PLJI (position) lit – less restrictive route (higher speed)	L2	L3
Incorrect PLJI (position) lit – more restrictive route (equal or lower speed)	L1	L2
Miniature Route Indicator		
Failure Mode or Consequence	Fault Found	No Fault Found
Indicator not lit with associated signal clear, indicator lamp not proven in aspect	L1	L1
Mechanical Signal - Stop / Distant		
Failure Mode or Consequence	Fault Found	No Fault Found
Section signal / slot not restoring to ON – arm not proved in controls	L2	L3
Non-Section Signal / slot not restoring to ON – arm not proved in controls	L1	L2
Any Signal / slot not restoring to ON – arm proved in controls	L1	L2
No light displayed during the hours of darkness – light not proved in controls	L1	L1
No light displayed during darkness – light proved in controls	L1	L1
No light displayed during hours of daylight	L1	L1
Signal arm / spectacle casting missing	L1	L2
Mechanical Signal - Shunt / Calling On		
Failure Mode or Consequence	Fault Found	No Fault Found
Signal not restoring to ON – arm not proved in controls	L1	L2
Signal not restoring to ON – arm proved in controls	L1	L2
Shunt – no light displayed during hours of darkness – light not proved in controls	L1	L1
Calling On – no light displayed during hours of darkness – light not proved on controls	L1	L1
Shunt – no light displayed during hours of darkness – light proved in controls	L1	L1
Calling On – no light displayed during hours of darkness – light proved on controls	L1	L1
No light displayed during daylight	L1	L1
Signal disc / spectacle casting missing	L1	L2
Mechanical Banner		
Failure Mode or Consequence	Fault Found	No Fault Found
Banner On but lamp out during darkness – lamp not proved in controls	L1	L1
Banner On but lamp out during darkness – lamp proved in controls	L1	L1
Lamp out during daylight	L1	L1
Banner Off but lamp out – during darkness	L1	L1
Banner not restoring to On – not proved in controls	L2	L3
Banner not restoring to On – proved in controls	L1	L2
Fibre Optic Banner		
Failure Mode or Consequence	Fault Found	No Fault Found
ON aspect not displayed – proved in controls	L1	L1
ON aspect not displayed – not proved in controls	L1	L1
OFF aspect not displayed	L1	L1

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Sign Back Matrix		
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SIGNALS		
LED Banner		
Failure Mode or Consequence	Fault Found	No Fault Found
ON aspect (white) not displayed – not proved in controls	L1	L1
OFF (white) - aspect not displayed – proved in controls	L1	L1
OFF (green) - aspect not displayed – proved in controls	L1	L1
No aspect displayed	L1	L1
Limit of Shunt / Notice Board All Types		
Failure Mode or Consequence	Fault Found	No Fault Found
Not illuminated – lamp proved	L1	L1
LOS or NB missing	L1	L2

POINTS		
All Types		
Failure Mode or Consequence	Fault Found	No Fault Found
Incorrect detection – facing points. Points detected with points laid in opposite position or when not locked or with switch rail open and locked	L3	L3
Able to move under a train – facing points	L3	L3
Incorrect detection –trailing points. Points detected with points laid in opposite position or when not locked or with switch rail open and locked	L3	L3
Able to move under a train –trailing points	L3	L3
Points indicating opposite lie of points – failure determined to be indication only. Interlocking functioning correctly	L3	L3
Point operating mechanism not isolated when on manual control	L2	L3
Points not self-restoring – failure not detected or indicated	L3	L3
Points not self-restoring – failure detected or indicated	L1	L1
Loss of point detection	L1	L1

TRACK CIRCUITS		
All Types – Showing Clear when Occupied		
Failure Mode or Consequence	Fault Found	No Fault Found
Which controls any Signal, Interlocking or Level Crossing (excluding where listed below)	L3	L3
Where due to Rail Head Contamination and whilst not being protected by Special Block Working (See SMTH Part5 Module S4)	L2	L3
Where protection by Special Block working (e.g. for leaf fall or sandite operation)	L1	L1
Remote Condition Monitoring - Alert or Alarm <300ms in duration (See SMTH Part5 Module S4)	L1	L2
Sequencing controls in place and effective (See SMTH Part5 Module S4)	L1	L2
Failure determined to be indication only (i.e. TKR / TKE and not TPR Circuits)	L2	L2
Showing occupied with no train	L1	L1

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TRACK CIRCUITS		
All Types – Showing Clear		
Failure Mode or Consequence	Fault Found	No Fault Found
Where track circuit interrupter is broken	L2	L3
All Types – Showing Occupied		
Failure Mode or Consequence	Fault Found	No Fault Found
Where track circuit interrupter is broken	L1	L1
All Types – Remote Condition Monitoring		
Failure Mode or Consequence	Fault Found	No Fault Found
Current exceeds high occupied current but does not exceed the track occupied current level	L2	L2

BLOCK CONTROLS		
Manual		
Failure Mode or Consequence	Fault Found	No Fault Found
Irregular Line Clear release obtained and able to clear signals	L3	L3
Irregular Line Clear indicated - unable to clear signals	L2	L3
Irregular Train On Line indicated	L1	L1
Unable to obtain Line Clear or Train On Line	L1	L1
Token / RETB		
Fault Found	Fault Found	No Fault Found
Irregular token release obtained	L3	L3
Bell		
Fault Found	Fault Found	No Fault Found
Operating irregularly when used in an emergency	L2	L2
Operating irregularly when used routinely.	L1	L1

TRAIN PROTECTION		
Automatic Warning System (AWS)		
Failure Mode or Consequence	Fault Found	No Fault Found
Code 2 - horn instead of bell, controlling signal displaying G aspect.	L1	L1
Code 3 - nothing received – controlling signals displaying G aspect (where associated with a signal- controlling signal displaying green. Only experienced at one signal or only reported by one train.)	L1	L2
Code 3 - nothing received – controlling signal displaying G aspect (where associated with a signal displaying Green, if experienced at two Green signals by the train or by two successive trains at the same signal)	L2	L3

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TRAIN PROTECTION		
Automatic Warning System (AWS)		
Code 4 - bell and horn, controlling signal displaying YY, Y or R aspect.	L1	L1
Code 5 - bell instead of horn – controlling signal displaying YY, Y or R aspect	L2	L3
Code 6 - brake application but no horn – controlling signal displaying YY, Y or R aspect	L1	L1
Code 7 - nothing received - controlling signal displaying YY, Y or R aspect.	L2	L3

TRAIN PROTECTION		
Automatic Train Protection (ATP)		
Failure Mode or Consequence	Fault Found	No Fault Found
Train under ATP supervision passes signal at danger – train stops beyond overlap	L3	L3
Train under ATP supervision passes signal at danger – train stops within overlap	L2	L3
ATP supervision allows train to exceed permissible / enhanced permissible speed	L3	L3
ATP supervision allows train to exceed ESR / TSRs when no indicator boards are provided.	L2	L2
ATP supervision allows train to exceed ESR / TSRs when indicator boards are provided.	L2	L3
ATP system displays train speed in excess of ATP supervision speed	L3	L3

TRAIN PROTECTION		
Train Protection and Warning System (TPWS)		
Failure Mode or Consequence	Fault Found	No Fault Found
Code 16 Failure A. TPWS at a signal fails to operate when required. Signal in rear reverts to danger and Signaller is aware of the failure	L1	L2
Code 16 Failure B. TPWS at a signal fails to operate when required. Signal in rear does not revert to danger and Signaller is aware of the failure	L2	L3
Code 16 Failure C. TPWS at a signal fails to operate when required. Signal in rear does not revert to danger and Signaller is unaware of the failure	L2	L3
Code 16 Failure D. TPWS at a set of lamp proved buffer stops, fail to operate when required Signaller is aware of the failure	L1	L2
Code 16 Failure E. TPWS at a set of lamp proved buffer stops fails, to operate when required Signaller is unaware of the failure	L2	L3
Code 16 Failure F. TPWS at a PSR fails to operate when required Signaller is aware of the failure	L1	L2
Code 16 Failure G. TPWS at a PSR fails to operate when required Signaller is unaware of the failure	L2	L3
Code 16 Failure H. TPWS correctly initiates brake application, but train does not stop before conflict point and train travelling within design speed of TPWS	L2	L3

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TRAIN PROTECTION		
Train Protection and Warning System (TPWS)		
Code 16 Failure J. Intermittent latched failure indication, not seen by the Signaller, no change of aspect of the signal in rear (found by maintenance Technician to be working correctly)	L1	L1
Code 16 Failure K. Intermittent latched failure indication, seen by the Signaller, no change of aspect of the signal in rear	L2	L3
Code 16 Failure L. Intermittent latched failure indication, not seen by Signaller, change of aspect of the signal in rear	L1	L2
Code 17. TPWS operates when not required (Loops not found transposed)	L1	L1
TPWS Transposed arming and trigger loops	L2	L3
TPWS operates when the train is travelling within the speed limit.	L1	L2

TRAIN PROTECTION		
TASS / Balise		
Failure Mode or Consequence	Fault Found	No Fault Found
TASS functions (speed supervision or Tilt Authorised) cease within an area where Driver route knowledge indicates should be available,	L1	L1
TASS functions (speed supervision or Tilt Authorised) cease and are NOT reinstated at a later point in the journey.	L1	L1
TASS critical system fault detected resulting in application of train brakes and braking of train to a stand.	L1	L1
Spurious speed supervision intervention.	L1	L1
TASS intervention fails to operate correctly when train speed exceeds defined limits.	L3	L3
Erroneous indication of speed supervised in an area where TASS is not supervising speed resulting in an unauthorised overspeed event.	L1	L2
Erroneous Tilt authorisation on route not gauge cleared for tilt operation	L3	L3
Erroneous Tilt authorisation on route gauged cleared for tilt operation.	L2	L3
TASS Immediate Tilt Stop Balise failed (missing, not functioning or functioning incorrectly in a manner that Telegram is not capable of being read and acted upon by a TASS fitted train).	L2	L3
Selective Door Opening (SDO) – Incorrectly positioned or incorrectly programmed beacon allowing train doors to open when not permissible.	L2	L3
Defective ETCS Balise - Train incorrectly issued a Movement Authority (MA) into an unproven section	L2	L3
Missing ETCS Balise - ??	L2	L3

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TRAIN PROTECTION		
Train Stop		
Failure Mode or Consequence	Fault Found	No Fault Found
Fails to energise with train trip cock when required to	L3	L3
Energises when not required	L1	L1

LEVEL CROSSINGS (All Barrier Types)		
Road Traffic Lights / Boom / Audible Warnings		
Failure Mode or Consequence	Fault Found	No Fault Found
No road lights at one or more sides – all barriers down	L1	L2
One or more red road lights out in any cluster – other clusters on same side of crossing operating correctly	L1	L2
Full failure of audible warning devices	L1	L2
Partial failure of audible warning devices	L1	L2
All yellow road lights at one or both sides not operating.	L1	L2
All barrier boom lights out on one or more barriers – road lights operating correctly	L1	L2
Individual barrier boom light out	L1	L1

LEVEL CROSSINGS		
MCB / CCTV		
Failure Mode or Consequence	Fault Found	No Fault Found
Barriers not fully lowered and all road lights not operating – able to clear protecting signals	L3	L3
One or more barriers not fully lowered – all road lights operating correctly and able to clear protecting signals	L3	L3
One or more barriers not fully lowered – all road lights operating correctly and not able to clear protecting signals	L1	L1
Able to lower barriers with reduced road traffic warning sequence	L2	L3
Spurious Crossing Clear able to be obtained and able to clear protecting signals	L3	L3
CCTV frozen or obscured picture, Signaller not aware	L2	L3
CCTV frozen or obscured picture, Signaller aware	L1	L2
Unable to see or obtain CCTV picture of the crossing	L1	L1

LEVEL CROSSINGS		
OD (Obstacle Detection) High Level COD / LIDAR		
Failure Mode or Consequence	Fault Found	No Fault Found
HL COD system spurious Crossing Clear (from ALL HL scanners forming the HL COD, with POD working correctly)	L2	L3

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LEVEL CROSSINGS		
OD (Obstacle Detection) High Level COD / LIDAR		
Failure Mode or Consequence	Fault Found	No Fault Found
HL COD scanner(s) spurious Detection Area Clear (from one or more HL scanners forming the HL COD but not all HL scanners, with POD working correctly) where less than 50% of the HLCOD Detection Area is working correctly, e.g. on large skew crossings	L2	L3
HL COD scanner(s) spurious Detection Area Clear (from one or more HL scanners forming the HL COD but not all HL scanners, with POD working correctly) where 50% or more of the HL COD Detection Area is working correctly	L2	L3

LEVEL CROSSINGS		
OD (Obstacle Detection) Low Level COD / LIDAR		
Failure Mode or Consequence	Fault Found	No Fault Found
LL COD system spurious Crossing Clear (from ALL LL scanners forming the LL COD, irrespective of POD or HL COD working correctly)	L3	L3
LL COD scanner(s) spurious Detection Area Clear (from one or more LL scanners forming the LL COD but not all LL scanners, where less than 50% of the LL COD Detection Area is working correctly, e.g. on large skew crossings.	L2	L3

LEVEL CROSSINGS		
OD (Obstacle Detection) MCB CCTV		
Failure Mode or Consequence	Fault Found	No Fault Found
BPM / BOD (inductive loops) to protect barriers from being damaged, failure to detect a road vehicle	L1	L1
BPM / BOD (inductive loops) to protect barriers from being damaged, Loop failed	L1	L1
Spurious crossing clear from POD (derailment / vehicle protection lost)	L3	L3

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LEVEL CROSSINGS		
AHBC		
Failure Mode or Consequence	Fault Found	No Fault Found
One or more barriers not fully lowered – all road lights operating correctly – train traverses crossing	L3	L3
No road lights at one or more sides – all barriers down – train traverses crossing	L2	L3
One or more red road lights out in any cluster – other clusters on same side of crossing operating correctly	L1	L2
Able to lower barriers with reduced road traffic warning sequence	L2	L3
Train passes over the crossing without the barrier sequence completed	L2	L3
Train arrives at crossing quicker than expected (possible timing issues)	L2	L3
Another Train Coming function not operating when needed – crossing lights operating correctly	L1	L2
Crossing Failed indication fails to operate when crossing has failed	L2	L2

LEVEL CROSSINGS		
ABCL		
Failure Mode or Consequence	Fault Found	No Fault Found
Barriers not fully lowered and all road lights not operating at one or both sides – Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
One or more barriers not fully lowered – all road lights operating correctly Drivers Red Light extinguished – Drivers White Light illuminated.	L3	L3
No road lights at one or more sides – all barriers down Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
DWL illuminated with any other failure which is designed to prevent DWL being illuminated present and not detected	L3	L3
DWL not illuminated with detected failure mode present	L1	L1
Crossing operates with reduced warning sequence	L2	L3
Another Train Coming function not operating when needed – crossing remains operated	L1	L2

LEVEL CROSSINGS		
AFBCL		
Failure Mode or Consequence	Fault Found	No Fault Found
Barriers not fully lowered and all road lights not operating at one or both sides – Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
One or more barriers not fully lowered – all road lights operating correctly Drivers Red Light extinguished – Drivers White Light illuminated.	L3	L3
No road lights at one or more sides – all barriers down Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
DWL illuminated with any other failure which is designed to prevent DWL being illuminated present and not detected	L3	L3

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LEVEL CROSSINGS		
AFBCL		
Failure Mode or Consequence	Fault Found	No Fault Found
DWL not illuminated with detected failure mode present	L1	L1
Crossing operates with reduced warning sequence	L2	L3
Another Train Coming function not operating when needed – crossing remains operated	L1	L2

LEVEL CROSSINGS		
AOCL		
Failure Mode or Consequence	Fault Found	No Fault Found
No road lights operating at one or both sides and Drivers White Light illuminated	L3	L3
DWL illuminated with any failure present which should prevent the DWL being illuminated	L3	L3
DWL not illuminated with detected failure mode present	L1	L1
Crossing operates with reduced warning sequence	L2	L3
Another Train Coming function not operating when needed – crossing remains operated	L1	L2

LEVEL CROSSINGS		
AOCL+B		
Failure Mode or Consequence	Fault Found	No Fault Found
Barriers not fully lowered and all road lights not operating at one or both sides – Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
One or more barriers not fully lowered – all road lights operating correctly Drivers Red Light extinguished – Drivers White Light illuminated.	L3	L3
No road lights at one or more sides – all barriers down Drivers Red Light extinguished and Drivers White Light illuminated	L3	L3
DWL illuminated with any other failure which is designed to prevent DWL being illuminated present and not detected	L3	L3
DWL not illuminated with detected failure mode present	L1	L1
Crossing operates with reduced warning sequence	L2	L3
Another Train Coming function not operating when needed – crossing remains operated	L1	L2
No road lights operating at one or both sides and Drivers White Light illuminated	L3	L3

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LEVEL CROSSINGS		
AOCR		
Failure Mode or Consequence	Fault Found	No Fault Found
No road lights operating at one or both sides – train traverses crossing	L3	L3
Crossing operates with reduced warning sequence	L2	L3
Another Train Coming function not operating when needed – crossing remains operated	L1	L2
Crossing Failed indication fails to operate when crossing has failed	L2	L2

LEVEL CROSSINGS		
Train Crew Operated Barriers		
Failure Mode or Consequence	Fault Found	No Fault Found
Barriers fully lowered with no road lights or DWL	L2	L2
Barriers not fully lower with DWL displayed	L3	L3
Able to lower barriers with reduced road traffic warning sequence	L2	L3
One or more barriers not fully lowered - all road lights operating correctly and able to clear signals	L2	L3

LEVEL CROSSINGS		
MSL		
Failure Mode or Consequence	Fault Found	No Fault Found
G aspect displayed vice R – train traverses crossing	L3	L3
No G aspect – user warning sign in place and clearly legible	L1	L1
No G aspect – user warning sign missing or illegible	L1	L2
No R aspect – user warning sign in place and clearly legible	L1	L2
No R aspect – user warning sign missing or illegible	L1	L2
Full failure of audible warning devices (where fitted)	L1	L2
Partial failure of audible warning devices (where fitted)	L1	L2
Crossing operates with reduced warning sequence	L2	L3

LEVEL CROSSINGS		
LC Protected by Audible Device		
Failure Mode or Consequence	Fault Found	No Fault Found
Audible warning device not operating with train approaching crossing	L2	L3
Partial failure of audible warning devices (where fitted)	L1	L2
Crossing Failed indication fails to operate when crossing has failed	L2	L2

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LEVEL CROSSINGS		
Rural Barriers		
Failure Mode or Consequence	Fault Found	No Fault Found
Both barriers do not lower when required to – not detected in protecting signals	L2	L3
One barrier does not lower when required to – not detected in protecting signals	L2	L2
Both barriers do not lower when required to – detected in protecting signals	L2	L3
One barrier does not lower when required to – detected in protecting signals	L1	L2
All barrier boom lights out on one or more barriers	L1	L2

LEVEL CROSSINGS		
Staff or Barrow Crossing		
Failure Mode or Consequence	Fault Found	No Fault Found
Warning light or alarm fails to extinguish for approaching train	L2	L3
Crossing operates with reduced warning time	L2	L3

LEVEL CROSSINGS		
Gated Crossing		
Failure Mode or Consequence	Fault Found	No Fault Found
Able to open gate when crossing closed to road with locking device engaged. Locking not detected in protecting signals	L2	L3
Able to open gate when crossing closed to road with locking device engaged. Locking detected on protecting signals, but signal type does not return to danger (Mechanical Signal.)	L2	L3
Able to open gate when crossing closed to road with locking device engaged. Locking detected on protecting signals, but signal type does not return to danger (Multi Aspect Signal.)	L2	L3
Able to open wicket gate when required to be locked	L2	L3
No light displayed in gate lamps	L1	L2
Full failure of audible warning devices (where fitted)	L1	L2
Partial failure of audible warning devices (where fitted)	L1	L2

LEVEL CROSSINGS		
Power Operated Gate Opener (POGO)		
Failure Mode or Consequence	Fault Found	No Fault Found
POGO performs un-commanded operation leading to a road vehicle to be in conflict area with train approaching	L2	L3

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INTERLOCKING AND CONTROLS		
Relay or Electronic Interlocking		
Failure Mode or Consequence	Fault Found	No Fault Found
Ineffective interlocking resulting in signals clearing prematurely	L3	L3
Ineffective interlocking resulting in conflicting routes able to be set and signals clearing	L3	L3
Ineffective interlocking resulting in conflicting routes able to be set -signals not clearing	L2	L3
Route self-sets and signals clear when signal being maintained at red	L3	L3
Route self-sets and signals clear without being set – route is safe / valid	L1	L1
Unable to replace all signals to On via “All Signals On facility”	L3	L3

INTERLOCKING AND CONTROLS		
Mechanical Frame		
Failure Mode or Consequence	Fault Found	No Fault Found
Ineffective interlocking resulting in signals clearing prematurely	L3	L3
Mechanical interlocking or Electric Lock defect which results in or might result in an irregular release being available	L3	L3

SIGNAL BOX INDICATIONS		
All types		
Failure Mode or Consequence	Fault Found	No Fault Found
Track circuit shows clear when occupied (indication only)	L2	L2
Route light fails to show	L1	L1
Point detection indication fails to show	L1	L1
Replacement switch fails to place signal at danger, but indication shows red	L2	L3

WARNING SYSTEMS		
Train Operated Warning System (TOWS)		
Failure Mode or Consequence	Fault Found	No Fault Found
Warning tone fails to sound or warning lights fail to extinguish for an approaching train.	L2	L3
System operates with reduced warning time	L2	L3
Warning tone sounding constantly with no approaching train.	L1	L1
Safe tone sounding constantly with no approaching train.	L1	L1

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MISCELLANEOUS SIGNALLING SYSTEMS

Power Supplies

Failure Mode or Consequence	Fault Found	No Fault Found
Power failure causing more than one black signal with signals in rear not held at danger	L2	L3
Power failure causing more than one black signal with signals in rear held at danger	L2	L2
Power failure causing single black signal, with signals in rear not held at danger, fitted with AWS	L2	L3
Power failure causing single black signal, with signals in rear not held at danger, not fitted with AWS	L2	L3
Power failure causing single black signal, with signals in rear held at danger	L1	L2
Power "blip" causing a temporary blackout not exceeding 30 seconds (typically can be caused by a power change-over). System working as designed.	L1	L1

Hot Axle Box Detectors (HABD)

Failure Mode or Consequence	Fault Found	No Fault Found
System fails to detect hot axle box within operating specification	L2	L3
System miscounts total axles	L1	L1
System gives false alarms	L1	L1

Detonator Placer

Failure Mode or Consequence	Fault Found	No Fault Found
Detonator placer fails to place detonators in the correct position – live detonators available	L2	L2
Detonator placer fails to place detonators in the correct position – operated in conjunction with signal when signal at On - live detonators available	L2	L2

Warning and Trip Wires

Failure Mode or Consequence	Fault Found	No Fault Found
Airport Runway Trip Wire fails to operate when required	L2	L3
Chalk Fall 'or 'Rock Fall' (or similar) warning wire fails to operate when required.	L2	L3
Tunnel warning wire fails to operate when required.	L2	L3

TELEPHONES

Signal Post Phones (SPT)

Failure Mode or Consequence	Fault Found	No Fault Found
Crosstalk or overhearing on SPTs	L2	L3
Call from signal connected to wrong position at signal box	L2	L3
Label incorrect	L2	L2
Label missing	L1	L2

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TELEPHONES		
Level Crossing Phones (All types of Crossing)		
Failure Mode or Consequence	Fault Found	No Fault Found
Crosstalk or overhearing on telephones	L2	L2
Poor quality of transmission on telephone, which might result in misinterpretation of instructions	L2	L2
Telephone with incorrect labelling or no operating instructions	L1	L2
Telephone fails and generates signal box alarm	L1	L1
Level Crossing Phones (AHBC)		
If one telephone is out of order, but another is available	L2	L2
Level Crossing Phones (AOCL, AOCL+B, ABCL, and AFBCL)		
If one telephone is out of order, but another is available	L1	L2
Level Crossing Phones (MSL)		
Signaller cannot be contacted by any telephone	L2	L2
Level Crossing Phones (Any Automatic Crossing (not MSL))		
Signaller cannot be contacted by any telephone (where provided)	L1	L2
Crossing only Protected by Telephone		
Signaller cannot be contacted by any telephone	L2	L2

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S13		
Wrong Side Failures on Recently Commissioned Equipment		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

1. Wrong Side Failures on Equipment in Service but before formal ‘take over’ by Maintenance

- 1.1 Wrong side failures have been known to happen on newly commissioned equipment.
- 1.2 Any wrong side failure on in-service equipment shall be investigated in accordance with the Signal Maintenance Testing Handbook.
- 1.3 With the exception of ([NR/SMTH/Part05/Module/S03](#) – Single Obvious Cause – Exempted Failures), details of wrong side failures of equipment that have been taken into operational use, but have not been taken back into maintenance, shall be advised to the Project Manager.

This will have normally been previously agreed between the Project Manager and the Maintenance organisation and documented in the Asset Management Plan.

During office hours, this should be undertaken before completion of the immediate investigation. This should also apply to allegations, even if these are subsequently disproved.

- 1.4 For the majority of wrong side failures, no formal action should be required from the project team in the immediate investigation of the failure. For certain complex failures, or failures requiring specialist equipment, or failures requiring specialist expertise to investigate them, the project team might supply additional resources to work under the direction of the testing team. In certain circumstances, such an involvement could be essential to investigate what happened.
- 1.5 In all cases of actual wrong side failure, the immediate cause of the fault shall be determined, and mitigation applied in accordance with Wrong Side Failure Test Guides.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S14		
Specialist Investigation of Equipment		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

1. Specialist Investigation of Equipment

- 1.1 All equipment suspected of, or confirmed as, causing a wrong side failure shall undergo specialist investigation unless the Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalent confirms this to be unnecessary, e.g. on the grounds that the failure mode is well known.
- 1.2 Any associated train-borne equipment which interfaces with the signalling system and which is suspected of causing a wrong side failure, shall also undergo specialist investigation, this shall be undertaken by the relevant stake holder/function.
- 1.3 Where equipment is sent away for specialist investigation, it shall be suitably packaged and labelled. All efforts shall be taken to avoid transit damage, particularly where evidence needs to be preserved.
- 1.4 Details of the equipment and its reported failure circumstances shall be provided with the equipment.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S15		
Derailments		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

1. Derailments

1.1 In the event of a derailment at S&C, if the S&C is operated by signalling equipment or has detection fitted and there has been no report of an irregular aspect or SPAD of the protecting signals, then either:

- a) Any derailment shall be assumed to be a result of either points moving when they should have been locked, or
- b) Point detection was incorrectly set, combined with some reason for the switch rail not being in the correct position.

1.2 In these circumstances, incident testing using the relevant Test Guide shall be started immediately and can only be abandoned when either:

a) The Rail Incident Officer (RIO), (see [NR/SMTH/Part05/Modules/S16](#) - Signals Passed At Danger (SPAD) and [NR/SMTH/Part05/Modules/S17](#) - Serious Incident Procedure) states formally that a definite cause, unrelated to the signalling has been established, or

b) The S&TME instructs the investigation to be stopped so that it can be completed by an independent testing organisation, or

c) On the direct instructions of the Police.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S16		
Signals Passed At Danger (SPAD)		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

1. Signals Passed At Danger (SPAD)

1.1 Where a reported signal passed at danger incident has not resulted in a derailment or collision, and there is no allegation against the signalling equipment, the actions detailed in [NR/SMTH/Part09/U007](#) (Tests Following an Alleged Signal Passed at Danger (SPAD)) shall be carried out.

If a derailment or collision resulted, the serious incident testing procedures shall be followed.

1.2 If a driver makes an allegation against the signalling, the testing is to be arranged and carried out as detailed in the Test Guides. Test Guides [NR/SMTH/Part08/T036](#), [NR/SMTH/Part08/T037](#), [NR/SMTH/Part08/T038](#) are specifically for allegations of signal sighting being degraded or obscured by an obstruction or by sunlight.

1.3 [NR/SMTH/Part09/U008](#) (Tests Following an Alleged Change of Aspect (COA)) sets out the procedure to be adopted for dealing with a reported SPAD due to a colour light signal reverting to a more restrictive aspect, where a cause is not obvious at the commencement of the investigation.

1.4 If it cannot be confirmed that the signal concerned, or the signal in rear, was displaying the correct aspect prior to the reported incident, a WRONG SIDE FAILURE shall be assumed, which shall be investigated using the Test Guide(s) in the T series.

1.5 If the correct operation of any equipment is doubted it shall be treated as defective and tested.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S17		
Serious Incident Procedure		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

1. Serious Incident Procedure

- 1.1 When a serious incident occurs, the rules of investigation and repair are changed.
- 1.2 GE/RT8000 (Rule Book), and Railway Group Standard RIS-3118-TOM (Incident Response Planning & Management) detail the requirements.
- 1.3 GE/RT8000 Module M3 states that “You must not move signalling equipment directly associated with the accident shall, even for testing purposes, until you are authorised to do so. This does not apply to equipment that must be used to protect the accident”.
- 1.4 A Rail Incident Officer (RIO) shall be appointed by Network Rail to co-ordinate the overall recovery process and shall be the single focus for dealing with other agencies involved, such as emergency services and Office of the Rail and Road (ORR).
- 1.5 No work on signalling or telecommunications equipment shall be attempted without specific authority from the RIO or someone who the RIO has delegated authority to.
- 1.6 Staff called to the incident shall log actions and observations made during attendance.

When recording notes, priority shall be given to equipment liable to be disturbed by traffic or by rescue/recovery services.

When recording details using a camera you should be mindful of taking photography that might cause distress and are of a sensitive nature.

Reports from train crews, Signallers or personnel from other departments are normally gathered by their respective management.

2. Use of Standard Test Guides

- 2.1 With the agreement of the RIO and RAIB, non-destructive testing can be conducted using standard Signalling Failure Investigation Test Guides.
 - However, before proceeding to destructive testing (which requires the further agreement of the RIO and RAIB), consideration should be given afresh as to whether the testing stated in the relevant Test Guide is correct given the knowledge of the incident and its possible causes.
- 2.2 In some cases, an additional test plan may be devised to address particular areas of concern.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S18		
Investigation Types		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

1. RAIB led Investigations

- 1.1 Where the RAIB lead an investigation, in the circumstances where an incident has occurred which falls within Schedule 1 of the Railways (Accident Investigation and Reporting) Regulations 2005 (see Appendix A), then they shall specify the level of independence required.

Use of Standard Test Guides

With the agreement of the RIO and RAIB, non-destructive testing can be conducted using standard Signalling Failure Investigation Test Guides.

Before proceeding to destructive testing (which shall require the further agreement of the RIO and RAIB), consideration shall be given afresh as to whether the testing stated in the relevant Test Guide is correct given the knowledge of the incident and its possible causes.

In some cases, an additional test plan may be devised to address particular areas of concern.

2. Network Rail led investigations

- 2.1 Where a Schedule 1 incident has occurred, but the RAIB decide not to carry out an investigation, or ask Network Rail to undertake this for them, the investigation shall be led by a person authorised to Level 3 sign-back but independent of the Delivery Unit responsible for the assets involved in the incident.

- 2.2 This person would normally be drawn from an adjacent Delivery Unit. In exceptional circumstances, the Route Engineer (Signalling), Principal Route Engineer (Signalling) or equivalents could provide an independent lead.

This independent person shall attend on site to lead the investigation work, which will follow the normal SFI process (including local level 2 and level 3 signoffs).

- 2.3 The investigation team may include the local Signalling Technicians, but they shall work under the direct supervision of the independent person.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S19		
Rail Accident Investigation Board (RAIB) Liaison		
Issue No: 01	Issue Date: 04/09/2021	Compliance Date: 04/12/2021

1. Rail Accident Investigation Board (RAIB) Liaison

1.1 Once notified of an incident by NR and agreement reached on the Schedule rating of the incident, RAIB may appoint an Accredited Agent (usually drawn from the NR pool of RIOs – note that an AA cannot also act as RIO) or elect to attend themselves. Regulation 6(1) applies. The scheduled events are shown in the Module S20.

1.2 Regulation 7(1) prohibits access to the signalling system for schedule 1 events without the consent of the RAIB or its Accredited Agent.

Every endeavour shall be made to contact RAIB or its Accredited Agent (via Infrastructure Fault Control) to request permission to commence non-destructive testing prior to independent SMTH (SFI) Testers arriving on site.

The RAIB or its Accredited Agent can elect to prevent such testing from starting and instigate its own investigations. RAIB duty controllers are available at all times.

1.3 [NR/SMTH/Part05/Module/S06](#) (Wrong Side Failure Testing Procedure) requires that non-destructive testing is always carried out before destructive testing is authorised by the Level 2 or 3 staff.

1.4 The Level 3 SFI Tester shall inform Infrastructure Fault Control if a NR contracted agency is called out to assist on site. RAIB or its Accredited Agent shall then be informed by Infrastructure Fault Control.

2. Gathering Evidence

2.1 If inspection activities by NR Signal Engineering staff have been allowed to commence before RAIB, its Accredited Agent or the RIO are on site, then the senior NR Signal Engineer on site shall inform them as to how far the testing has proceeded and reach an agreement on the start of all subsequent steps.

2.2 The RAIB or its Accredited Agent shall always be given the opportunity to witness all tests.

2.3 No equipment shall be removed from its operational position without RAIB or its Accredited Agent's agreement – Regulation 9 applies. The RAIB or its Accredited Agent can remove equipment for investigation to specialist laboratories.

The RAIB or its Accredited Agent shall always consult with the NR senior Signal Engineer on site before doing so and would normally expect NR staff to undertake the removal under SMTH and arrange packaging.

2.4 Any application of scribe witness marks shall only be undertaken with the agreement of the RAIB or its Accredited Agent.

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NR/SMTH/Part05/Module/S19		
Rail Accident Investigation Board (RAIB) Liaison		
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- 2.5 Any application of identification marks (e.g., bar codes) by RAIB or its Accredited Agent shall only be made with the agreement of the senior NR Signal Engineer on site and shall be applied to allow subsequent examination of the equipment without needing to remove the mark.
- 2.6 In all cases agreement shall be reached on site as to who has responsibility for the continuity of protection of evidence.
- 2.7 Where the laboratory investigation requirements fall within the capability of the NR appointed agents then that agent is likely to be used. In this instance NR shall be responsible for safe transportation of the equipment to the laboratory and for managing the activities of the agency.
- 2.8 RAIB shall always be given access to all steps of laboratory investigation and they shall also be involved in any decision to move from the non-destructive phase to the destructive phase.

In this case removing seals and covers from equipment is not considered to be destructive but RAIB shall be consulted before doing so. If RAIB requires tests in addition to those instructed by NR then RAIB shall fund and manage these tests.

- 2.9 Reports produced by the NR agency shall include NR and RAIB instructed work and be transmitted to NR Centre/Region and RAIB in parallel.
- 2.10 RAIB might well take witness statements from NR staff or contractor's staff. Regulation 10(2) prevents disclosure of the contents of the interview without a court order or consent of the individual.

Therefore, NR cannot rely on such witness statements to further its investigation and shall undertake its own interviews as necessary.

3. Use of Evidence

- 3.1 NR may disclose within NR any evidence jointly gathered, but any external release can only be made with the agreement of RAIB. Regulation 9(7) applies.
- In the case of Schedule 2 events then NR are normally allowed to disclose externally.
- 3.2 Therefore, the issue of SINs or other notices to control or mitigate risks elsewhere is allowed.

END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S20		
Schedules of Reportable Events		
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1. Schedules of Reportable Events

1.1 Schedule 1 (report immediately)

- a) An accident resulting in the death of a person or the serious injury of two or more persons.
- b) An accident on a Level Crossing involving rolling stock, resulting in the death of a person or serious injury to a person.
- c) A collision between rolling stock on a running line that was open to railway traffic at the time of the collision.
- d) A derailment of rolling stock on a running line that was open to railway traffic at the time of the derailment, or which blocks a running line that was open to railway traffic at the time of the derailment.
- e) A collision of rolling stock with an arrestor mechanism or buffer stop, other than in a siding, that causes damage to the rolling stock.
- f) An accident involving the release or combustion of dangerous goods being carried on rolling stock that necessitates the evacuation of the area.
- g) An accident or incident that is likely to result in suspension of a railway service for a period in excess of 6 hours.
- h) An accident that causes extensive damage to rolling stock, the infrastructure or the environment.
- i) An accident or incident which under slightly different conditions might have led to a death, serious injury or extensive damage to rolling stock, the infrastructure or the environment.

1.2 Schedule 2 (report within 3 working days)

- a) A collision of rolling stock with an object on or adjacent to a running line which under slightly different conditions might have caused a derailment, except:
 - i. If it is notifiable under regulation 4(1) (i.e. schedule 1).
 - ii. If the object was an animal.
 - iii. Where the obstruction was caused by an obvious act of vandalism.
- b) An accident resulting in the serious injury of one person only except if it is notifiable under regulation 4(1) (i.e. schedule 1).

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NR/SMTH/Part05/Module/S20		
Schedules of Reportable Events		
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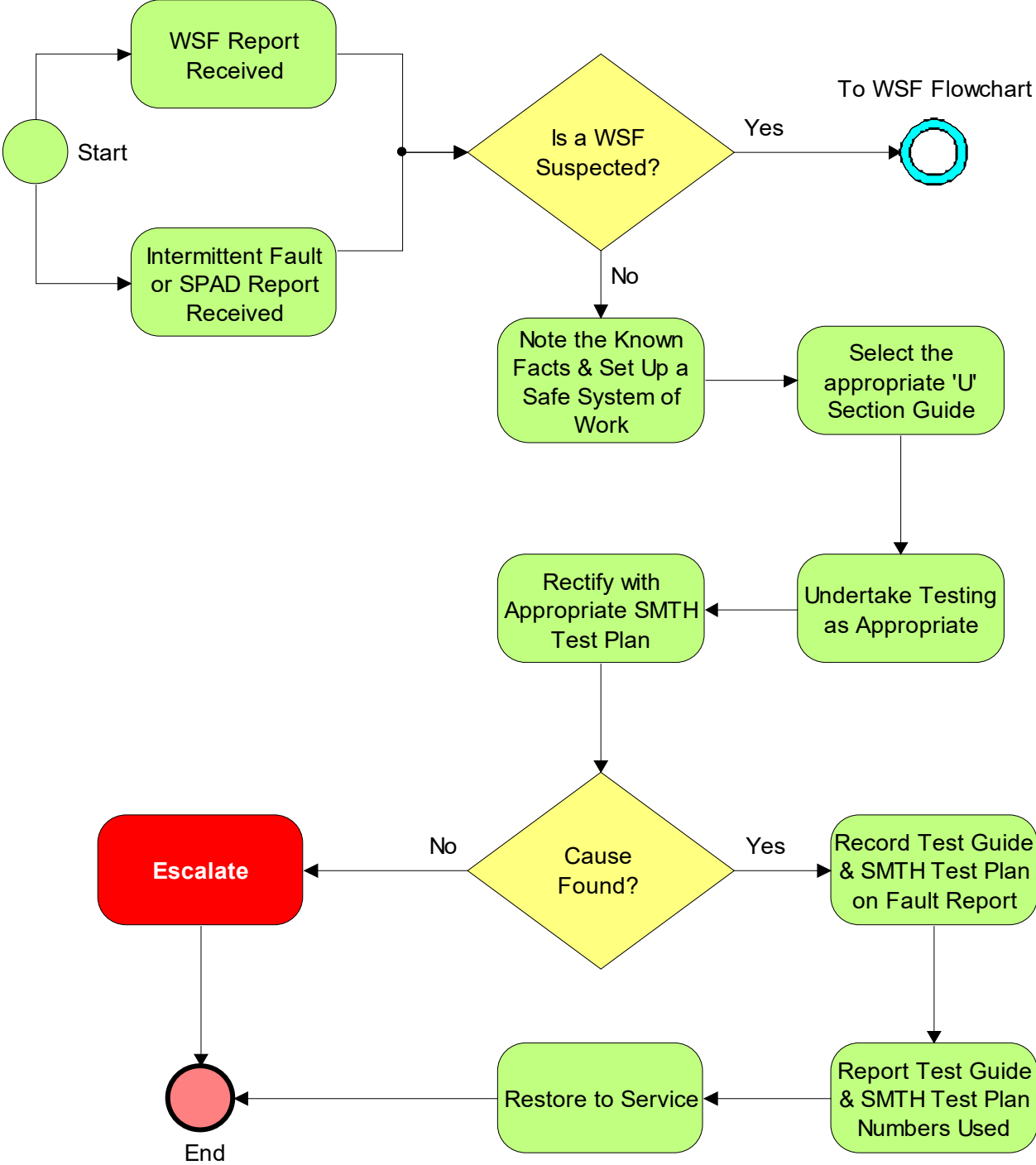
- c) An obstruction of, or damage to, track, caused by a road vehicle encroaching onto a running line, except when the obstruction or damage occurs on a part of a tramway track that runs on a carriageway.
- d) Any unintended division of a train or a tramcar.
- e) The failure of rolling stock on a track caused by:
 - i. The failure of an axle.
 - ii. The failure of a wheel or tyre, including a tyre loose on its wheel.
 - iii. A fire or severe electrical arcing or fusing, whether or not extinguished by a fire-fighting service.
- f) The failure of a cable or the fastening thereof of the winding plant or other equipment involved in working a railway operated by a cable haulage system.

1.3 Schedule 3 (report within 10 days of the end of the month in which the event occurred)

- a) The failure of equipment at a level crossing which reduces the level of safety on the railway.
- b) The failure of a rail, including a rack rail, on a running line whether by a complete fracture through its cross section, or by the buckling or detachment of a piece of rail which necessitates an immediate closure of that running line or speed reduction on that running line.
- c) The failure of a structure on railway property, including a tunnel, bridge, viaduct, culvert, railway cutting, embankment, station, signal or fixed electrical equipment which under slightly different circumstances might have led to a serious accident or which otherwise reduces the level of railway safety.
- d) A failure in the signalling system which reduces the level of railway safety.
- e) Rolling stock passing a railway signal displaying a stop aspect, unless either the driver had been given authority to pass the signal or the signal did not display in enough time to enable the driver to stop safely at the signal.
- f) A collision between a tramcar and a road vehicle on a part of a tramway running along a carriageway.

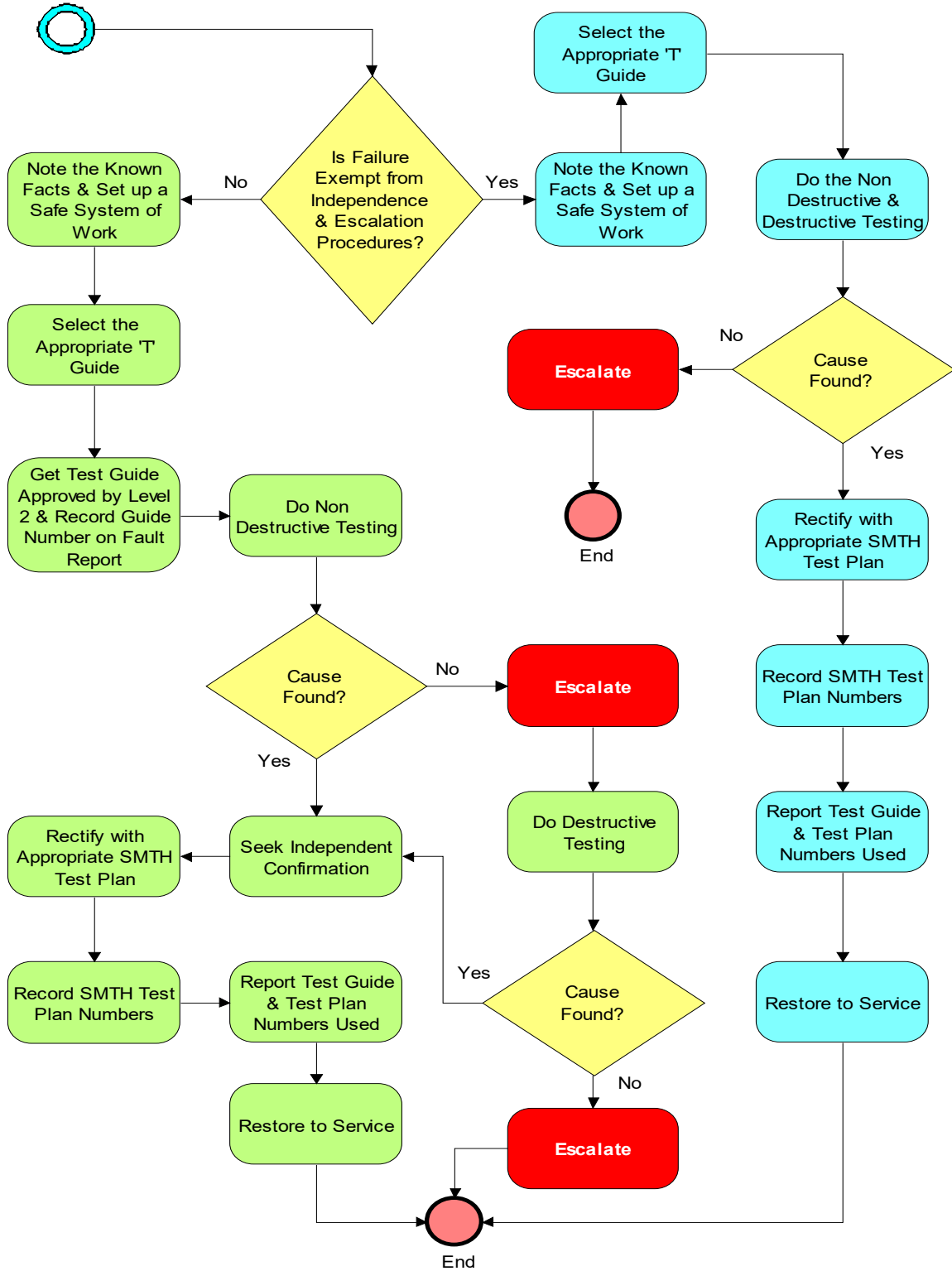
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NR/SMTH/Part05/Module/S21		
Failure and Incident Testing Flowchart		
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NR/SMTH/Part05/Module/S21		
Failure and Incident Testing Flowchart		
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From WSF Flowchart



END

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part05/Module/S22		
Management of Obscured Signals		
Issue No: 01	Issue Date: 02/12/2023	Compliance Date: 02/03/2024

1. Scope

This module provides guidance on the categorisation, investigation and sign back of a Signal that is alleged to be difficult to see or *becoming* difficult to see.

This module applies to all Signals, including banner repeaters and associated indicators

2. Categorisation of Signals alleged to be difficult to see or are becoming difficult to see because of trees, foliage or other obstructions.

2.1 Report that a Signal is difficult to see or *becoming* difficult to see.

The Signaller should follow the Rule Book and establish certain information that will assist the investigation and prompt the correct response.

Examples of information the Signaller should obtain:

- a) Whether the signal is visible at all times between the AWS and the Signal.
- b) Where it became difficult to see.
- c) The location of the obstruction.
- d) What is causing the obstruction.
- e) The estimated duration of the obstruction to sighting at permissible speed (less than 2 seconds or greater than 2 seconds).

This information should be captured on the RT3185 form.

Where an obscuration is judged to be affecting less than 10% of any signal element it may be considered as *becoming* difficult to see (ref. NR/L2/SIG/10157).

NOTE: The terms “fully” and “partially” are no longer used.

2.2 Signal difficult to see

A Signal shall be considered defective if any aspect or associated indicator is difficult to see between the designed Minimum Reading Distance (MRD) and the asset position.

This shall be treated as a Wrong Side Failure and investigated.

The Minimum Reading Distance (MRD) for a signal is defined on its Signal Sighting Record.

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NR/SMTH/Part05/Module/S22		
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If the Signal Sighting Record is not available, the MRD shall be determined by using the process in [NR/SMS/PartB/Test/302](#) (Signal Visibility Check).

NOTE: Any known, permitted obscurations are also defined on the Signal Sighting Record.

Examples of where the obscuration report may come from:

- a) Reports from Drivers.
- b) Reports from On Board staff.
- c) Reports from Station Staff.
- d) Reports from Cab Rides by staff.
- e) Review of recorded video footage.

2.3 Signal *becoming* difficult to see.

A Signal becoming difficult to see is not classified as a Wrong-Side Failure because the Minimum Reading Distance (MRD) is not compromised.

The Minimum Reading Distance (MRD) for a signal is defined on its Signal Sighting Record. In the case this is not available, the MRD shall be determined by using the process in [NR/SMS/PartB/Test/302](#) (Signal Visibility Check).

A Signal reported as *becoming* difficult to see is assumed to be currently unobscured but is at risk of obscuration, for example with further growth of vegetation.

Examples of where confirmation that the signal is not obscured but is at risk of obscuration may come from:

- a) Report from subsequent driver(s) asked to report back following an initial allegation of a signal difficult to see.
- b) Review of recorded video footage taken after the initial report.
- c) Reports from follow up Cab Ride by S&T staff.
- d) Site visit by S&T staff.

NOTE: These reports might be a precursor that a Wrong Side failure of the Signal is imminent and should be actioned (e.g. Arrange for Clearance).

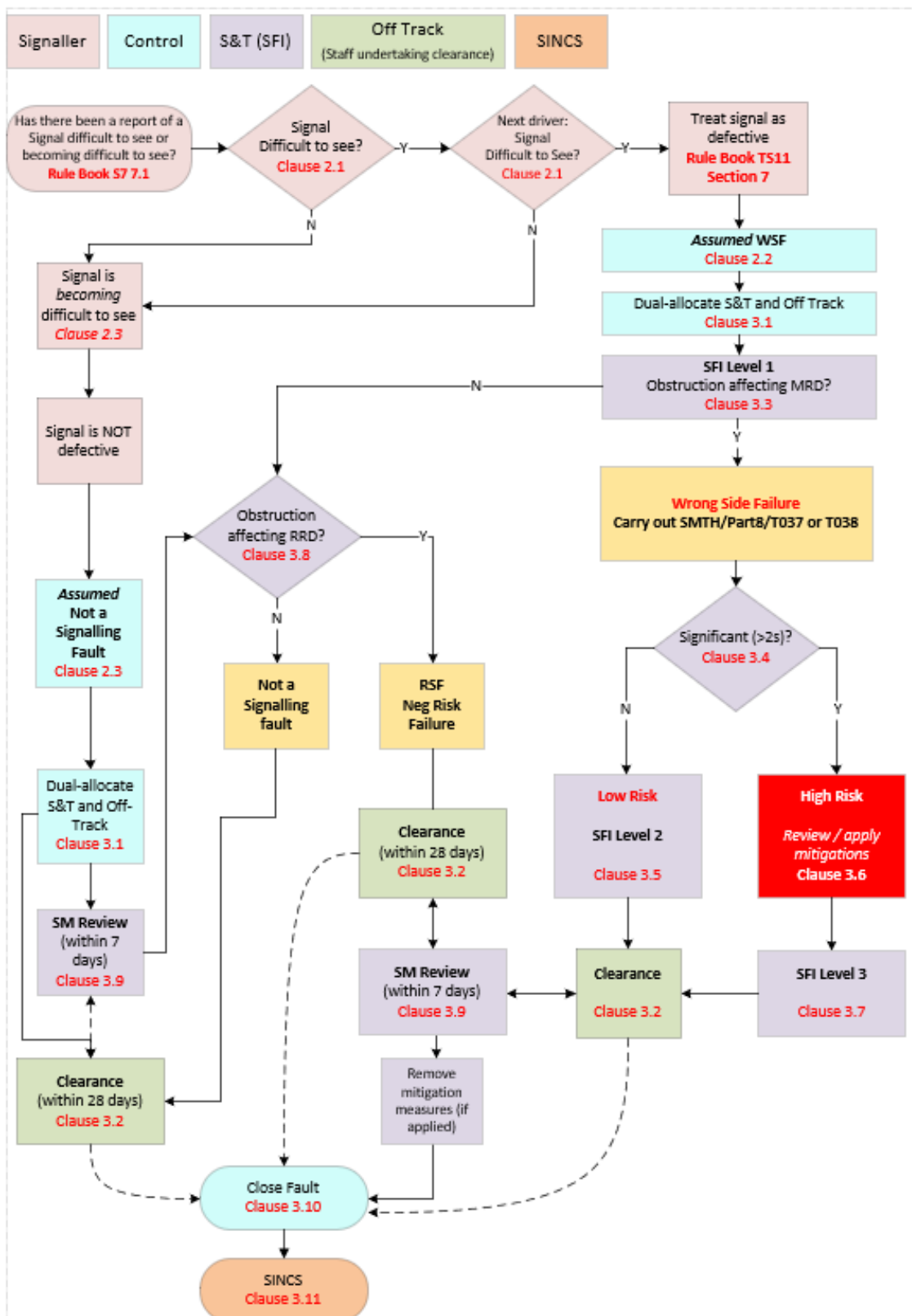


Figure 1 – Signal Obscuration Management Flowchart

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3. Management of Obscured Signals

The flowchart (Figure 1) and the corresponding guidance describes the process to be followed when classifying, investigating and signing back Signals that are alleged to be difficult to see or *becoming* difficult to see.

3.1 Dual-Allocation of faults

A report of a Signal difficult to see or *becoming* difficult to see shall be raised and allocated in the Fault Management System to both SFI staff and to Vegetation Clearance staff, where these are different teams.

Teams shall co-operate to investigate, capture information, and then rectify the fault in a timely manner and without losing evidence.

3.2 Clearing vegetation / obstruction

The principle of SFI is to preserve evidence of a wrong side failure and investigate thoroughly to establish the root cause.

Staff undertaking clearance activities shall record all pertinent information (e.g. digital photos, recordings, measurements) to clearly show the situation as found, and when cleared.

3.3 SFI Level 1 Response

The SFI Level 1 shall ascertain the risk using the Signal Sighting Record (or [NR/SMS/PartB/Test/302](#) (Signal Visibility Check)) and information collected from site following the initial report.

An obstruction between the Minimum Reading Distance (MRD) and the asset position shall be investigated using the process in SMTH/Part8/T037 or T038.

NOTE 1: *This is a wrong-side failure.*

NOTE 2: *Any known, permitted obscurations are defined on the Signal Sighting Record.*

3.4 Significance Assessment (High Risk / Low Risk)

Where the obstruction is between the Minimum Reading Distance (MRD) and the asset position, refer to [NR/SMS/Part Z/Z01](#) (Signal – Reference Values) to calculate its significance.

Significant (High Risk) Obscuration is an obstruction affecting 2 seconds or more of reading time at permissible speed.

Minor (Low Risk) Obscuration is an obstruction affecting less than 2 seconds of reading time at permissible speed.

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3.5 Low-Risk Obscuration

The SFI Level 2 shall be responsible for the review of Signal Visibility.

The SFI Level 2 may authorise normal use of a signal with a minor obscuration for a maximum of 72 hours from the initial report.

Train Operators shall be notified of the increased risk of SPAD at the location/asset.

NOTE: *The name of the person giving authorisation should be documented on the failure record along with the time the decision was made.*

Example considerations before authorising normal working:

- a) Consult with a Signal Sighting Engineer.
- b) Potential for mis-read from other signals nearby.
- c) TPWS fitments.
- d) Multi-SPAD.
- e) Effect on Train Dispatch.
- f) Overrun Risk (SORAT).

3.6 High Risk Obscuration

An obstruction that impacts sighting between the MRD and asset position for more than 2 seconds at the permissible line speed is high risk and shall be mitigated.

Examples of possible mitigation measures:

- a) Emergency Speed Restriction.
- b) Temporary Approach Control.
- c) Double-Block Working.
- d) Clear on Approach.

3.7 SFI Level 3 Review

The SFI Level 3 may authorise sign-back of mitigated working for a maximum of 7 days from the initial report.

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3.8 RRD Risk Assessment

Where the obstruction is affecting the Required Reading Distance (RRD) but not the Minimum Reading Distance (MRD), this is “Negligible Risk”

The Off-Track / veg clearance allocation should be left open until the risk is confirmed cleared or a Work Order raised in Ellipse (M1 priority).

NOTE: The Section Manager (Signalling) should consider whether further monitoring is required.

3.9 Section Manager (Signalling) Review

The Signalling Section Manager shall be responsible for the review of signal visibility and managing the failure record.

All reports shall be reviewed within 7 days from the initial report.

If the review identifies an error in the initial decision or risk assessment this shall be corrected, and the correct response initiated as per this process.

If the review identifies an increase in risk (e.g. due to further vegetation growth) this shall be escalated, and the correct response initiated as per this process.

3.10 Closing the Failure Record

The failure record shall only be closed when both allocated groups have confirmed required actions are completed or resolved.

3.11 SINCS File.

The Section Manager (Signalling) shall arrange for information to be collected to support the investigation, sign back and closure of the SINCS file.

END