AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Signalling) **Category: Procedure**

Signalling Irregularities and Wrong Side Failures

ESM-00-03

Applicability

ARTC Network Wide	✓	**CRIA (NSW CRN)**	✓

Primary Source

SMP 04

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1.0	21 Oct 08		First issue. Supersedes NSW Standard SMP 04 v1.3 in part
1.1	07 Oct 09		Disclaimer updated as per Risk & Safety Committee 14/09/2009
1.2	13 August 2010	All	Issued as final.

Contents

1 General

1.1 Signalling Irregularities and Wrong Side Failures

A signalling failure is termed an irregularity when vital signalling equipment items or circuits do not function correctly in accordance with their design specifications to provide the intended protection.

A signalling irregularity is termed wrong side failure under the following conditions such as but not limited to:

- a signal shows a less restrictive indication for a train than conditions should allow
- a set of points are released under traffic conditions when they should be locked
- where automatic level crossing protection fails to operate for a train.
- Detectors – If signals can be cleared incorrectly i.e. with facing points not closed or not locked
- Track Circuits – If a track circuit fails to detect a presence of a train
- Mechanical or Electrical Interlocking – If a release can be incorrectly obtained from the locked position
- Electric Locks – If a lock is incorrectly free.

1.2 Reporting and Recording of Signalling Irregularities and Wrong Side Failures

All irregularities and wrong side failures detected shall be reported to the Network Controller at the first instance detailing the incident and what actions have been taken to minimise any risks associated with the incident. Following the establishment of the necessary safety procedures on site the Maintainer shall obtain as much relevant information as they immediately can and relay the information to the Signal Manager, Signal Engineer, Team Manager immediately and the nominated ARTC National Incident & Investigations Manager as required.

All irregularities, whether they result in an unsafe system failure or not, shall be promptly investigated by a nominated authorised officer (Investigating Officer).

A separate file uniquely identified for each signal irregularity or wrong side failure shall be kept. These files shall not be closed until all investigations and enquiries have been completed and all recommendations, corrective and preventive actions have been satisfactorily implemented.

Every signal irregularity or alleged signal irregularity shall be reported, recorded and analysed so that appropriate measures can be taken to reduce such failures to a minimum.

In reporting an irregularity or a wrong side failure consideration shall be given to the circumstances of the irregularity or wrong side failure regarding the need for the appointment of an Independent Investigating Officer.

The Independent Investigating Officer shall be external to the maintenance organisation and the appointment of this officer shall be made after consultation with the nominated ARTC National Incident & Investigations Manager.

1.3 Signalling Irregularity Investigation and Train Operation

The procedure for dealing with signalling irregularities by the Investigating Officer is generally as follows:

Establish that the reported situation constitutes an irregularity.

Book out signalling equipment concerned, that is alleged to have not operated in accordance with their design specifications to provide the intended protection.

Provide site protection by booking out and disconnecting any signal route to prevent trains approaching the signalling equipment concerned given the reported circumstances.

Care should be taken when opening or working on equipment to prevent destruction of evidence and prevent determination of the true cause of the irregularity.

The failure conditions shall be examined and noted by the investigating officer in an attempt to determine the cause of the irregularity without disturbing the fault or associated evidence.

If the cause of the irregularity is positively determined by the Investigating Officer but cannot be rectified without delay, and if under the prescribed procedures train operations using the signal can be safely allowed by disconnecting and securing the defective equipment in a safe state, then the signals providing protection may be restored to use once the defective equipment has been disconnected and secured in accordance with the prescribed procedure.

While testing is being carried out, book out and disconnect any signalling equipment which is subject to interference by the testing work and could endanger the passage of trains.

Note: Photographs may be useful and all observations, measurements and witness reports should be recorded in writing.

1.4 Signalling Irregularity Investigation to Determine Cause

It is the duty of the Investigating Officer to determine whether there has been a signalling irregularity and if so, determine its technical cause through inspection and testing of the signalling apparatus.

It is difficult to prescribe particular inspections and tests for irregularity investigations as circumstances can vary greatly and reports may range from anonymous, vague recollections, to specific allegations to cases where the irregularity occurrence is obvious.

Whatever the case the Investigating Officer is accountable for certifying that the signalling involved is safe by signing the equipment back into use.

The Investigating Officer must therefore be satisfied that the correct cause has been conclusively identified and rectified or that the integrity of the signalling has been verified.

There is a further requirement that the Investigating Officer and management determine and correct any deficiency in the signalling or in the management control systems including deficiencies in staff competency, supervision and procedures.

1.5 Securing the Evidence

It is necessary that the incident circumstances and the signalling concerned be kept as undisturbed as possible until relevant symptoms are noted and inspections and tests are conducted by authorised persons.

Where tests necessarily require the equipment to be interfered with or disturbed then the Investigating Officer shall arrange to carry out these tests after carrying out other non-disturbing inspections and tests that may determine the cause or reduce the possibilities by elimination.

1.6 Restoration of Equipment

Identify and rectify the cause. Record test results and findings and attach to detailed report.

Test and certify the signalling system as safe and operational.

Book the signalling system back into use.

If the signalling system is likely to be out of use for sometime and trains services are going to be seriously affected, the Investigating Officer shall consult with the Network Controller to determine if other permissible means of protection that will ensure a safe situation but minimise the disruption to train services can be employed.

1.7 History of the Apparatus involved

An examination of the failure, maintenance and operating history of the apparatus concerned may provide useful information.

It may be that a defect has been present for some time and has only come to attention under the circumstances of the irregularity incident.

For an irregularity to occur after a previous history of correct operation something must have changed such as but not limited to:

- A set of operating conditions occurs for which deficient signalling design or incorrect installation does not provide protection.
- Degradation or catastrophic change occurs in the physical properties of materials or equipment on which fail-safe operation of vital circuits and equipment are dependent.
- A false feed occurs from one circuit to another.
- A current leakage path falsely qualifies part of the correct selection in a circuit.
- Detection or indicating equipment becomes out of adjustment.
- Foreign matter interferes with correct train detection.
- Foreign matter or lack of lubrication obstructs gravity return or spring return devices.
- Worn or defective bearings or linkages obstruct gravity return or spring return devices or cause lost motion in drive mechanisms or in detection mechanisms.
- A complete interruption of power supply to protection systems occurs.
- Time limit release devices shorten from time interval stipulated.
- Interference from personnel alters adjustment, correspondence.
- Damage occurs affecting the integrity of the equipment in the operating environment.

2 Investigation Strategy

The Investigating Officer will need to gather the evidence and study the circumstances and details of the alleged irregular incident, accident or derailment.

The Investigating Officer will need to devise a strategy and plan for investigating the cause. This could change as evidence unfolds or as suspect items are eliminated.

The Investigating Officer may need to:

Analyse: whether the evidence allows the cause to be localised to the trackside apparatus itself or the controls to or indications from the trackside apparatus.

Identify: all related circuits and equipment items that control and operate the trackside apparatus and provide indications of its operations.

Inspect and Test: those circuits and equipment items to check that they are installed and operate correctly to the specifications design drawings and to the interlocking and control tables.

Deduce: what omission, interference or other deviation factor could have caused irregular operation of the apparatus or the related circuits and equipment items.

Ascertain: whether those factors are or could have been present at the time of the incident using appropriate inspection and tests together with analysis of witness reports, event recorders and other clues.

Attempt: to reproduce the alleged irregularity.

The Investigating Officer should understand the respective signalling system, its components and the operating environment.

The Investigating Officer shall seek expert advice and assistance if not satisfied that the inspections and tests have successfully determined the true cause or verified the integrity of the signalling.

2.1 Inspections and Tests

The investigation may involve the following inspections and tests:

- General apparatus inspection
- Circuit testing
- Apparatus function testing
- System functional testing

Look first and only when satisfied proceed to function test, insulation test, circuit test etc.

The investigation will seek to verify conformance with the designs, compliance with installation standards and correct adjustment, correspondence, interlocking and control of the trackside equipment concerned.

The inspections would start with a close, critical examination of the operating equipment involved particularly of the mechanical operation of mechanisms such as relays, looking for signs of damage, interference or irregular behaviour.

Electrical wiring and terminations and mechanical linkages and connections would be similarly inspected.

Function tests to the control tables of the interlocking and controls between the items of trackside apparatus involved, correspondence and adjustment tests of those items and then delve more deeply into the individual elements of the controls and indications.

When a defect is found that conclusively accounts for the problem and the Investigating Officer considers that multiple causes would not exist then further testing need not be performed.

Depending on the incident the inspection and tests could typically involve the following:

- Inspection of the aspects of signals

- Mechanical interlocking inspections and tests
- Electro-mechanical interlocking inspection test
- Electrical interlocking and control tests
- Train detection tests
- Electrical insulation / isolation inspections and tests
- Circuit test to wiring diagrams
- Security inspections
- Signal inspections