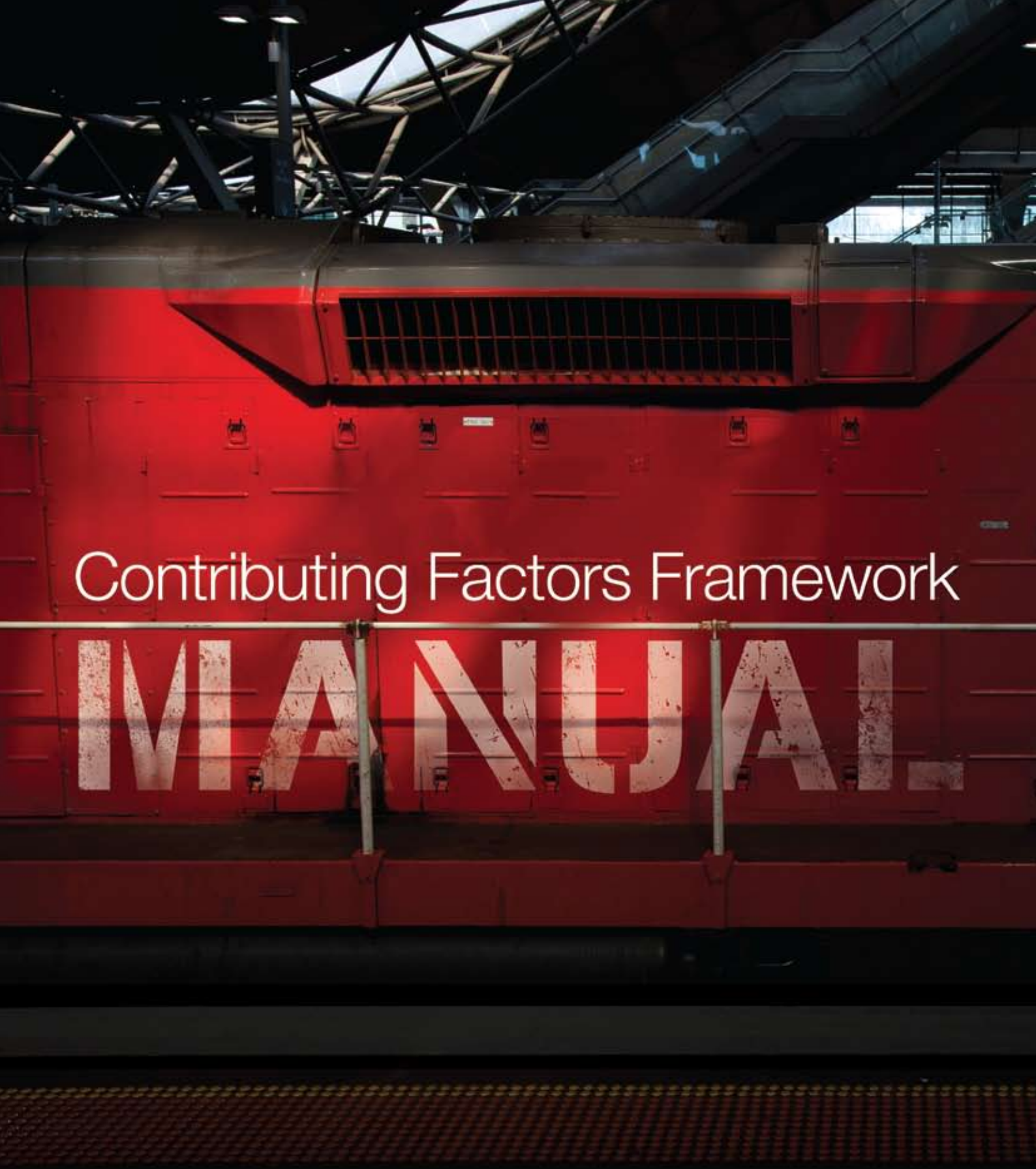


Contributing Factors Framework

Version 2 August 2011

Rail Safety
Regulators' Panel

Contributing Factors Framework

Manual

(version 2) **August 2011**

Document information

Document control

Document name: Contributing Factors Framework ~ Manual

Version number: V 2.0

Documentation status:

Working draft

Approved for issue

Archived

Version history

Next scheduled review date: June 2010

Document versions: This document is controlled through version numbers.

Version number	Date	Reason/comments
V 1.0	February 2009	Publication
V 1.3	March 2011	2010 Annual review amendments for approval
V 2.0	August 2011	Revision approved for publication

Feedback on the CFF

This manual undergoes regular review. Feedback to improve the framework and manual is welcome. Comments may be directed to the Rail Safety Regulator Panel (RSRP).

Published by the Rail Safety Regulators' Panel

Rail Safety Regulators' Panel
Email: admin@rsrp.asn.au
Website: www.rsrp.asn.au

Disclaimer:

This publication is intended as a general information source. While very effort has been made to ensure that the material contained therein is accurate and up to date, no responsibility or legal liability is accepted for the accuracy and completeness of the information contained in this publication. This document does not contain professional advice.

Foreword

As chair of the Contributing Factors Framework Working Group (CFFWG) and on behalf of the Rail Safety Regulators' Panel (RSRP), I am pleased to endorse the Contributing Factors Framework (CFF) and manual.

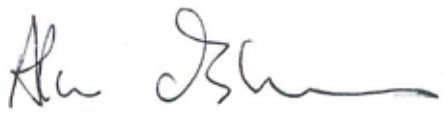
I would like to thank the members of the CFFWG for their insight and hard work in producing the framework and manual. I would also like to pay tribute to Rob Burrows, the WA rail safety regulator, for his leadership and drive as the previous CFFWG chair.

The framework provides rail transport operators, rail safety investigators and regulators with a structured coding system and process to consistently capture the systemic factors that contribute to rail safety occurrences. The CFF will support better analysis and identification of remedial measures.

The CFF is based on a best practice approach and is aligned with the Model of Organisational Accidents developed by Professor James Reason. This approach has been widely adopted across the rail industry and other safety critical industries. The CFF is also aligned with and complementary to the principal documents used for investigation within the Australian rail industry such as AS 4292.7 (Standards Australia, 2006) and the Code of Practice for Investigations (CMC, 2006).

The CFF and manual were developed in close collaboration with Australian rail industry representatives and independent rail safety investigation bodies resulting in a comprehensive and systematic approach. It is hoped that the rail industry will experience similar safety benefits and success as that seen in other industries and countries where contributing factors are systematically captured and analysed.

I commend the framework and manual to the Australian rail industry.



Alan Osborne

Chair Contributing Factors Framework Working Group
February 2009

Acknowledgements

The Contributing Factors Framework Working Group is made up of representatives from the Australian rail safety regulators, industry representatives, and independent rail safety investigation bodies.

The following organisations are represented:

Australian Transport Safety Bureau (ATSB)

Department of Transport (DoT), WA

Department for Transport, Energy and Infrastructure - Office of the Rail Safety Regulator (ORSR), SA

Department of Infrastructure, Energy and Resources (DIER), TAS

Independent Transport Safety Regulator (ITSR), NSW

Office of Transport Safety Investigations (OTSI), NSW

Pacific National (PN)

Transport Safety Victoria (TSV)

Rail Safety Regulation Branch, Department of Transport and Main Roads (DTMR), QLD

RailCorp, NSW

V/Line, VIC

Related documents

Australian Code of Practice: Rail Safety Investigation (CMC: Version 1.0, 2006).

Australian Standard for Rail Safety Investigations (AS 4292.7) (Standards Australia, 2006).

Standard No. ON-S1 (Version 2) and OC-G1 (Version 1). Occurrence Notification Standard, Occurrence Categories and Definitions (RSRP, 2008).

Table of contents

Section 1

Contributing Factors Framework ~ Context

The following section describes the context of the Contributing Factors Framework and how it fits within the Australian rail industry.

1 The context of the Contributing Factors Framework

1.1 About this document

Purpose

The purpose of this document is to provide guidance on how to use the Contributing Factors Framework (CFF) data set and definitions to code the systemic factors contributing to rail safety occurrences.

Who will use this document?

It is proposed that this reference manual will be used by personnel such as rail safety investigators, data coders, researchers and analysts working in the rail safety area to help them code and interpret the factors contributing to rail safety occurrences.

1.2 CFF Outcomes

The aim of the CFF is to:

- provide a structured and consistent framework to code the systemic contributors to incidents and accidents
- facilitate the analysis of aggregate data to identify patterns and trends in safety issues
- assist in making informed decisions on safety issues and enhance continual improvement practices.

1.3 System accidents

Rail safety occurrences

Not all rail safety occurrences are complex in nature but it is generally accepted that many have their roots in the broader organisational and/or operational system. Often known as 'system accidents', these types of occurrences should be treated systemically.

Describing rail safety occurrences

System accidents can be described at two levels - at the level of the event itself (what occurred, for example, derailment, collision) and at the systems level (why it occurred). Contributing factors describe the systemic aspects of the occurrence. They can be considered to be, "any element of an event that, if removed from the sequence of the events leading to the occurrence, would have prevented the occurrence or reduced the severity of it" (AS 4292.7, 2006). These include factors in the local workplace and in the organisational system which contributed to the accident.

Note
Any coding system can only represent a high level summary of an occurrence and for legal purposes reference to the full investigation is required. Legal liability is not implied just because a factor is identified as contributing.

Identifying the systemic issues

Consistent with modern approaches to investigation, rail transport operators seek to identify systemic issues that may have contributed to occurrences. They use approaches such as those provided in AS 4292.7 (Standards Australia, 2006) and the Investigations Code of Practice (CMC, 2006).

1.4 Safety performance data

Data provides insight on rail safety

Safety performance data are important for identifying safety issues in transportation. Safety performance data provide lag (after the event) information about rail safety occurrences. This information can be used to identify important aspects of current safety performance and to direct effort towards those aspects of the organisation most in need of intervention and/or improved safety management.

The collection and analysis of safety data allows rail transport operators to determine whether a problem is a one-off or repeating and persistent issue.

About the CFF

Within the Australian rail industry, rail transport operators collect data that describe the occurrence and deliver it to the rail safety regulator in each jurisdiction using criteria specified within the Standard ON-S1 (Version 2) and OC-G1 (Version 1) (RSRP, 2008).

ON-S1 and OC-G1 gather information about rail safety occurrences in terms of what occurred, but do not reveal much information about why it occurred. For example, ON-S1 and OC-G1 can be used to describe a derailment or a collision.

The CFF describes why an incident occurred by showing the systemic factors that contributed or led to the event. It is a structured and consistent framework, data set and definitions, within which systemic and related information can be collected and reported. The information can then be summarised and further analysed to identify potential safety issues and trends.

The CFF captures the findings from investigations in a structured and consistent way which, over time, will better assist safety analysis.

Note
For convenience, the CFF also includes technical failures and individual/team actions. Strictly speaking, these are not systemic contributors to rail safety occurrences, but rather symptoms of systemic deficiencies. However, as they are not covered systematically within the ON-S1 (Version 2) and OC-G1 (Version 1) (RSRP, 2008) criteria at this stage, they are included within the CFF to ensure that this essential information is not lost.

Which occurrences will be coded?

The CFF structure, data set and definitions described in this manual apply to all rail safety occurrences where investigation has revealed systemic contributors (contributing factors) to the occurrence.

Primarily, coding using the CFF is recommended for level 1 or 2 occurrences (as described in AS 4292.7, 2006), after a formal investigation has been conducted.

However, it is also possible to code any occurrences where detailed and quality information has been obtained, including level 3 and 4 investigations. For example, case study one (page 68) is a level 3 investigation.

1.5 The CFF and the investigation process

How the CFF and the investigation process fit together

All rail transport operators are required to conduct rail safety investigations in accordance with the terms of their accreditation. AS 4292.7 provides an approach for systemic investigations. These investigations are expected to address the systemic contributors to the rail safety occurrence.

Figure 1 summarises how the CFF fits into the investigation process.

There is a rail safety occurrence

Following a rail safety occurrence, the rail transport operator would typically report the occurrence to the rail safety regulator using a notification form and ON-S1 (Version 2) and OC-G1 (Version 1) to describe the event.

A systemic investigation is conducted

If the occurrence is a level 1 or 2 event, a formal systemic investigation is conducted. The investigators will document their investigation and their findings and recommendations including the contributing factors they have evidence for.

Findings are coded using the CFF

Once the investigation report has been completed, the CFF is used to code the contributing factors identified during the investigation.

Data are recorded and analysed

The contributing factors associated with the occurrence have now been turned into data that can be recorded for further analysis. This permits comparison of contributing factors across investigation reports to identify common problems and trends.

The collected data from a range of rail safety occurrences will provide the rail industry with guidance on the types of issues that need further exploration and which may need to be addressed to prevent future rail safety occurrences.

The data also provides analysts and researchers from rail transport operators and government and industry bodies with rich information about safety issues and the factors that contributed to them. These researchers can also use the data to identify areas for further improvements in rail safety.

Figure 1: Outline of how the CFF fits into the investigation process.

1.6 Assumptions

ON-S1 (Version 2) and OC-G1 (Version 1) classification has been applied

It is assumed that the rail safety occurrence has been classified according to ON-S1 and OC-G1 and that a record has been made in the rail operator's database. It is also assumed that all ON-S1 and OC-G1 codable occurrences have been identified and noted.

Currently, only the top or main event is coded using ON-S1 and OC-G1. However, as each CFF coding is related to an ON-S1 and OC-G1 code, all ON-S1 and OC-G1 codable events in an occurrence should be identified and the CFF used. If this is not completed, valuable information will be lost.

A systemic investigation has taken place

It is assumed that a systemic investigation has been undertaken as described in AS 4292.7 (Standards Australia, 2006) and/or the Investigations Code of Practice (CMC, 2006). This means that the investigation has looked beyond any errors or failures at the time or location of the accident.

It also means that there has been an attempt to identify whether there were any contributors to the occurrence within the affected rail organisation and (potentially) the broader rail industry.

Note
The use of the CFF does not assume anything about the terms of reference of these investigations.

The systemic investigation continues to ask why something occurred until the person conducting the investigation considers it no longer worth continuing, either in terms of effort or reward.

Investigators are best placed to use the CFF

Those staff conducting the investigation are best placed to code the contributing factors because they have been immersed in the investigation process.

Investigators are appropriately qualified

It is assumed that investigators are appropriately qualified and/or experienced at using systemic investigation techniques.

Multiple investigations are in conflict

Multiple investigations around the same event may sometimes result in conflicting findings. Where this is not resolved at the time of collation of the CFF codes, the Regulator will make the decision regarding which codes will be recorded in the their regulators' CFF database.

What can be coded

Only the findings (including contributing factors) from the investigation report will be coded. CFF categories selected must reflect the findings. This means that the report must clearly link the factual information (or evidence) and its analysis with the conclusions (or findings) reached. The chain of evidence is then clear. In exceptional cases, where a conclusion is made within the report that a factor has contributed (but this has not been included as a finding), if the chain of evidence is clear such a factor could be coded. Where something is implied, but the chain of evidence is not clear the finding should not be coded.

Section 2

About the Contributing Factors Framework

The following section describes the contributing factors framework and a summary of its structure.

2 About the Contributing Factors Framework

2.1 What is the Contributing Factors Framework?

Coding the systemic causes of rail safety occurrences

The Contributing Factors Framework (CFF) is used to code the systemic factors that contribute to rail safety occurrences. The CFF is made up of the framework, a set of data items and definitions and additional related information.

The basis of the CFF is the Model of Organisational Accidents (Reason, 1997), commonly known as the 'Reason Model'. This model is illustrated in Figure 2.

The Model of Organisational Accidents

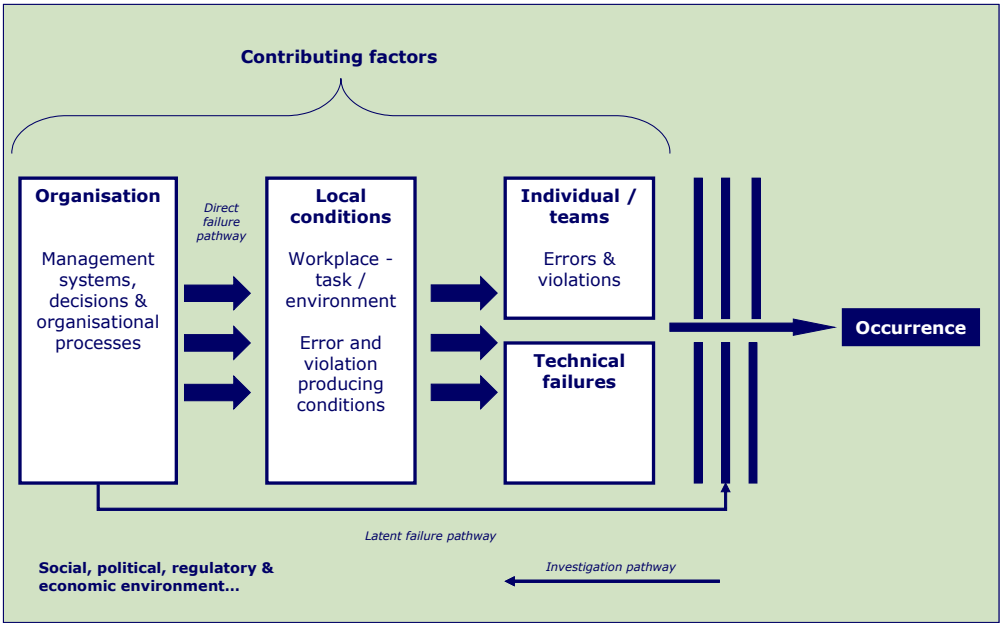


Figure 2: The Model of Organisational Accidents (based on Reason, 1997).

Reason's Model of Organisational Accidents describes how an occurrence unfolds. Reading from left to right on Figure 2, the chain of events suggests that accidents have their origins in the organisational realm (far left box). These may be management decisions and/or failures in the management system and processes.

Failures arising in these processes are transmitted directly along organisational pathways and give rise to task and environment conditions (local conditions - central box). These latent failures in the organisational system are likely to lead to active failures (violations and errors) by people and/or teams in the workplace or to technical failures (right boxes).

These errors and violations or technical failures can eventually line up with any gaps in the defences (vertical solid lines) and lead to an occurrence.

The defences themselves may also be absent or fail directly due to latent failures (note the failure pathway in the diagram). Defences may also be refered to as (risk) controls.

Note
The diagram has been modified slightly from the original to include the addition of technical failures. This is because technical failures can be considered to be the product of similar organisational and environmental factors. Figure 2 also acknowledges that social, political and regulatory matters might be amongst the latent conditions. The investigation pathway travels from right to left consistent with the approach outlined in AS 4292.7 (2006) and the Investigations Code of Practice (2006).

Other systemic approaches

Rail transport operators, using alternative investigation models or tools, can also use the framework for coding contributing factors provided they have taken a systemic approach to their investigations. Using CFF will require minimal effort in organisations that use systemic approaches and coding systems.

Figure 3 below maps the CFF against the Loss Causation Model (LCM) (Bird and Germain, 1996, p.7).

- Organisational factors in the CFF maps to lack of control in the LCM.
- Local conditions (workplace) maps to basic causes.
- Technical failures maps to substandard conditions.
- Individual/team actions maps to substandard acts/practices.

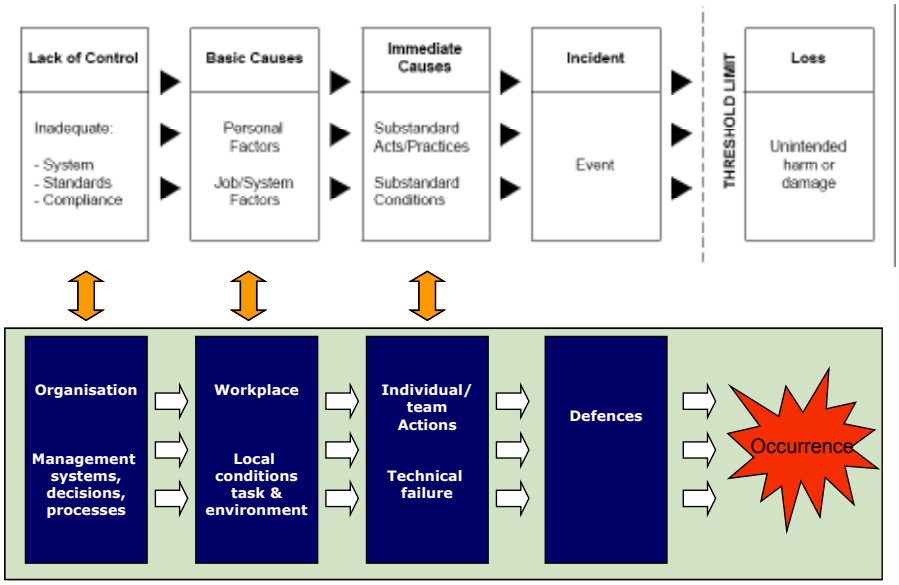


Figure 3: Mapping of the CFF and the LCM. The arrows indicate where systemic contributors map to each other

2.2 The structure of the CFF

CFF categories are derived from the Model of Organisational Accidents

The CFF is comprised of three main categories derived from the Model of Organisational Accidents. This is illustrated in Figure 4.

The categories are:

- local conditions and organisational factors
- technical failures
- individual/team actions.

Related information

Each of the three categories include a range of related information which acts to provide a more indepth picture of the contributing factor. This is summarised below and in Figure 4.

- Local conditions and organisational factors. Local conditions and/or organisational factors are gathered. Related information is gathered in the form of the functional area affected by the occurrence.
- Technical failures. Related information is gathered in the form of a description of the failed component, the failure mechanism and the origin or aspect of the lifecycle in which the failure occurred.
- Individual/team actions. Related information is gathered identifying the person who took the action, the activity they were performing and the type of error made.

  Note: Individual/team actions for level crossing occurrences are slightly different and a different list of items is used. This is provided in Appendix 2.
- Defences. Failed and/or absent defences are identified.

A complete list of the CFF categories is provided in Table 1 on page 17.

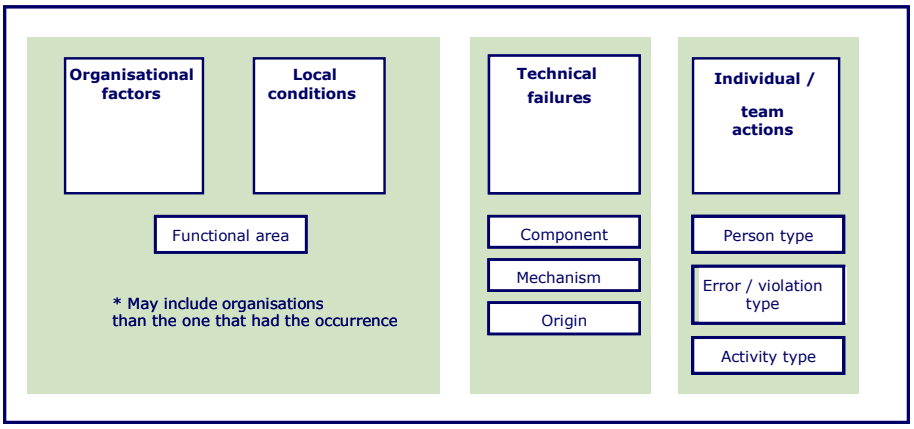


Figure 4: A summary of the CFF including its main categories and related information.

The CFF does not include an event description

As discussed earlier, the occurrence itself is not described using the CFF. Rather the occurrence is described by ON-S1 and OC-G1 (RSRP, 2008). All ON-S1 and OC-G1 occurrences should be coded, not just the top event.

Coding using the CFF requires evidence

The selection of codes must be supported by a short statement that describes (showing chain of evidence) why a code has been selected. Usually, the findings of an investigation report should be sufficient to provide this description. The following sections provide further detail on the three main categories.

Local conditions and organisational factors	Technical failures		Individual/team actions
Personal factors* Knowledge, skills and experience* Task demands* Physical environment* Social environment* Procedures* Training and assessment* Equipment, plant and infrastructure* People management* Organisational management* External organisational influences*	**Failed component** ***Rollingstock*** Bogies Braking systems Car-body Coupler/drawgear Load restraining equipment On board traction systems On board train protection systems Other rollingstock component ***Infrastructure*** Bridge Buildings Cuttings Drains/flood mitigation systems Lineside rolling stock fault detection systems Overhead power systems Road-rail interfaces Switches/crossings Track Track protection devices Track support Tunnels Other infrastructure component ***Signalling and communications*** Communication systems Control interface equipment Interlocking systems Traffic control Train detection systems Wayside signalling equipment Other signalling and communications component ***Other*** Other vehicles	**Failure mechanism** Corrosion Deformation Electrical discontinuity Fracture Mechanical discontinuity Software/firmware anomaly Wear Other failure mechanism Unknown failure mechanism **Failure origin** Design Manufacture Installation / commissioning Operation Maintenance Decommissioning Unknown failure origin	**Person type** Infrastructure maintainers Network controllers Rollingstock maintainers Train crew Station staff Terminal staff Light passenger vehicle drivers Heavy freight vehicle drivers Emergency services staff Other persons **Activity type** Preparation and planning Operating equipment Communicating Monitoring and checking Handover/takeover Other activity type **Error/violation type** Error Violation Unknown error/violation
Functional area Freight handling Infrastructure construction and maintenance Off-train operations On-train operations Passenger management Rollingstock construction and maintenance Road environment Emergency management			

Table 1: A summary of CFF categories and related data set. Items marked with an * indicates that the item includes additional keywords. Keywords for local conditions and organisational factors can be found in Table 2 on page 23.

2.3 Individual/team actions

Observable behaviours

Individual/team actions are defined as observable behaviours performed by operational personnel that could have an effect on safety. The term 'operational personnel' refers to any person that can have a relatively direct effect on safety (for example, drivers, signallers, station staff, maintenance personnel). In the railway environment, these people are generally called rail safety workers.

As described earlier, the data set for individual/team actions is made up of:

- person type
- activity type
- error/violation type.

Definitions for each of these terms are provided in Section 4 from page 39.

Human error and 'Blame'

It is important to differentiate between the concepts of human error/violations and the concept of blame.

Active failures (errors and violations) are a natural product of the human condition. Modern approaches to the understanding of human error and violations accept that human error is inevitable. This approach accepts that errors and often violations are the product of latent failutes in the organisational system such as poor systems design, inadequate procedures and operational practices.

As such, the identification of an error or violation does not automatically signify a requirement to place blame.

The 'just culture' approach in systemic investigations acknowleges that errors are inevitable. The purpose of the investigation is to identify the systemic contributors to the error or violation so that they can be removed or fixed. This means that the error or violation is less likely to occur in future and that system become more error tolerant. Consistent with this approach, the CFF does not imply blame when errors/violations are identified and coded.

Person type

Person type refers to the role of the person/s who performed the activity in which an error or violation occurred. These people are the operational personnel. The person types are:

- infrastructure maintainers
- network controllers
- rollingstock maintainers
- train crew
- station staff
- terminal staff
- light passenger vehicle drivers
- heavy freight vehicle drivers
- emergency services staff
- other person/s.

Definitions for each of these terms are provided in Section 4, pages 39-40.

Activity Type

A list of activity types is used to describe the activity being undertaken in which the error/violation occurred. These are:

- preparation and planning
- operating equipment
- communicating
- monitoring and checking
- handover/takeover
- other activity type.

Definitions for each of these terms are provided on page 41.

Error/violation type

Error/violation type describes the nature of the action that went wrong. Three error/violation types have been defined:

- error
- violation
- unknown error/violation.

Definitions for each of these terms are provided on page 42.

2.4 Technical failures

Breakdowns of technology

Technical failures are defined as breakdowns of technology used in rail operations. The technical failures data set is made up of three items:

- failed component
- failure mechanism
- failure origin.

Definitions for each of these terms are provided in Section 4 from page 43.

Failed component

The component is the actual part and/or item of plant or equipment that failed. Technical components of the main categories are listed below.

Rollingstock

- bogies
- braking systems
- car-body
- coupler/drawgear
- load restraining equipment
- on board traction systems
- on board train protection systems
- other rollingstock component.

Infrastructure

- bridge
- buildings
- cuttings
- drains/flood mitigation systems
- lineside rolling stock fault detection systems
- overhead power systems
- road-rail interfaces
- switches/crossings
- track
- track protection devices
- track support
- tunnels
- other infrastructure component.

Signalling and communications

- communication systems
- control interface equipment
- interlocking systems
- traffic control
- train detection systems
- wayside signalling equipment
- other signalling and communications component.

Other

- other vehicles.

Definitions for each of these terms are provided from page 43.

Failure mechanism

Failure mechanism describes the nature of the failure. These are:

- corrosion
- deformation
- electrical discontinuity
- fracture
- mechanical discontinuity
- software/firmware anomaly
- wear
- other failure mechanism
- unknown failure mechanism.

Definitions for each of these terms are provided on page 49.

Failure origin

Failure origin describes the part of the lifecycle in which the failure originated. These are:

- design
- manufacture
- installation/commissioning
- operation
- maintenance
- decommissioning
- unknown failure origin.

Definitions for each of these terms are provided on page 50.

Note

The failure origin category has been included to provide additional information on what has occurred and why. However, it is still essential to identify local conditions and organisational factors associated with a technical failure to complete our understanding of why something has failed.

If it were found that there was a failure in the maintenance part of the asset lifecycle, it would be important to understand why.

For example:

- *was maintenance an issue due to poor resource management*
- *was there a lack of training or competency*
- *were appropriate procedures missing?*

These factors all reside in the local workplace and/or the organisational system. Therefore, it is important to ensure that any local conditions and organisational factors are also identified.

2.5 Local conditions and organisational factors

Factors that influence human and technical performance

Local conditions and organisational factors are defined as those features within an organisation and/or local workplace that influence or lead to an Individual/team action or a technical failure. These may range from personal issues to factors within the wider organisation and even the external environment.

For example, many of these factors and conditions are risk controls, safeguards, barriers or defences implemented within the organisations' safety management system. As such, consideration of these factors and conditions from a risk perspective is important in the investigation of rail safety occurrences.

Eleven local conditions and organisational factors are specified. A third type of item covers the functional area affected by the failure. Identifying the functional area (for example, rollingstock construction and maintenance) affected by any of the contributing factors will help identify where remedial action should be focussed.

Local conditions can be considered conditions present in the local workplace or environment in which the individual/team action or technical failure occurs.

The organisational factors can be considered those factors in the management system, decision-making at the senior level and policy setting that guide the activities of the organisation.

Definitions of these terms and their keywords are located in Section 4 from page 51.

Keywords ~ local conditions and organisational factors

Keywords are used to further describe each local condition and organisational factor. These are summarised in Table 2.

Local conditions and organisational factors	Keywords	
Personal factors	Alcohol/drugs Expectation Fatigue/alertness Health-related condition Motivation/attitude	Physical limitations Pre-occupation Stress/anxiety Other personal factors
Knowledge, skills and experience	Abnormal/emergency operations knowledge and skills Normal operations knowledge and skills	Task experience Communication skills Teamwork skills Other knowledge, skills and experience factors
Task demands	Distractions High workload Low workload	Time pressure Other task demand factors
Physical environment	Air quality Housekeeping Lack of environmental cues Lighting/visibility	Noise Temperature/humidity Vibration Weather-related factors Other environmental factors
Social environment	Diffusion of responsibility Peer pressure Norms and values	Team climate Other social environment factors
Procedures	Absent procedure Accuracy/adequacy Availability/access	Clarity Work-ability/relevance Other procedures factors
Training and assessment	Competency assessment Currency tracking Initial training	Ongoing training Training review Other training factors
Equipment, plant and infrastructure	Availability Absent equipment, plant and infrastructure Alarm design Control/input device design Display design	Infrastructure design Signage Functionality Reliability Other equipment, plant and infrastructure factors
People management	Job/task design Selection/recruitment Reward/discipline structures Roles and responsibilities Rostering/scheduling	Fitness for duty monitoring Staff support Supervision Other people management factors
Organisational management	Business planning and asset/resource management Communication and consultation process Competence of senior personnel Compliance Contractor/interface management Information management	Monitoring, review and validation Organisation design Policy Risk/change management Interface management Other organisational management factors
External organisational influences	Community expectations or behaviour Government influences Industry standards or guidance	Regulatory activities Regulatory standards and guidance Other external organisational influences

Table 2: Summarises the local conditions and organisational factors and their associated keywords. Definitions can be found from page 51.

2.6 Defences

Defences defined

It is important to know which (risk controls) were absent or failed in the context of the occurrence. This information can be captured under the concept of defences in the CFF model.

A defence must meet both of the criteria listed below:

(a) Its primary purpose is to protect against a specified risk.

(b) It is designed to serve one or more of the functions listed below:

- create understanding and awareness of the local hazards
- give clear guidance on how to operate safely
- provide alarms and warnings when danger is imminent
- restore the system to a safe state in an abnormal or emergency situations
- interpose safety barriers between the hazards and the potential losses
- contain and eliminate the hazards should they escape this barrier
- provide the means of escape and rescue should hazard containment fail (Reason, 1997, pp7).

Coding of a defence in the CFF simply requires identifying those contributing factors considered to be absent or failed defences.

2.7 Non-contributing safety issues

During investigations, safety issues are sometimes identified that had no bearing on the occurrence being investigated but, if not addressed, could lead to future safety occurrences. These may be systemic factors (local conditions and organisational factors), technical failures and even human errors (individual/team actions).

Any non-contributing safety issues identified by investigations should be recorded using the CFF coding framework.

Section 3

Using the Contributing Factors Framework

The following section describes the procedure for using the CFF.

3 Using the Contributing Factors Framework

3.1 Getting started

The following section describes the procedure for coding an investigation using the CFF. Both summary and detailed directions on using the CFF have been provided.

The CFF coding template

The CFF coding template is illustrated in Figure 5. A full size version of the template can be found on pages 87-88.

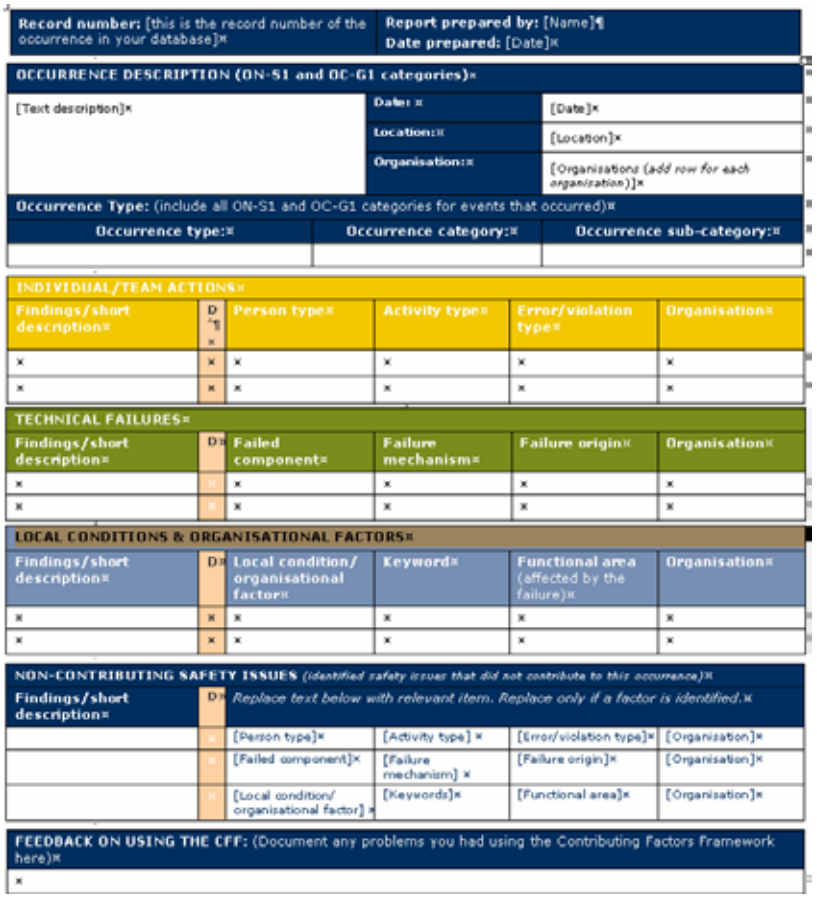
Quick start guide

Regular and/or experienced users of the CFF, please refer to the Quick Start Guide on page 37.

Detailed procedure

A detailed procedure and form have been developed for first time or infrequent users of the CFF. Each step of the process for CFF coding is outlined with supporting notes.

Each section of the form is colour-coded to match the corresponding section of the CFF. White sections denote areas for entering text. In the Word template new rows can be added to each section as required.



Record number: [this is the record number of the occurrence in your database]

Report prepared by: [Name]
Date prepared: [Date]

OCCURRENCE DESCRIPTION (ON-S1 and OC-G1 categories)

[Text description]

Date:	[Date]
Location:	[Location]
Organisation:	[Organisations (*add row for each organisation*)]

Occurrence Type: (include all ON-S1 and OC-G1 categories for events that occurred)

Occurrence type:	Occurrence category:	Occurrence sub-category:

INDIVIDUAL/TEAM ACTIONS

Findings/short description	D	Person type	Activity type	Error/violation type	Organisation

TECHNICAL FAILURES

Findings/short description	D	Failed component	Failure mechanism	Failure origin	Organisation

LOCAL CONDITIONS & ORGANISATIONAL FACTORS

Findings/short description	D	Local condition/ organisational factor	Keyword	Functional area (affected by the failure)	Organisation

NON-CONTRIBUTING SAFETY ISSUES (*identified safety issues that did not contribute to this occurrence*)

Findings/short description	D	*Replace text below with relevant item. Replace only if a factor is identified.*			
		[Person type]	[Activity type]	[Error/violation type]	[Organization]
		[Failed component]	[Failure mechanism]	[Failure origin]	[Organisation]
		[Local condition/ organisational factor]	[Keywords]	[Functional area]	[Organisation]

FEEDBACK ON USING THE CFF: (Document any problems you had using the Contributing Factors Framework here)

Figure 5: The CFF coding form.

3.2 Detailed procedure for using the CFF

Before you start coding! Begin by recording details of the occurrence including the ONS1 and OCG1 code/s.

Recording These details should be recorded in the section of the CFF coding form shown in Figure 6.

<table>
<tr><th colspan="3">OCCURRENCE DESCRIPTION (ON-S1 and OC-G1 Categories)</th></tr>
<tr><td rowspan="3">[Text description] Provide a short description of the occurrence including any outcomes such as injuries, fatalities and damage to property.</td><td>Date:</td><td>[Date] Enter details regarding the date of the occurrence</td></tr>
<tr><td>Location:</td><td>[Location] Enter details regarding the location of the occurrence.</td></tr>
<tr><td>Organisation:</td><td>[Organisation] Identify the organisations involved.</td></tr>
<tr><th colspan="3">Occurrence Type: (include all ON-S1 and OC-G1 Categories for events that occurred)</th></tr>
<tr><th>Occurrence type:</th><th>Occurrence category:</th><th>Occurrence sub-category:</th></tr>
<tr><td>Next, enter the ON-S1 and OC-G1 code/s for the occurrence. This information will most likely already be available in which case it will be a simple matter to transfer the ON-S1 (Version 2) and OC-G1 (Version 1) (RSRP, 2008) coding on to the CFF coding sheet (page 83).

If the occurrence has not been coded, you should classify the occurrence before you start filling in the CFF coding template. Record this information on the CFF coding template in the section marked ON-S1 and OC-G1 classification.

All parts of the occurrence that can be classified using ON-S1 and OC-G1 should be classified.

For example, if a signal passed at danger (SPAD) has preceded a derailment, both the SPAD and the derailment should be recorded on the CFF coding form in the space provided.</td><td></td><td>Note: If coding a level crossing occurrence, in addition to the OC-G1 event classification, the type of protection provided at the level crossing should be included in the occurrence sub-category. The level crossing control type should be chosen from the following ON-S1 codes:

- active - lights only

- active - lights and boom gates

- passive - stop signs

- passive - giveway signs

- none.

If the level crossing protection type is not covered by the categories above (for example, manual gates, traffic flagged by crew), please use the ‘other’ code.</td></tr>
</table>

Figure 6: Section on CFF coding form for the recording of ON-S1 and OC-G1 classification.

General rules of coding

The following general rules apply to coding using the CFF. They apply to all parts of the CFF including the coding of individual/team actions, technical failures and local conditions and organisational factors.

Using the same code multiple times

As a general rule, if you find that two different findings have the same contributors, they should both be coded. This would mean that each of the findings is independent (that is, they are not the same finding).

The examples below illustrate this point.

- If two different workers (separately) made the same error, both would be coded.
- If two different failed components had the same failure mechanism and origin, both would be coded.
- If two different procedures are noted to be absent, then both findings should be coded.

Coding must reflect the reports findings

CFF categories selected must reflect the findings of the investigation report. This means that the report must clearly link the factual information (or evidence) and its analysis with the conclusions (or findings) reached. The chain of evidence is then clear. Where something is implied, but the chain of evidence is not clearly specified in the written finding, the finding should not be coded.

3.3 Coding individual/team actions (Step 1)

Documenting the individual/team actions

To use the CFF to code the individual/team actions associated with the safety occurrence under investigation, follow the Step 1 instructions below.

Review your investigation findings

Review your investigation findings.

Did any individual and/or team actions happen before or during the occurrence?

If **NO**, go on to Step 2.

If **YES**, record this information on the CFF coding form in the section marked individual/ team actions (Figure 7).

Record using the CFF coding form

INDIVIDUAL/TEAM ACTIONS					
Findings/short description	D[1]	Person type	Activity type	Error/violation type	Organisation

Figure 7: Section on CFF coding form for the recording of individual/team actions.

Information should be recorded by following the steps summarised in Figure 8 below, which are described in more detail in the Supporting Notes (opposite page) to help you record the relevant information.

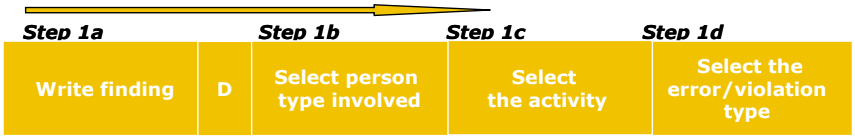


Figure 8: Step 1 – Coding individual/team actions

Repeat

Repeat Step 1 as many times as necessary to record all the individual/team actions involved in the occurrence.

1 D: Tick the factors that correspond to absent or failed defences.

Supporting Notes – individual/team actions

Step	How to…
Step 1a **Write finding**	Record your finding, as it is in the investigation report, or write a short description if the finding requires some further explanation. **Note** *This is your evidence for selecting a particular code and you should make your choices clear. For the most part you should be able to cut and paste from the findings in your investigation report to fill out this description.* *If you find that you do need to write something, the short description should be specific. Describe exactly what the person was doing and the details of their actions.* *Provide a clear description of what occurred, because it will provide analysts and researchers with important information.* *There will not always be an individual/team action to identify and multiples of this category are also possible.*
Step 1b **Select person types involved**	Ask the questions listed below. • Who performed the action in which the error/violation occurred? • Were they at or near the site of the occurrence? Did their action occur close to the time of the occurrence? If the answer is **YES** to either or both of these questions, you should be able to find the person/s (or something close to it) in the list of person types. • **Hint**: If they have manager in their title (or you cannot find their title in the list) the action should, most likely, not be recorded here. It should be recorded as a systemic problem (under local conditions and organisational factors). **Note** *Railway personnel may perform roles outside of their primary job. Where this is the case, the role being performed at the time of the error/violation occurring should be coded.* *It is expected that 'other' item will be used infrequently. If 'other' is used, provide a detailed description.*
Step 1c **Select the activity**	Ask the question below. • What was the main task the person was doing at the time of the occurrence?
Step 1d **Select the error/ violation type**	Ask the questions below. • Did the person performing the activity know the correct action but intentionally take the incorrect action? If so, record a violation and describe how you know this. • Did the person unknowingly take the incorrect action (for example, had forgotten about the correct procedure, misunderstood the procedure, was distracted, made a wrong assumption)? If so, record an error and describe what the error was. **Note** • If you cannot be sure either way, the action must be classified as 'unknown'. Only when a person knowingly breaks a rule should it be considered a violation.
Return to Step 1a?	Are there additional individual/team actions to record? If **YES**, return to Step 1a. If **NO**, go on to Step 2.

3.4 Coding technical failures (Step 2)

Documenting the technical failures

To use the CFF to code the technical failures associated with the safety occurrence under investigation, follow the Step 2 instructions below.

Review your investigation findings

Review your investigation findings.

Was there a technical failure before or during the occurrence and, if so, did it contribute to the occurrence?

If **NO**, go on to Step 3.

If **YES**, record this information on the CFF coding form in the section marked technical failures (Figure 9).

Record using the CFF coding form

TECHNICAL FAILURES					
Findings/short description	D	Failed component	Failure mechanism	Failure origin	Organisation

Figure 9: Section on CFF coding form for the recording of technical failures.

Record using the CFF coding form

Information should be recorded by following the steps summarised in Figure 10 and described in more detail in the Supporting Notes to help you record the relevant information.

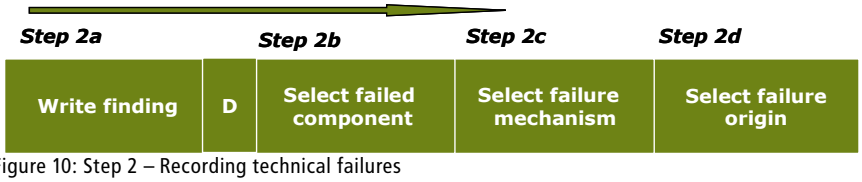


Figure 10: Step 2 – Recording technical failures

Repeat

Repeat Step 2 as many times as necessary to record all the technical failures involved in the occurrence.

Supporting Notes – technical failures	
Step	**How to…**
Step 2a **Write finding**	Record your finding, as it is in the investigation report, or write a short description if the finding requires some further explanation. **Note** *This is your evidence for selecting a particular set of codes and you should therefore make your choices clear. For the most part you should be able to cut and paste from the findings in your investigation report to fill this description in.* *If you find that you do need to write something, the short description should be specific. Describe exactly what component failed and the circumstances of the failure. One or two sentences may be required to describe what occurred.* *Provide a clear description of what occurred, as it will provide analysts and researchers with important information.*
Step 2b **Select failed component**	Ask the question below. • What component, piece of equipment, item of plant or material failed and triggered the occurrence?
Step 2c **Select failed mechanism**	Ask the question below. • How did the equipment, item of plant or material fail? Think along the lines of the actual physical failure of the component. The reasons for the failure, the local conditions and organisational factors are covered elsewhere.
Step 2d **Select failure origin**	Ask the question below. • During which stage of the equipment, plant or material lifecycle did the failure originate?
Return to Step 2a?	Are there additional technical failures to record? If **YES**, return to Step 2a. If **NO**, go on to Step 3.

3.5 Coding local conditions and organisational factors (Step 3)

Document the local conditions and organisational factors

To use the CFF to code the local conditions and organisational factors associated with the safety occurrence under investigation, follow the Step 3 instructions below.

Review your investigation findings

Review your investigation findings.

Were any local conditions and/or organisational factors present before or during the occurrence?

Which keywords best describe the local condition and/or organisational factors you have selected?

If **NO**, go on to Step 4.

If **YES**, record this information on the CFF coding form in the section marked marked local conditions and organisational factors.

Record using the CFF coding form

LOCAL CONDITIONS and ORGANISATIONAL FACTORS					
Findings/short description	**D**	**Local condition/ organisational factor**	**Keyword**	**Functional area (affected by the failure)**	**Organisation**

Figure 11: Section on CFF coding form for the recording of Local conditions and organisational factors.

Information should be recorded by following the steps summarised in Figure 12 and described in more detail in the Supporting Notes to help you record the relevant information.

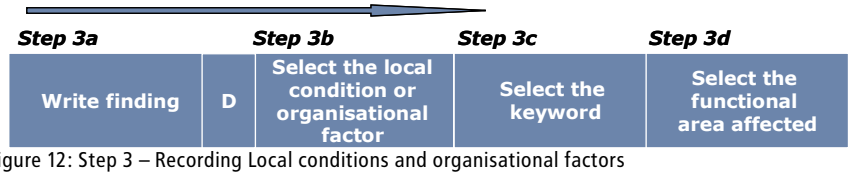


Figure 12: Step 3 – Recording Local conditions and organisational factors

Repeat

Repeat Step 3 as many times as necessary to record all the Local conditions and organsiational factors involved in the occurrence.

Supporting Notes – local conditions and organsiational factors

Step	How to...
Step 3a **Write finding**	Record your finding, as it is in the investigation report, or write a short description if the finding requires some further explanation. **Note** *This is your evidence for selecting a particular set of codes and you should therefore make your choices clear. For the most part you should be able to cut and paste from the findings in your investigation report to fill this description in.* *If you find that you do need to write something, the short description should be specific. Describe exactly what component failed and the circumstances of the failure. One or two sentences may be required to describe what occurred.* *Provide a clear description of what occurred, as it will provide analysts and researchers with important information.*
Step 3b **Select the local condition or organisational factor**	The questions below will help you select the factor(s). • Were there failures in the local workplace or in the organisational management system? • Were there any failures in other organisations involved in the event (eg. interface partners or the regulator)? **Note** *Management and supervisory errors are coded under this heading, not under Individual/team actions.*
Step 3c **Select the keyword**	Ask the question below. • What keyword/s best describe the local conditions and/or organisational factors identified? These are important as they provide evidence for the selection of Local conditions and/or organsiational factors.
Step 3d **Select the functional area affected**	Identify the part(s) of the organisation to which the failure occurred (not the group that generated the failure). **Note** *This is unlikely to be the corporate body or organisation. This part of the organisation may generate failure types but is unlikely to be affected in such a way that leads directly to an occurrence.*
Return to Step 3a?	Are there any additional Local conditions or organsiational factors to record? If YES, return to Step 3a. If NO go on to Step 4.

3.6 Coding Defences (Step 4)

Identify the absent or failed defences

To use the CFF to code the absent or failed defences associated with the safety occurrence under investigation, follow the Step 4 instructions below.

Review your investigation findings

Review your CFF coding.

What were the absent or failed defences?

Use the following criteria to work out what should be identified as a failed or absent defence.

(a) Is its primary purpose to protect against a specified risk?

(b) Was it designed to serve one or more of the functions listed below?:

- create understanding and awareness of the local hazards
- give clear guidance on how to operate safely
- provide alarms and warnings when danger is imminent
- restore the system to a safe state in an abnormal or emergency situations
- interpose safety barriers between the hazards and the potential losses
- contain and eliminate the hazards should they escape this barrier
- provide the means of escape and rescue should hazard containment fail.

If **NO**, go on to Step 5.

If **YES**, record this information on the CFF coding form by a tick in the relevant check box (**D**) located to the left of the findings cell.

Record using the CFF coding form

3.7 Coding non-contributing safety issues (Step 5)

Document other safety issues

To use the CFF to code the non-contributing safety issues, follow Step 5.

This information is recorded because it is essential that action be taken on any identified safety issues that could lead to occurrences, regardless of whether they contributed to the occurrence under investigation.

Identify any other safety issues

Did you find any other safety issues that did not contribute to the event (non-contributing safety issues) but that could contribute to future occurrences if not addressed?

If **NO**, coding is complete.

If **YES**, record this information on the CFF coding form in the section marked non-contributing safety factors (Figure 13).

Record these issues as described in Steps 1 – 3, depending on the type of factor identified.

Record using the coding form

NON-CONTRIBUTING SAFETY ISSUES *(identified safety issues that did not contribute to this occurrence)*					
Findings/short description	**D**	**Replace text below with relevant item. Replace only if a factor is identified.**			
		[Person type]	[Activity type]	[Error/violation type]	[Organisation]
		[Failed component]	[Failure mechanism]	[Failure origin]	[Organisation]
		[Local condition/ organisational factor]	[Keywords]	[Functional area]	[Organisation]

FEEDBACK ON USING THE CFF: (Document any problems you had using the Contributing Factors Framework here)

Figure 13: Section on CFF coding form for the recording of non-contributing safety issues.

Repeat

Repeat Step 5 as many times as necessary to record all the non-contributing safety issues involved in the occurrence.

3.8 Feedback on the CFF

If you notice any issues with the CFF associated with its structure, definitions, or lack of clarity in the text, record your comments in the field headed 'Feedback on using the CFF'.

Do not put comments about the quality of the investigation report, or issues with the investigation here.

Quick Start Guide

Before you start coding!

Ensure ON-S1, OC-G1 classification is complete

Identify the correct ON-S1 and OC-G1 coding for the occurrence and record this on the CFF coding form. **Note ~** All ON-S1 and OC-G1 classifiable events that happened during the occurrence need to be recorded *NOT JUST* the top event.

Step 1 — **Individual / team actions**

Did any individual/ team actions contribute to the occurrence?

If **NO** go on to Step 2. If **YES**, complete the following:

Step 1a		*Step 1b*	*Step 1c*	*Step 1d*
Write finding	D	Select person type involved	Select the activity	Select the Error/violation type

Repeat **Step 1** as many times as necessary to record all the individual / team actions involved in the occurrence.

Step 2 — **Technical failures**

Did any technical failures contribute to the occurrence?

If **NO** go on to Step 3. If **YES**, complete the following

Step 2a		*Step 2b*	*Step 2c*	*Step 2d*
Write finding	D	Select failed component	Select failure mechanism	Select failure origin

Repeat **Step 2** as many times as necessary to record all the technical failures involved in the occurrence.

Step 3 — **Local conditions and organisational factors**

Did any Local conditions and/or Organisational factors contribute to the occurrence?

If **NO** go on to Step 4. If **YES**, complete the following:

Step 3a		*Step 3b*	*Step 3c*	*Step 3d*
Write finding	D	Select the local condition or organisational factor	Select the keyword	Select the functional area affected

Repeat **Step 3** as many times as necessary to record all the local conditions & organisational factors involved in the occurrence.

When there are no more go on to Step 4.

Step 4 — **Defences**

What were the absent or failed defences? Tick the box marked D, next to each defence that was absent or failed. Then go on to Step 5.

Step 5 — **Non-contributing safety factors**

Did you find any ***other safety issues*** that did not contribute to the occurrence but that could lead to a rail safety occurrence?

Record these factors using the contributing factors data set. For example, if it is an individual action, record using Step 1 and so on…

Figure 14: Quick Start Guide: steps required to complete CFF coding.

Section 4

Definitions

This section provides definitions for all items contained within the CFF data set.

4 Definitions

4.1 Definitions – individual/team action

Individual/team actions defined	An action or omission by one or more of the defined person types having an affect on safety. This category includes the: • person type • activity type • error/violation type.
Person type defined	The role of the person or persons who performed the activity and the subsequent error or violation. The items for person types and their definitions are below.

Person type	Definitions
Infrastructure maintainers	Rail safety workers who install, assess and/or service infrastructure used by the railway, including track, bridges, signalling and communications. Includes protection officers, track workers, handsignallers, track inspectors, signal maintainers, engineers, electrical and signal fitters and any other person whose work on infrastructure may affect the safe operation of the railway. **Note** *When operating a track vehicle outside a designated work site (that is, on a running line), persons should be classified as train crew.*
Network controllers	Rail safety workers who are responsible for the allocation of train paths and the management and/or supervision of trains in transit. Includes train controllers and signallers.
Rollingstock maintainers	Rail safety workers who inspect, service and repair locomotives, wagons, railcars and other rail vehicles, including those who influence the design or modification of rollingstock. Includes fitters, mechanics, engineers and other personnel whose work may involve the identification and repair of vehicle faults.
Train crew	Rail safety workers who have direct control of the operation of a train or may intervene in the operation of a train. Includes drivers, other train crew and guards. **Note** *If operating a track vehicle within a designated work site, persons should be classified as infrastructure maintainers.*
Station staff	Rail safety workers who supervise public areas of a railway and provide an operational interface with train services. They have a direct relationship to the safe operation of the railway. Includes platform staff such as station attendants, station masters, station supervisors, security staff and platform inspectors.
Terminal staff	Rail safety workers who manage the assembly and loading of a train prior to its departure from, and following arrival at, a terminal or destination, its unloading and break up. Includes shunters, goods handlers, train examiners and clerks who have control over the placement of loadings.

Light passenger vehicle drivers

Persons in control of a motorised vehicle (other than a heavy vehicle) whose actions impact on the safe operation of the railway. Includes drivers of cars, utes, 4wds, delivery vans, light commercial vehicles (◂4.5t), mini buses (maximum capacity of 12 passengers) as well as motorcyclists.

Note
This code is appropriate when coding the errors and violations of road users in relation to level crossing incidents. Where a road user has performed an action not related to traversing a level crossing, this should be coded in the 'other' category.

Heavy freight vehicle drivers

Persons in control of a heavy vehicle whose actions impact on the safe operation of the railway. Includes drivers of medium rigid trucks, semi trailers, B double trucks and road trains.

Note
This code is appropriate when coding the errors and violations of road users in relation to level crossing incidents. Where a road user has performed an action not related to traversing a level crossing, this should be coded in the 'other' category.

Emergency services staff

Employees of emergency services organisations whose primary role is to respond to emergencies.

Includes police, fire and rescue personnel, and paramedics.

Other person type

Any other person who may be on or near a railway, regardless of employment status, but whose role does not entail responsibility for the safe operation of the railway. Includes passengers, trespassers, general public, security staff, ticket inspectors and train managers. Also includes other vehicle drivers such as bus drivers.

To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the list of person types.

Activity type

Activity type defined The main rail safety activity or function being performed at the time the error or violation occurred. The items for activity types and their definitions are below.

Activity type	Definitions
Preparation and planning	Actions associated with planning, preparing or briefing for a task. Includes pre-trip inspections, assessing, journey planning and pre-work risk assessment.
Operating equipment	Actions associated with the use of any plant and/or equipment such as the control or handling of a rail vehicle/s, switching, train control or communications equipment.
Communicating	Actions associated with verbal and/or written communication of relevant information to other operational personnel or passengers. Includes talking on the radio, taking a train order, giving instructions, among other things. **Note** *Communications associated with handing or taking over a task should be recorded under handover/takeover.* Actions relating to the incorrect operation of communication equipment should be recorded under operating equipment.
Monitoring and checking	Actions associated with maintaining awareness of system states and serviceability, environmental conditions, traffic disposition and other relevant acts. Includes inspecting, testing, monitoring, assessing and validating. **Note** *For operational tasks, monitoring and checking problems that occur at or prior to departure should be coded under preparation and planning.*
Handover/takeover	Actions associated with the exchange of information related to the operation of the railway or to the completion of a task. Includes handover, takeover, signoff, sign-over, crew change and shift change. Generally occurs at the change of a shift but may occur during a shift, for example when taking or giving a train order or other operational instruction.
Other activity type	Any activities not covered by the above criteria, including any actions of the general public and trespassers. To use this category you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above activity type list.

Error/violation type

Error/violation type defined	The nature of the identified behaviour. The items for error/violation types and their definitions are below.

Error/violation type	Definitions
Error	All those occasions in which a planned sequence of mental or physical activities fails to achieve its intended outcome. **Note** *An error may not necessarily result in a negative outcome as it may be detected and managed in time.*
Violation	A deliberate deviation from rules or procedures. For example, if the person knows the correct rule or procedure and does not follow it (for example, a common shortcut), the action is a violation. However, if the person does not know or has forgotten the correct rule or procedure, the action is considered an error.
Unknown error/violation	Where there is insufficient information available to determine whether the action is an error or a violation.

4.2 Definitions – technical failure

Technical failure defined

The breakdown or failure of an item of equipment, plant or material contributing to an occurrence.

This category includes the:

- failed component (the *what*)
- failure mechanism (the *how*)
- failure origins (the *why*).

The items for technical failures and their definitions are below.

Failed component defined

Failed components are defined as the piece of equipment, plant or material that failed. For convenience, components have been grouped into three areas, rollingstock, infrastructure and signalling and communications.

Rollingstock items include:

- bogies
- braking systems
- car-body
- coupler/drawgear
- load restraining equipment
- on board traction systems
- on board train protection systems
- other rollingstock component.

Infrastructure (track, civil and electrical) items include:

- bridge
- buildings
- cuttings
- drains/flood mitigation systems
- lineside rolling stock fault detection systems
- overhead power systems
- road-rail interfaces
- switches/crossings
- track
- track protection devices
- track support
- tunnels
- other infrastructure component.

Signalling and Communications items include:

- communication systems
- control interface equipment
- interlocking systems
- traffic control
- train detection systems
- wayside signalling equipment
- other signalling and communications component.

Other:

- other vehicles

Failed component *(rollingstock)*	Definitions
Rollingstock defined	A rail vehicle operating on or utilising a railway track. Includes locomotives, rail cars, trams, freight wagons, track machines, road transferable locomotives (RTLs) and light track vehicles.
Bogies	Includes any component of a bogie (excluding braking components) or in the case of four-wheeled stock, its wheel sets. Bogie components may include wheels, axle, bolster, tyre, side bearer, frames, king casting, bolster pivots, centre pins, bolster/spreader beams, bearings, and springs.
Braking systems	The subsystem of a rail vehicle used to affect braking. Includes any element of the braking system, such as brake pipes, compressors, control valves, brake rigging and brake shoes, brake pipes, brake shoes/blocks, brake rigging, hand brakes, load compensation devices, and brake control equipment (including for example, electro-pneumatic systems). **Note** *Dynamic braking systems are included under traction systems.*
Car-body	Any part of the vehicle body and components, such as doors, windows, steps, brackets, chassis. Car-body components may also include the underframe, centre sill, side sill, bolster centre, queen casting and access hatches.
Coupler/drawgear	Any part of a rail vehicle's connecting system. Includes elements of the coupling system such as the coupler, drawgear pocket, methods for securing (eg. Murray keys), and sub-components. Other connecting system components may include knuckle, drawbar, retainer pin, drawgear, carrier, shank and articulated connectors.
Load restraining equipment	Any part of a rail vehicle's load restraining equipment. Includes devices used to secure loads within or onto a rail vehicle including twist locks, grab rails and tiedowns.
On board traction systems	Any part of a rail vehicle's traction system. Includes the power source (for example, diesel engine or boiler) and any associated fitting that controls or transfers power to the driving wheels (for example, rods, traction motors, control stands and associated wiring). Other traction system components include traction motors, control cubicle, dynamic braking module, control stand, logic controllers, main generator, alternators, exciters, pantographs, gearboxes, and final drive. **Note** *Where electric traction is used, the power supply is not considered to be part of the traction system. It should be considered under overhead power systems.*
On board train protection systems	The protection systems installed into or onto a rail vehicle which can control or affect the operation of the train. Includes systems such as ATP, AWS, train stops, and vigilance or deadman systems that may intervene in the operation of a train when defined parameters are met. Train protection system components may also include in-cab display systems for electronic signalling and tripcocks.
Other rollingstock component	Any component not included above that relates to a rail vehicle operating on or utilising a railway track. To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above failed component *(rollingstock)* list.

Failed component *(Infrastructure ~ track, civil and electrical)*	Definitions
Infrastructure (track, civil and electrical) defined	Includes the elements that make up the rail, track formation, drainage, fixed structures beside, over or under the track and overhead electrical traction equipment. It also includes supports for signalling and telecommunications equipment (but does not include associated components). **Note** *The term 'fixed structures' includes buildings (and their fixtures) and tunnels.*
Bridge	Any structure that allows people or vehicles to cross over a railway. Includes road bridges, footbridges, and railway bridges.
Buildings	Any structure within, or affecting the railway corridor, where it is not described elsewhere. Includes station buildings, goods sheds, silos, relay huts/rooms, and platforms/concourses/public areas.
Cuttings	Describes any location where a railway is situated below the natural ground level, but is not enclosed (that is, it is open to the natural environment). Includes retaining walls used to support embankments.
Drains/ flood mitigation systems	Any track structure used to drain water away from the railway, or to protect the railway from water. Drain/flood mitigation components may include sump, floodway, scour protection, levee banks, flood gates, cesses, culverts, or floodways. **Note** *Bridges over waterways or roads should be coded under track support.*
Lineside rolling stock fault detection systems	Equipment used to detect abnormal rolling stock situations, including out-of-gauge loading and overloading. Lineside rolling stock fault detection systems may include acoustic bearing monitoring (ABM), wheel impact load detector (WILD), in-motion weighbridges, loading gauges, dragging equipment detection (DED) systems.
Overhead power systems	Equipment used to deliver power to electric trains (not installed on the train such as power distribution systems within the control of the railway) and or the systems supporting the railway. Overhead power supply components may include catenary, mast, stanchion, contact wire, dropper, transformer, circuit breaker and insulator.
Road-rail interfaces	Infrastructure associated with grade crossings, including gates/barriers, lights, road surfaces, warning device and signage, whether for motor vehicle, pedestrian or animal traffic. Other road-rail interfaces may include occupational crossings and pedestrian access. **Note** *Where detection equipment to activate the crossing fails, consider coding as train detection systems. Where relay or control systems fail, consider coding under interlocking systems.*
Switches/crossings	Infrastructure used to divert a train from one track to another. Includes diamonds, single slips, double slips and typical switches as well as components such as points blades. **Note** *This item does not include equipment used to control the switch. This would typically be coded under wayside signalling equipment.*

Failed component *(infrastructure ~ track, civil and electrical)*	Definitions
Track	Track includes components that when assembled are intended to carry a rail vehicle such as: rail, sleepers, fasteners, ballast, fish plates, and dog spikes. Track also includes broken rails and/or failed welds, or where track is out of specification.
Track protection devices	Includes devices to warn, stop, or prevent trains from fouling a running line such as derailers, chock-blocks, scotch-blocks and catch points.
Track support	Includes components associated with the rail bed as well as embankments and track substructures, such as bridges (and their components) over roads and rivers. **Note** *Components such as sump, floodway, scour protection, levee bank, floodgate, cesses, culverts, or floodways are included in drains/flood mitigation.*
Tunnels	An underground passageway carrying a railway. The tunnel may be under a building or series of buildings.
Other infrastructure component	Any component not included above that relates to the elements that make up the rail, track formation, drainage, fixed structures beside, over or under the track and overhead electrical traction equipment. To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above failed component *(infrastructure)* list.

Failed component *(signalling and communications)*	Definitions
Signalling and communications defined	The equipment used to control and regulate the safe movement of trains on the railway.
Communication systems	Equipment used by crew and network controllers to communicate. Communication systems may include train control radio, satellite phones and telephone.
Control interface equipment	Equipment installed to communicate signalling requests from control rooms to the field, or to communicate the status of the network, and train control equipment, back to the network controller. Control interface equipment include cabling, troughs, satellite communications systems, UHF/microwave links and supporting hardware. **Note** *Where the system uses an integrated command/control system consider coding faults/ failures in interlocking systems.*
Interlocking systems	Mechanical, electrical or electronic systems used to control or operate switches and signalling systems (including in-cab systems), other than those directly connected to switches or signals, or operated by network controllers. Interlocking system components include relays, signal logic, solid state interlocking (SSI) and computer based interlocking (CBI). **Note** *Equipment used by train controllers should be coded under traffic control. Local control equipment should be coded under wayside signalling equipment.*
Traffic Control	This includes the equipment and systems used (locally) by network controllers and signallers to input commands (for example, keyboards, levers, mimic boards) in order to plan and manage train movements. **Note** *Signal displays and devices to control train movement in the field should be coded as wayside signalling equipment.*
Train detection systems	Equipment that detects the presence of a train, or monitors its passage. Train detection system components may include track circuits, axle counters, track circuit actuator, and automatic warning system (AWS)/automatic train protection (ATP) magnets/ transponders that detect and report on the location of a train. **Note** *The in-cab elements of AWS/ATP should be coded under train protection systems.*
Wayside signalling equipment	Equipment which directly controls or is used to directly control a switch, derailer, catchpoint or a signal. They may or may not be remotely operated. Wayside signalling equipment may include switch motors, switch stands, levers, ground stands, tie bars, points locking and train stops. Also included is equipment that provides an indication or information to train crew regarding state of the track. Components may include signals, route indicators, repeaters and warning boards. **Note** *Displays installed in-cab should be considered under train protection systems. Derailers, catchpoints, chock-blocks and scotch blocks are coded under track protection devices.*
Other signalling and communications component	Any component not included above that relates to the equipment used to control and regulate the safe movement of trains on the railway. To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above failed component *(signalling and communications)* list.

Failed component *(Other)*	Definitions
Other vehicles	Any component of a vehicle that is not rollingstock. For example, cars, trucks, excavators and other vehicles.

Failure mechanism

Failure mechanism defined This describes the nature of the failure. The items for failure mechanisms and their definitions are below.

Failure mechanism	Definitions
Corrosion	Loss of material through a chemical reaction between a component and its environment. This may be a localised reaction or a general surface reaction at low or high temperatures. Includes general rusting, pitting, exfoliation, oxidation and sulphidation.
Deformation	Physical distortion. May be plastic deformation (permanent) or elastic deformation (recoverable after force removed). Includes buckling, twisting, bending, crippling and deflection.
Electrical discontinuity	Disruption of an electrical connection at wiring level, circuit level or integrated circuit level. Includes plugs coming loose, wires fracturing/burning through, fuses/circuit breakers opening and failure of electrical or electronic components.
Fracture	Physical separation of component parts. Includes excessive stress fracture, fatigue fracture and stress corrosion fracture (involves the growth of cracks to a critical size).
Mechanical discontinuity	Disruption of a physical connection in a mechanical, hydraulic or pneumatic system. Includes fasteners loosening, joints separating, adhesive joints disbonding, hydraulic, fuel or pneumatic lines separating/leaking or components seizing.
Software/firmware anomaly	Computer or microprocessor program malfunction. Includes software bugs and unintended system actions.
Wear	Deterioration through use or stress of a component. Includes abrasive wear, adhesive wear (galling), erosion, fretting, rubbing, scraping and chafing of wires or tubes. **Note** *Wearing should not be confused with ageing. If the failure mechanism is ageing, it should be coded in 'other'. Ageing is considered a normal or natural deterioration of a component not due to any physical or external factors.*
Other failure mechanism	Any type of failure mechanism not included above that describes *how* (not *why*) a component failed. To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above failure mechanism list.
Unknown failure mechanism	Where the failure mechanism was not or could not be determined.

Failure origin

Failure origin defined

The underlying origin of the technical failure in terms of the lifecycle of the equipment, plant or material that failed. The items for failure origin and their definitions are below.

Note
Many technical failures will have their origins in the organisational system. As such, any associated Local conditions and organsiational factors should also be coded.

Failure origin	Definitions
Design	A component is not adequately designed to meet its intended function, increasing the likelihood of a failure.
Manufacture	Equipment or a component is not properly manufactured or finished, increasing proneness to failure. Includes problems with the manufacturing of the material, the assembly of components and the manufacture of new components that are added to equipment or plant that is already in service (although the fitment of these new components should be considered as part of maintenance).
Installation/ commissioning	Component, equipment or system is not effectively installed for operational use. Includes construction of track works and buildings where design specifications are not met.
Operation	Equipment is not operated appropriately, increasing proneness to failure. Includes use of equipment in the wrong physical environment, in environments not envisaged during the design process and/or for purposes other than for that which it was designed.
Maintenance	A component or equipment is not maintained, inspected or repaired after manufacture as required, increasing proneness to failure. Includes replacement with inappropriate parts.
Decommissioning	Component, equipment or system is not effectively removed from service or disabled.
Unknown failure origin	Where the failure origin was not or could not be determined.

4.3 Definitions - local conditions and organisational factors

Local conditions and organisational factors defined

Local conditions and organsiational factors are those features within an organisation or in a local workplace (including personal factors) that were preconditions for an individual/team action or a technical failure to occur. Those matters range from factors that may be personal to an individual, to factors within the organisation's internal or even external environment.

The keywords for Local conditions and organsiational factors and their definitions are provided from page 52.

Note
Local conditions and organsiational factors may sometimes be identified in organisations other than the one that had the occurrence. These contributing factors should be coded.

Personal factors

Personal factors defined

Personal factors that affect the ability of a rail safety worker to perform their work, often arising from or as a consequence of physical or psychological factors such as illness, fatigue or stress. Both transient and permanent factors are included. The keywords for personal factors and their definitions are below.

Note
This category does not include Workload. Where Workload is identified, this should be coded under task demands.

Keywords *(Personal factors)*	Definitions
Alcohol/drugs	Alcohol or drugs (including prescribed, over the counter and prohibited substances) have been consumed and have affected the worker's ability to safely undertake their duties.
Expectation	An expectation is formed through past experience or familiarity) or may be induced by environmental factors. Includes situations where signals very rarely display a stop aspect and therefore drivers may expect them to be at proceed or where a road user never experiences a train at a level crossing and therefore doesn't expect a train.
Fatigue/alertness	A mental or physical state brought about by insufficient sleep, high or extended personal or occupational work demand, and/or the influence of a person's circadian rhythm, which has affected a worker's ability to safely perform their duties.
Health-related condition	A permanent or temporary illness and/or injury that impairs a worker's ability to assess, interpret and/or respond to their work environment. Includes headache, flu, back pain, depression and heart attack. **Note** *This category does not include illnesses and/or injuries that are the result of the safety occurrence being investigated.*
Motivation/attitude	A lack of willingness to undertake allocated tasks, inattentiveness to work and/or a failure to engage with fellow workers to complete work.
Physical limitations	A physical characteristic that affects a worker's ability to undertake a task, including their ability to access work areas. This includes issues associated with height, visual and auditory impairments.
Pre-occupation	A state of mind where attention is focussed internally on something other than the task at hand. Includes pre-occupation with personal issues, daydreaming or some other aspect of work not related to the task at hand (for example, impending disciplinary actions). **Note** *Where a worker's attention is being captured by activities other than the primary tasks, distraction should be used (see task demands).*
Stress/anxiety	A state where a person experiences discomfort because of a perceived mismatch between their abilities and the demands of a task, job or the work environment. Includes work and non-work related stress. **Note** *This category refers to stress or anxiety that pre-exists the task. Problems arising during the task should be coded under Task demands.*
Other personal factors	Any personal factors not described above. To use this category you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above personal factors list.

Knowledge, skills and experience

Knowledge, skills and experience defined

The worker does not have the required knowledge, skills or experience to effectively conduct their tasks. This category includes routine and emergency tasks. The keywords for knowledge, skills and experience and their definitions are below.

Note
The reason for the knowledge, skill or experience problem (if known) should be coded as a separate factor – reasons may include problems with training and assessment, procedures or people management processes.

Keywords *(knowledge, skills and experience)*	Definitions
Abnormal/emergency operations knowledge and skills	The worker does not have the required knowledge and skills to assess and respond to emergencies or to conditions that would not be routinely experienced. **Note** *If the person's experience is a factor, this should also be coded under task experience.*
Normal operations knowledge and skills	The worker does not have the required knowledge and skills to undertake their usual work duties. **Note** *If the person's experience is a factor, this should also be coded under task experience.*
Task experience	A lack of familiarity with a given task brought about through a lack of past opportunities to perform/or exposure to that task.
Communication skills	Inability to effectively share information or instructions with others, either verbally or in writing, in a clear, concise and logical manner, or to understand and respond to information. This includes language and literacy issues. **Note** *Barriers such as hearing impairment should be considered in personal factors.*
Teamwork skills	Inability to work effectively with others in small groups. Includes the ability to work under direction, take a leadership role and/or provide supervisory direction or mentorship for less experienced workers, where necessary.
Other Knowledge, skills and experience factors	Any knowledge, skills and experience factors not described above. To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above knowledge, skills and experience list.

Task demands

Task demands defined

The nature of the task and/or the conditions under which it has to be performed adversely affects the performance of an individual or group. The keywords for task demands and their definitions are below.

Note
Where deficiencies in training or skills are identified, consider using training and assessment and/or knowledge, skills and experience.

Keywords *(task demands)*	Definitions
Distractions	Non-essential additional tasks, requirements or external influences (for example, activities on a platform) that affect the performance of the primary task. **Note** *If it is determined that the nature of the distraction is more internally focussed (for example, thoughts about an impending event) consider using personal factors – pre-occupation.*
High workload	A task (or tasks) is undertaken that is of high complexity and/or composed of a number of simultaneous tasks. It may also occur where a task is equal to or exceeding the skills or abilities of the employee leading to impaired performance.
Low workload	The allocated work can be completed well within given time constraints, but places insufficient demand on the worker leading to poor concentration, low alertness, poor morale or boredom which may influence performance.
Time pressure	Situations in which the limited amount of time available to perform a task has led to poor decision-making, speeding, shortcuts and violations.
Other task demands	Any task demand factors that are not described above. To use this category you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above task demands list.

Physical environment

Physical environment defined

Factors in the workspace and physical environment that may affect or alter a worker's ability to perceive, accurately interpret and/or effectively respond to events or information. The keywords for physical environment and their definitions are below.

Note
Physical environment considers issues within the workspace that have an influence over a worker's ability to complete their job safely. Where issues related to equipment or plant usability are identified (for example, visibility restrictions imposed by cab design or accessibility/usability of controls on a machine), these should be coded under equipment, plant and infrastructure.

Keywords *(physical environment)*	Definitions
Air quality	The quality of the ambient air has an influence on individual performance or technical components. Includes smoke, fumes, carbon monoxide levels, oxygen levels, dust and noxious odours.
Housekeeping	The work environment is not maintained in a clean and tidy state, and/or tools and supplies are not maintained in an orderly fashion.
Lack of environmental cues	The surrounding environment does not provide enough information for workers to be able to identify, assess, plan and execute their activities appropriately. Includes situations where crew 'lose their place' on the network. **Note** *Where it is identified that displays or controls on equipment are deficient, these should be coded in equipment, plant and infrastructure - human-machine interface.*
Lighting/visibility	The ability to detect or process visual information is impaired by environmental factors. Includes illumination level, glare, obstructions to visibility due to weather, dust, fogged windscreen or vegetation growth. **Note** *Any signal sighting issues not related to the factors listed above, as well as physical obstructions to visibility due to equipment design should be classified under equipment, plant and infrastructure.*
Noise	The ability to detect or process auditory information is impaired by environmental factors. Includes high noise levels and noise interference. **Note** *If the noise is distracting (for example, a nearby conversation) rather than impairing an individual's perception, then it should be coded as task demands - distractions.*
Temperature/humidity	The temperature, humidity and other aspects of ambient environment (for example, draughts) adversely affect individual performance or technical components.
Vibration	Individual performance or technical components are affected by vibration. The vibration may vary in terms of frequency and amplitude. For example, coarse (shaking) or fine (vibration from rail corrugations).

Keywords *(physical environment)*	Definitions
Weather-related factors	A persons performance or technical components are affected by weather factors. Includes extremes (and any resulting natural disasters), as well as normal weather. **Note** *Where extremes of heat, cold and humidity are identified, these should be coded as temperature/humidity. Where weather leads to reduced visibility, this should be coded as lighting/visibility.*
Other environmental factors	Any physical environment factors not described above. To use this category you must specify a keyword that describes the factor. The keyword cannot be one from the above physical environment list.

Social environment

Social environment defined The relationships between co-workers, their supervisors and management. How those relationships influence behaviour in the workplace and the sharing or delineation of responsibility within a team or workgroup. The keywords for social environment and their definitions are below.

Keywords *(social environment)*	Definitions
Diffusion of responsibility	Where it is not clear which worker was responsible for a particular task or function. **Note** *This category does not include allocation of responsibility. This falls under people management - roles and responsibilities.*
Norms and values	Where the culture of an organisation or group within the organisation has contributed to acts or behaviours other than those intended by systems of work (for example, acceptance of deviations from procedures).
Peer pressure	Where a group/s within the organisation overtly or covertly place pressure on an individual to act in a way that may potentially lead to poor safety outcomes.
Team climate	Where relationships or behaviours within a group of workers has adversely affected the ability of the group members to undertake their work as intended. Includes situations where there is conflict or disharmony between two or more people within a group. **Note** *This category takes into account the broader relationships between a group/s of workers. This may include a work team/crew or an element or department of an organisation.*
Other social environment factors	Any social environment factors not described above. To use this category, you must specify a keyword that describes the factor. The keyword cannot be one from the above social environment list.

Procedures

Procedures defined

The design, consistency or availability of procedures used by workers. Includes effectiveness of standard procedures, abnormal or emergency procedures, rules, technical and work instructions, checklists and special notices.

The keywords for procedures and their definitions are below.

Note

- *Where a worker does not understand a procedure because of training issues, consider coding under training and assessment.*
- *Where a worker does not understand the procedure because of literacy or language issues, consider coding under Knowledge, skills and experience.*
- *Issues associated with the process of developing procedures should be coded under organisational management.*

Keywords *(Procedures)*	Definitions
Absent procedure	Where a procedure which should reasonably exist (by industry practice or standards) does not.
Accuracy/adequacy	Procedures or part thereof are either incorrect (i.e. the content is incorrect, or is based on wrong/discounted theories, etc.) or do not contain all required components.
Availability/accessibility	The availability of, or access to, work instructions or procedures is restricted or otherwise limited.
Clarity	Procedures are not written in a way that makes them clearly understandable to the people who use them; they are difficult to interpret or capable of multiple interpretations. Includes instances where procedures are not written in plain English and are therefore difficult to understand.
Work-ability/relevance	The structure of the procedure does not clearly and directly relate to the task being undertaken.
Other procedures factors	Any procedures factors not described above. To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above procedures list.

Training and assessment

Training and assessment defined

The content, format, delivery or availability of training provided to workers. Includes problems associated with the way a worker's performance or ability to do work-related tasks is checked or evaluated. It also refers to all training, including initial or induction training, on-going training and refresher training, training for normal operations, emergency/abnormal operations and team resource management skills.

The keywords for training and assessment and their definitions are below.

Note
When a training deficiency is identified in a management position, this should be coded as organisational management.

Keywords *(training and assessment)*	Definitions
Competency assessment	The methods used to assess the competence of workers are inadequate or do not exist. This item includes situations where competency assessments of particular skills are not being undertaken because the skill has not been identified or where competency assessments have been identified as completed, but were not conducted in accordance with agreed criteria.
Currency tracking	The systems in place to monitor the timing of employee reviews and skill re-appraisals are inadequate.
Initial training	The initial training and assessment of workers did not adequately address the knowledge and skills required for the task.
Ongoing training	The ongoing training of workers has not adequately addressed the skills required for the task, has fallen behind schedule and/or has excluded necessary training elements.
Training review	Training programs have not been reviewed as planned or as required and/or changes recommended during the review process have not been implemented.
Other training factors	Any training factors not described above. To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above training assessment list.

Equipment, plant and infrastructure

Equipment, plant and infrastructure defined

Where equipment, plant or infrastructure is not fit for purpose, or where usage is other than intended. This includes all components and situations where design may be a factor, such as visibility affected by window design or the placement of controls or displays.

The keywords for equipment, plant and infrastructure and their definitions are below.

Note
Where is it identified that an item of plant or equipment has broken down or failed, consider coding under technical failures.

Keywords *(equipment, plant and infrastructure)*	Definitions
Availability	The appropriate tool or plant needed to safely perform the task is not available or availability/access is restricted.
Absent equipment, plant and infrastructure	Equipment, plant or infrastructure is not present where it is reasonable (by industry practice or standards) to expect it to be present. May include situations where the item has been stolen or removed for some reason.
Alarm design	The design of alarms or warnings leads to them being ineffective or to encouraging unsafe or suboptimal practices. For example, a high number of irrelevant or low priority alarms may result in network controllers developing a mindset that alarms are not important because "they never are". Includes alarms and warnings in train cabs, control centres and signalboxes as well as warnings provided to road users in association with level crossings.
Control/input devices design	The design of control/input devices hinders or limits effective and efficient operation by its users or design features encourage unsafe or suboptimal practices. Includes input devices and radio devices in train cabs, controls in network control centres, equipment in signal boxes and shunting remote controls.
Display design	The design of displays hinders or limits a person's ability to safely perform a task. The display may not provide the information necessary for the task or information may be displayed in a way that does not support the task. Includes displays in the train cab and displays in network control centres and signal boxes such as mimic panels. Excludes static displays (signs).
Infrastructure design	The design of infrastructure hinders or limits a person's ability to safely perform a task. Includes issues with the design of signals or the design of level crossing infrastructure.
Signage	The design of signage hinders or limits a person's ability to perceive or understand the message being communicated. Signage includes any static display used to communicate information to rail safety workers and/or the general public and passegnars. Includes emergency signs on trains, wayside signs such as caution boards, temporary speed boards and road signage for level crossings.

Keywords *(equipment, plant and infrastructure)*	Definitions
Functionality	Refers to limitations in the functionality of equipment, plant or infrastructure in its ability to serve its purpose well.
Reliability	Plant or equipment is considered unsuitable for the task because it is unreliable.
Other equipment, plant and infrastructure factors	Any equipment, plant and infrastructure factors not described above. To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above equipment, plant and infrastructure list.

People management

People management defined The processes by which the organisation designs jobs and selects, manages and supports its workers to ensure they can perform as required. The keywords for people management and their definitions are below.

Keywords *(people management)*	Definitions
Fitness for duty monitoring	The processes used to ensure workers are fit to undertake the tasks they are allocated are inadequate. Includes periodic health assessments, as well as local mechanisms to ensure workers are fit for duty on a day-to-day basis.
Job/task design	A task exceeds the capabilities and/or capacity of workers or the job has not been designed to adequately take into account the potential for error and the recovery from it.
Reward/discipline structures	Performance management processes are not followed or are deficient. Also includes any negative affects on the safe performance of work and/or workplace culture that may arise from reward and/or disciplinary systems. For example, an investigation may find that workers have not been reporting injuries to management for fear of losing safe work bonuses.
Roles and responsibilities	The organisation has not explicitly identified which person is responsible for a particular task or function. This includes allocation of responsibility.
Rostering/scheduling	Rostering does not provide adequate resources for a particular activity (for example, adequate rest) or where rostering outcomes (for example, staff mix) have compromised the safe performance of tasks.
Selection/recruitment	The processes used to review and assess applicants and their ability to perform a given task are inadequate.
Staff support	The systems or processes in place to assist workers in managing work and non-work related demands are inadequate.
Supervision	Supervisory support is inappropriate for the circumstance. Includes where the supervision is deficient or the supervising person lacks experience.
Other people management factors	Any people management factors not described above. To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above people management list.

Organisational management

Organisational management defined

The affect of policies and decisions of the board and senior management on the ability of the organisation to safely manage its operations.

The keywords for organisational management and their definitions are below.

Note
Issues related to selection and training of operational personnel should be coded under people management.

Keywords *(Organisational management)*	Definitions
Business planning and asset/ resource management	The organisation has not identified the need for and allocated resources for current (and future) operations. For example, an investigation identifies that the organisation has been staffing its operations using overtime.
Communication and consultation process	The methods employed by the organisation to consult with workers regarding safety management and the communication of information within and external to the organisation are found to be ineffective. The item includes safety-related information and information that relates to the operation of the business, but is not necessarily safety critical. **Note** *This keyword relates to issues with actual communication with workers. For issues associated with the availability or currency of information to enable workers to do their job safely, consideration should be give to the information management code.*
Competence of senior personnel	The skills and abilities of those in positions of responsibility to objectively and effectively manage the organisation are inadequate.
Compliance	Acting in accordance with standards, systems and processes set internally by the organisation (for example, processes set out in the safety management system) or externally by regulators (for example, acting on an improvement notice.)
Contractor/interface management	The methods used by the organisation to manage the performance of its contractors and/or the arrangements under which such matters are managed are deficient. In particular, inadequate processes are used to ensure there is appropriate communication of safety related matters between the parties.
Information management	The processes and systems employed by the organisation to ensure that correct information is available to workers are inadequate. This includes issues associated with knowledge management, corporate memory and document control and adminstration. **Note** *For issues associated with the methods used to communicate to and consult with workers, consideration should be give to the code communication and consultation process.*
Interface management	Where the roles, responsibilities and/or operations of two or more organisations overlap or are joined, the organisations involved must manage the interface. This would usually involve interface agreements that cover all aspects of the processes and systems used to manage the interface/s.

Keywords *(Organisational management)*	Definitions
Monitoring, review and validation	The organisational processes to monitor safety performance and to review and improve the safety management system are ineffective. Includes activities such as internal and independent auditing.
Organisation design	The structure of the organisation negatively affects processes for communication of information critical to the safe conduct of operations. Includes instances where there is poor management of interfaces between different areas or departments of the organisation.
Policy	A plan or course of action set by management is detrimental to the development of a positive safety culture and to the procedures, work standards and behaviours required for safe operations.
Risk and/or change management	The processes used by the organisation to assess and manage operational safety risks. This is particularly relevant to the management of change. This category includes factors associated with hazard identification and documentation, risk assessment and implementation of risk controls. Areas of concern include rail safety risks and the activities undertaken to control risk.
Other Organisational management factors	Any organisational management factors not described above. To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above oganisational management list.

External organisational influences

External organisational influences defined

The external factors that may affect the management of the organisation and its activities.

The keywords for external organisational influences and their definitions are below.

Keywords *(External organisational influences)*	Definitions
Community expectations or behaviour	The affect, whether direct or indirect, that community standards and behaviour may have on the rail organisation.
Government influences	The affect of government policy on the approach taken by an organisation to manage a given hazard or operational issue.
Industry standards or guidance	Issues arising from compliance with industry standards and codes of practice, or where they are inadequate or non-existent.
Regulatory activities	Where regulatory activity has had unintended or inadequate effect, or where there is an absence of such activity. Note This does not include the provision and content of standards and guidance, which is covered under regulatory standards and guidance.
Regulatory standards and guidance	Where regulatory/legislative requirements have had an unintended or inadequate effect, or where there is an absence of such standards or guidance.
Other External organisational influences	Any external organisational influences factors not described above. To use this category, you must specify a keyword or sentence that describes the factor. The keyword cannot be one from the above external influences list.

4.4 Definitions - Functional area

Functional area

Functional area defined

Information regarding the part(s) of the organisation affected by the local condition or organisational factor being classified.

For example, if the organisational factor is business planning and asset/resource management, which leads to maintenance scheduling being cut back, leading to a broken wheel, the area affected is rollingstock maintenance.

Where more than one functional area was affected, code all relevant areas.

The items for functional areas and their definitions are below.

Keywords *(functional area)*	Definitions
Freight handling	Areas that manage the loading and unloading of trains, ensuring the integrity of loading practices so that train loading is undertaken in accordance with agreed procedures. Functions include ensuring appropriate freight mixes on a train, loading, unloading, securing, train and dangerous goods manifests.
Infrastructure construction and maintenance	Areas that provide services relating to the design, construction and maintenance of rail infrastructure. Includes areas responsible for protection for worksites (excluding signaller/ train control activities for granting permissions for worksites).
Off-train operations	Sections of the organisation that support train operations, such as train preparation, signalling, train control, allocation and mix of rollingstock and motive power and rostering of crew. Functions include marshalling, shunting, train assembly and pre-trip inspection.
On-train operations	Train operation and/or train running. Functions include train driving, train management and any actions associated with on-train operational activities.
Passenger management	Areas of a railway that have responsibility for ensuring the safety of the public and passengers through supervision and management. Functions include the embarkation and disembarkation of passengers, security and crowd control.
Rollingstock construction and maintenance	Areas that manage the design, construction and maintenance of rollingstock (including road-rail vehicles).
Road environment	Non-rail organisations or authorities responsible for aspects of level crossings or public roads that have negatively impacted on the safety of the rail network. Also refers to the impact of road users where there is no other relevant functional area in the above list.
Emergency management	Areas of the railway dedicated to providing incident management or emergency response. Also emergency services organisations whose primary role is to respond to emergencies. Includes police, fire and rescue personnel and paramedics.

Section 5

Case Studies

The following section contains four examples of coding using the CFF. The case studies are based on actual rail safety occurrences but have been summarised and adapted from the investigation reports.

The case studies have been included to provide examples of coding. Readers may or may not agree with the findings of a given report, however, the important issue here is how those findings are translated into CFF coding.

5 Case studies

5.1 Case study 1 - Broken wheel

Notes

This case study is a good example of a level three investigation where good quality information was obtained and it can therefore be coded using the CFF.

Description

A locomotive that had been identified as requiring wheel maintenance had been taken to the maintenance depot for attention.

Whilst awaiting this work at the depot, the local manager sent the locomotive back out on traffic for a long haul service.

Following its return to the maintenance depot, and during movement into the depot for attention, the locomotive derailed.

Examination revealed that the flange on one wheel had broken off causing the derailment.

Findings and contributing factors

The investigation into the derailment identified a number of contributing factors.

- The wheel flange fracture had occurred due to the flange and tread wearing well beyond the acceptable condemning limit.
- The local operations manager had utilised the locomotive for service after its arrival at the maintenance depot.
- It was not clear what communication or information the local manager had sought or had been given concerning the state of the wheels or the reason why the decision was made to send the locomotive out again.
- Field staff and some maintenance staff were not clear on the wheel condemning limits.
- Wheel condemning limits were not clearly defined in procedures.
- Three types of inspection gauges were in use with no procedures to define their application.
- A survey of other locomotive wheels identified that other wheel sets were worn beyond the condemning limit. These were immediately brought in to maintenance depots for attention.
- A structured training program on use of the wheel measurement gauges was not in place.
- The roles and responsibilities of the maintenance manager and local manager in relation to the management of the wheel maintenance program were not clearly defined or documented.

See the attached coding sheets for the contributing factors associated with the broken wheel case study.

Case study 1 - Broken wheel continued

Record number: [this is the number of the occurrence in your database]	**Report prepared by: [Name]** **Date prepared: [Date]**

OCCURRENCE DESCRIPTION	**Date:**	[Date]
A locomotive derailed in the yard of a maintenance facility due to the flange on one wheel breaking away from the wheel rim.	**Location:**	[Location]
	Organisation:	[Organisation]

Occurrence type: (include all ON-S1 and OC-G1 Categories for events that occurred)		
Occurrence type:	**Occurrence category:**	**Occurrence sub category:**
Derailment	Yard derailment	
Rollingstock irregularity	Wheel/axle failure	

INDIVIDUAL/TEAM ACTIONS					
Findings/short description	**D**	**Person type**	**Activity type**	**Error/violation type**	**Organisation**

TECHNICAL FAILURES					
Findings/short description	**D**	**Failed component**	**Failure mechanism**	**Failure origin**	**Organisation**
Wheel flange fracture had occurred due to the flange and tread wearing well beyond the acceptable condemning limit.		Bogies	Wear	Maintenance	

LOCAL CONDITIONS and ORGANISATIONAL FACTORS					
Findings/short description	**D**	**Local condition/ organisational factor**	**Keyword**	**Functional area (affected by the failure)**	**Organisation**
Field staff and some maintenance staff were not clear on what the wheel condemning limits were.		Knowledge, skills and experience	Normal operations skills	Rollingstock construction and maintenance	
Wheel condemning limits were not clearly defined in procedures.		Procedures	Accuracy/clarity	Rollingstock construction and maintenance	
Roles and responsibilities of maintenance manager and local manager in relation to the management of the wheel maintenance program were not clearly defined or documented.		People management	Roles and responsibilities[2]	Off-train operations	

2 Coded as roles and responsibilities rather than diffusion of responsibility, as the issue occurred between two areas of the organisation rather than a particular task or function.

NON-CONTRIBUTING SAFETY ISSUES *(identified safety issues that did not contribute to this occurrence)*					
Findings/short description	**D**	***Replace text below with relevant item. Replace only if a factor is identified.***			
		[Person type]	[Activity type]	[Error/violation type]	[Organisation]
		[Failed component]	[Failure mechanism]	[Failure origin]	[Organisation]
		[Local condition/ organisational factor]	[Keywords]	[Functional area]	[Organisation]
Three types of inspection gauges were in use with no procedures to define their application.		[Local condition/ organisational factor] Procedures	[Keyword] Absent procedure	[Functional area] Rollingstock construction and maintenance	
A structured training program on use of the wheel measurement gauges was not in place.		[Local condition/ organisational factor] Training and assessment	[Keyword] Competency assessment	[Functional area] Rollingstock construction and maintenance	

FEEDBACK ON USING THE CFF: (Document any problems you had using the Contributing Factors Framework here)

5.2 Case study 2 - Freight train derailment

Background

A south bound freight train on the Interstate Main Line derailed following a bearing failure on an open goods wagon. The derailed wagons fouled the railway corridor, including the adjacent broad gauge line.

Following behind the freight train, on the adjacent broad gauge track (managed by a second railway owner), was a passenger train. This was scheduled at an interval of about three minutes behind the derailed train.

Despite efforts of the crew to alert train control to the derailment, difficulty in effectively operating the communications systems fitted to the locomotive meant that the second train was not warned of the first derailment and subsequently collided with the derailed wagons of the first train.

Findings and Contributing factors

The investigation identified a number of contributing factors.

- The failed bearing on the open goods wagon had been in service for 10 years prior to the incident.
- The wagon had been stowed for approximately seven years.
- Maintenance records for the wagon (including bearing servicing) were not available.
- The axle bearing failed due to a loss of interference fit on the axle journal, causing heat to build up and then seizing leading to derailment. This occurred due to manufacturing error.
- Train crew advised train control of the derailment.
- Train crew attempted to contact the passenger train via radio.
- The train crew was unable to effectively operate the communications system and this led to delays in relaying information to the other network's train control centre.
- The train crew's knowledge of operating the communications systems during emergencies was not comprehensive.
- The demands of the emergency situation contributed to difficulties in effectively operating the radio systems.
- Design of the radio system fitted in the locomotive of the derailed train when in emergency mode defaulted to allow only identified emergency communications.
- Communication between networks was delayed due to other communication traffic. The network controller for the track on which the derailment occurred is generally unaware of traffic on the adjacent line.
- Maintenance standards used by the freight train operator for this type of wagon were based on distance travelled and did not take into account storage time.

See the attached coding sheets for the contributing factors associated with the freight train derailment case study.

Case study 2 - Freight train derailment continued

Record number: [this is the record number of the occurrence in your database]	Report prepared by: [Name] Date prepared: [Date]

OCCURRENCE DESCRIPTION (ON-S1 and OC-G1 Categories)		
Derailment of a freight train and the subsequent collision with a passenger train]	**Date:**	[Date]
	Location:	[Location]
	Organisation:	[Organisations (add row for each organisation)]

Occurrence type: (include all ON-S1 and OC-G1 Categories for events that occurred)		
Occurrence type:	**Occurrence category:**	**Occurrence sub-category:**
Collision	Running line	Between trains
Derailment	Running line derailment	

INDIVIDUAL/TEAM ACTIONS					
Findings/short description	**D**	**Person type**	**Activity type**	**Error/violation type**	**Organisation**
The train crew was unable to effectively operate the communications system and this led to delays in relaying information to the other network's train control centre.		Train crew	Operating equipment	Error	

TECHNICAL FAILURES					
Findings/short description	**D**	**Failed component**	**Failure mechanism**	**Failure origin**	**Organisation**
The axle bearing failed due to a loss of interference fit on the axle journal, causing heat to build up and then seizing leading to derailment.		Bogies	Mechanical discontinuity	Manufacture	

LOCAL CONDITIONS and ORGANISATIONAL FACTORS					
Findings/short description	**D**	**Local condition/ Organisational factor**	**Keyword**	**Functional area (affected by the failure)**	**Organisation**
The train crew's knowledge of operating the communications systems during emergencies was not comprehensive.		Knowledge, skills and experience	Abnormal/ emergency operations knowledge and skills	On-train operations	

LOCAL CONDITIONS and ORGANISATIONAL FACTORS					
Findings/short description	**D**	**Local condition/ Organisational factor**	**Keyword**	**Functional area (affected by the failure)**	**Organisation**
The demands of the emergency situation contributed to difficulties in effectively operating the radio systems.		Task demands	Time pressure	On-train operations	
Design of the radio system fitted in the locomotive of the derailed train when in emergency mode defaulted to allow only identified emergency communications.		Equipment, plant and infrastructure	Functionality	On-train operations	
Communication between networks was delayed due to other communication traffic. The network controller for the track on which the derailment occurred is generally unaware of traffic on the adjacent line.		Equipment, plant and infrastructure	Functionality	Off-train operations	
Maintenance standards used by the freight train operator, for this type of wagon, were based on distance travelled and did not take into account storage time.		Procedures	Accuracy/clarity	Rollingstock construction and maintenance	

NON-CONTRIBUTING SAFETY ISSUES *(identified safety issues that did not contribute to this occurrence)*					
Findings/short description	**D**	**Replace text below with relevant item. Replace only if a factor is identified.**			
		[Person type]	**[Activity type]**	**[Error/violation type]**	**[Organisation]**
		[Failed component]	**[Failure mechanism]**	**[Failure origin]**	**[Organisation]**
		[Local condition/ organisational factor]	**[Keywords]**	**[Functional area]**	**[Organisation]**
No maintenance records or bearing history were identified prior to June 2000 due to changes in ownership.		**[Local condition/ organisational factor]** Organisational management	**[Keyword]** Information management	**[Functional area]** Rollingstock construction and maintenance	

FEEDBACK ON USING THE CFF: (Document any problems you had using the Contributing Factors Framework here)

5.3 Case study 3 - Collision between a train and a road-rail vehicle

Background

A train and a road-rail utility vehicle collided at a crossing loop.

A train was expected to depart from its depot at 0945. At around 0913, the train controller authorised a road-rail vehicle to proceed on an inspection.

The train left earlier than was planned and headed towards the first crossing loop on the line. The train had authority, in accordance with the safeworking rules, to proceed into the station yard to complete the change to the 'safeworking staff'.

At the same time, the road-rail vehicle was heading towards the station from the opposite direction, to off-track following its inspection run. The area to off-track the road-rail vehicle was just past the hut where the 'safeworking staff' equipment was located.

The road-rail crew identified the train and, believing they had enough time, decided to proceed to the off-track area. Shortly thereafter the train collided with the road-rail vehicle.

The road-rail vehicle sustained front end damage, the train was undamaged and no worker was injured.

Findings and Contributing Factors

The investigation identified a number of contributing factors.

- The train controller did not appropriately endorse the path of the train on the train graph.
- The train controller was trying to manage a high workload at the time, including supervising a trainee.
- The train controller was experiencing some personal issues.
- Communications between the signaller and the train controller were ambiguous with respect to the (anticipated) departure time of the train.
- The train controller did not instruct the signaller to place blocking facilities on the starting signal in order to prevent the train from departing.
- The road-rail crew entered the yard without authority. They took tacit authority from the staff to proceed into the yard to the off-track point.
- The road-rail crew believed that the staff gave them authority to enter into the yard.
- The road-rail crew decided to continue towards the off-track point at the location of the collision when they sighted the approaching train.
- The road-rail vehicle involved in the accident was not designed to activate track-circuits. Therefore the signal authorising the train to enter the 'staff' station yard limits was cleared to 'proceed'. This occurred while the track vehicle was on the main line within the staff station yard limits.The existence of two sets of rules and procedures on the entire corridor and the potential affect on operational and safety aspects has not been considered in the risk assessments or the associated safety case for the transfer of operational and maintenance responsibility from one railway organisation to the other.
- It had been practice to issue verbal track occupancy authorities for access within unattended station yard limits on the corridor. This practice goes against relevant network rules. Risk assessments conducted by the operating railway did not identify the incorrect practices used to issue track occupancy authorities on the corridor.

See attached coding sheets for the contributing factors associated with the train and road-rail collision case study.

Case study 3 - Collision between a train and a road-rail continued

Record number: [this is the record number of the occurrence in your database]	Report prepared by: [Name] Date prepared: [Date]

OCCURRENCE DESCRIPTION (ON-S1 and OC-G1 Categories)		
A train and a road-rail vehicle were given permission to be in the same section and subsequently collided.	**Date:**	[Date]
	Location:	[Location]
	Organisation:	[Organisations (add row for each organisation)]

Occurrence Type: (include all ON-S1 and OC-G1 Categories for events that occurred)		
Occurrence type:	**Occurrence category:**	**Occurrence sub-category:**
Collision	Yard collision	Between trains

INDIVIDUAL/TEAM ACTIONS					
Findings/short description	**D**	**Person type**	**Activity type**	**Error/violation type**	**Organisation**
Communications between the signaller and controller were ambiguous with respect to the (anticipated) departure time of the train.		Network controllers	Communicating	Error	
Train controller did not instruct the signaller to place blocking facilities on the starting signal in order to prevent the train from departing.		Network controllers	Preparation and planning	Error	
The road-rail crew decided to continue towards the off-track point at the location of the collision when they sighted the approaching train.		Train crew	Operating equipment	Error	
The road-rail crew entered the yard without authority. They took tacit authority from the staff to proceed into the yard to the off-track point.		Train crew	Monitoring and checking	Unknown error/ violation	

TECHNICAL FAILURES					
Findings/short description	**D**	**Failed component**	**Failure mechanism**	**Failure origin**	**Organisation**

LOCAL CONDITIONS and ORGANISATIONAL FACTORS					
Findings/short description	**D**	**Local condition/ Organisational factor**	**Keyword**	**Functional area (affected by the failure)**	**Organisation**
The existence of two sets of rules and procedures on the entire corridor and the potential affect on operational and safety aspects have not been considered in the risk assessments or the associated safety case for the transfer of operational and maintenance responsibility from one railway organisation to the other.		Organisational management	Risk/change management	On-train operations	
Road-rail crew believed that the staff gave them authority to enter into the yard.		Knowledge, skills and experience	Normal operations knowledge and skills	On-train operations	
Train controller was trying to manage a high workload dealing with operations at the time, including supervising a trainee.		Task demands	High workload	Off-train operations	
Train controller was experiencing some personal issues.		Personal factors	Preoccupation	Off-train operations	
The road-rail vehicle involved in the accident was not designed to activate track-circuits. Therefore the signal authorising access for the train to enter the staff station yard limits cleared to proceed while the track vehicle was on the main line within the staff station yard limits.		Equipment, plant and infrastructure	Functionality	On-train operations	
It had been practice to issue verbal track occupancy authorities for access within unattended station yard limits on the corridor. This practice goes against relevant network rules. Risk assessments conducted by the operating railway did not identify the incorrect practices used to issue track occupancy authorities on the corridor.		Organisational management	Risk / change management	Off-train operations	

NON-CONTRIBUTING SAFETY ISSUES *(identified safety issues that did not contribute to this occurrence)*					
Findings/short description	**D**	**Replace text below with relevant item. Replace only if a factor is identified.**			
		[Person type]	**[Activity type]**	**[Error/violation type]**	**[Organisation]**
		[Failed component]	**[Failure mechanism]**	**[Failure origin]**	**[Organisation]**
		[Local condition/ organisational factor]	**[Keywords]**	**[Functional area]**	**[Organisation]**
Train graph not endorsed with path for the train.		[Person type] Network controllers	[Activity type] Preparation and planning	[Error/violation type] Error	

FEEDBACK ON USING THE CFF: (Document any problems you had using the Contributing Factors Framework here)

5.4 Case study 4 - Runaway of road transferable locomotive (RTL)

Background

A road transferrable locomotive (RTL) was being used within a closed worksite to move wagons containing ballast from a loading point to areas within the site requiring additional ballast.

The truck had been set up with a particular type of air brakes, and these were connected through to the rollingstock. The set up was hauling a total of 337t at the time. To assist with air supply for the braking system, an extra compressor had been installed. This ran continuously and had been cross connected by staff who were not familiar with the particular air brake principles.

While pulling the fourth load, the truck lost all braking power, and ran away, reaching speeds of 35-40km per hour. Brakes working on the road wheels of the truck locked the wheels but the wheels could not establish grip on the wet rails.

The driver repeatedly operated the train brake valve in an attempt to apply the brakes but they did not respond. He also waited for the vigilance system to time out believing this would bring the truck to a stop.

The brakes on the wagons eventually came on, bringing the runaway to a halt. One worker sustained minor injuries.

Findings and contributing factors

The investigation identified a number of factors that contributed to the incident.

- The RTL driver operated the air brake system in accordance with his knowledge of truck air brakes which was incorrect.
- The operator and other employees at the site were not aware of the operational limitations of the vehicle or the risks associated with using it as a locomotive.
- A site specific safe work statement had not been prepared for the work the vehicle was to be used for.
- The brake pipe on the RTL was cracked and leaking.
- The RTL operator was not trained to conduct brake tests.
- The risk assessments undertaken by the network owner did not consider the RTL being used as a locomotive.
- The RTL operator was not trained in the operation of the RTL and its supporting systems as a locomotive.
- The owner of the RTL did not have the technical expertise to maintain the air-brake system fitted to the truck.
- Written instructions/procedures for the operation of the RTL were not available.
- Brake tests were not conducted, as required by the network owner.

See attached coding sheets for the contributing factors associated with the runaway of RTL case study.

Case study 4 - Runaway of road transferable locomotive (RTL) continued

Record number: [this is the record number of the occurrence in your database]	Report prepared by: [Name] Date prepared: [Date]

OCCURRENCE DESCRIPTION (ON-S1 and OC-G1 categories)		
A hi-rail hauled ballast truck lost brake power and ran-away.	**Date:**	[Date]
	Location:	[Location]
	Organisation:	[Organisations (*add row for each organisation*)]

Occurrence Type: (include all ON-S1 and OC-G1 categories for events that occurred)		
Occurrence type:	**Occurrence category:**	**Occurrence sub-category:**
Rollingstock irregularity	Braking system	-

INDIVIDUAL/TEAM ACTIONS					
Findings/short description	**D**	**Person type**	**Activity type**	**Error/violation type**	**Organisation**
The RTL driver operated the air brake system in accordance with his knowledge of truck air brakes which was incorrect.		Train crew	Operating equipment	Error	

TECHNICAL FAILURES					
Findings/short description	**D**	**Failed component**	**Failure mechanism**	**Failure origin**	**Organisation**
The brake pipe on the RTL was cracked and leaking.		Braking systems	Fracture	Unknown failure origin	

LOCAL CONDITIONS and ORGANISATIONAL FACTORS					
Findings/short description	**D**	**Local condition/ Organisational factor**	**Keyword**	**Functional area (affected by the failure)**	**Organisation**
The risk assessments undertaken by the network owner did not consider the RTL being used as a locomotive.		Organisational management	Risk/change management	On-train operations	
A site specific safe work instruction had not been prepared for the work the vehicle was to be used for.		Procedures	Absent procedure	On-train operations	
Work instructions/ procedures for the operation of the RTL were not available.		Procedures	Availability	On-train operations	

LOCAL CONDITIONS and ORGANISATIONAL FACTORS					
Findings/short description	**D**	**Local condition/ Organisational factor**	**Keyword**	**Functional area (affected by the failure)**	**Organisation**
The operator and other employees at the site were not aware of the operational limitations of the vehicle or the risks associated with using it as a locomotive.		Knowledge, skills and experience	Normal operations knowledge and skills	On-train operations	
Operator was not trained in the operation of the RTL and its supporting systems as a locomotive.		Training and assessment	Initial training	On-train operations	
The owner of the RTL did not have the technical expertise to maintain the air-brake system fitted to the truck.		Knowledge, skills and experience	Normal operations knowledge and skills	Off-train operations	

NON-CONTRIBUTING SAFETY ISSUES *(identified safety issues that did not contribute to this occurrence)*					
Findings/short description	**D**	**Replace text below with relevant item. Replace only if a factor is identified.**			
		[Person type]	**[Activity type]**	**[Error/violation type]**	**[Organisation]**
		[Failed component]	**[Failure mechanism]**	**[Failure origin]**	**[Organisation]**
		[Local condition/ Organisational factor]	**[Keywords]**	**[Functional area]**	**[Organisation]**
The operator of the RTL did not complete a brake test of the train as he had not been trained how to complete a train brake test.		**[Local condition/ organisational factor]** Training and assessment	**[Keyword]** Initial training	**[Functional area]** On-train operations	

FEEDBACK ON USING THE CFF: (Document any problems you had using the Contributing Factors Framework here)

References

Bird, F. E. and Germain G. L. (1996). *Practical Loss Control Leadership* (Revised Edition). Loganville, Georgia: Det Norsk Veritas.

Code Management Company (2006). *Australian Code Of Practice: Rail Safety Investigati*on (Ver 1.0). Canberra: Code Management Company.

Rail Safety Regulators Panel (2008). *Standard No. ON-S1 (version 2) and OC-G1 (Version 1). Occurrence Categories and Definitions*. Rail Safety Regulators Panel.

Reason, J. (1997). *Managing the Risk of Organisational Accidents*. Aldershot, UK: Ashgate.

Reason, J. (1993). *Human Error*. Aldershot, UK: Ashgate.

Standards Australia (2006). *Australian Standard™ Railway Safety Management Part 7: Railway Safety Investigation* (AS 4292.7—2006). Melbourne: Standards Australia.

List of figures

List of tables

Glossary of terms and abbreviations

Term/abbreviation	Description
ARA	Australasian Railway Association
RTO	Rail Transport Operator
AS 4292.7	Australian Standard for Rail Safety Investigation
ATSB	Australian Transport Safety Bureau
Contributing factor	Any element of an occurrence, which if removed from the occurrence sequence, would have prevented the occurrence or reduced the severity of the consequences of the occurrence (AS4292.7, 2006). In addition, it could include any element that would have prevented another contributing factor from occurring. **Note** *Any coding system can only represent a high level summary of an occurrence and for legal purposes reference to the full investigation is required. Legal liability is not implied just because a factor is identified as contributing.*
Contributing Factors Framework (CFF)	The framework, data set, definitions and other related information that describe the factors contributing to a rail safety occurrence.
Controls	*See Defences*
COP	Code of Practice
Defences	A defence must meet both of the criteria listed below: (a) its primary purpose is to protect against a specified risk (b) it is designed to serve one or more of the functions listed below: • create understanding and awareness of the local hazards • give clear guidance on how to operate safely • provide alarms and warnings when danger is imminent • restore the system to a safe state in an abnormal or emergency situations • interpose safety barriers between the hazards and the potential losses • contain and eliminate the hazards should they escape this barrier • provide the means of escape and rescue should hazard containment fail. Coding of a defence in the CFF simply requires identifying those contributing factors considered to be absent or failed defences.
Error	When a planned sequence of mental or physical activities fails to achieve its intended outcome.
Event	The 'what happened' aspect of a rail safety occurrence. For example, derailments and collisions are events.
Individual/team action	An act or omission by a rail safety worker that can have an affect on safety.
Level 1 or Level 2 Investigation	As defined in AS 4292: Railway Safety Management (Part 7) - Railway Safety Investigation.
Local conditions	Conditions that existed in the local workplace or environment.

Term/abbreviation	Description
Non-contributing safety issue	An event or condition that increases safety risk but did not contribute to the occurrence being coded. Something that, if it occurred in the future, would increase the likelihood of an occurrence, and / or the severity of the adverse consequences associated with the occurrence.
Occurrence	A general term for accidents and incidents which lead to injury or loss, or which are considered by the relevant authority to have the potential to compromise safety (AS 4292.7, 2006). Any accident or incident involving a train or rollingstock, whether in motion or not, or any other event on railway property affecting the safety of persons, property or railway operations (ON-S1 (Version 2) and OC-G1 (Version 1) (RSRP, 2008).
ON-S1 and OC-G1	Occurrence Notification – Standard 1: Notification Standard, Occurrence Categories and Definitions. Occurrence Classification - Guideline One (OC-G1) Guidance for the classification of rail safety occurrences (events).
Organisational factors	Those factors in the management system (for example, decision-making at the senior level, policy setting) that guide the activities of the organisation.
RSRP	Rail Safety Regulators' Panel
Rail safety work	As defined in rail safety legislation for a specified jurisdiction.
RSW	Rail safety worker A person, who has carried out, is carrying out or is about to carry out rail safety work.
Safety issue	An event or condition that increases safety risk.[3]
SPAD	Signal passed at danger
Systemic investigation	An investigation that seeks to identify the systemic factors contributing to a rail safety occurrence and reviews the performance of aspects of the safety management system, to identify areas that can be improved.
Systemic safety deficiency	A safety deficiency which is present throughout all or a substantial part of a railway organisation/s and is not simply a localised problem (AS 4292.7, 2006).
Technical failure	Breakdowns of technology used in the rail operation. They may occur in any aspect of the lifecycle, including design, manufacture, operations or maintenance.
Violation	A deliberate deviation from rules or procedures. For example, if the person knows the correct rule or procedure and does not follow it (for example, a common shortcut) the action is a violation. However, if the person does not know or has forgotten the correct rule or procedure, the action is considered an error.

3 This definition is based on the Australian Transport Safety Bureau's definition of a Safety Factor.

Appendix 1 ~ Coding templates

Appendix 1.1 ~ Coding template (general)

Record number: [this is the record number of the occurrence in your database]	Report prepared by: [Name] Date prepared: [Date]

OCCURRENCE DESCRIPTION (ON-S1 and OC-G1 categories)		
[Text description]	**Date:**	[Date]
	Location:	[Location]
	Organisation:	[Organisations (*add row for each organisation*)]

Occurrence Type: (include all ON-S1 and OC-G1 categories for events that occurred)		
Occurrence type:	**Occurrence category:**	**Occurrence sub-category:**

INDIVIDUAL/TEAM ACTIONS					
Findings/short description	**D**[4]	**Person type**	**Activity type**	**Error/violation type**	**Organisation**

TECHNICAL FAILURES					
Findings/short description	**D**	**Failed component**	**Failure mechanism**	**Failure origin**	**Organisation**

LOCAL CONDITIONS & ORGANISATIONAL FACTORS					
Findings/short description	**D**	**Local condition/ organisational factor**	**Keyword**	**Functional area (affected by the failure)**	**Organisation**

NON-CONTRIBUTING SAFETY ISSUES *(identified safety issues that did not contribute to this occurrence)*					
Findings/short description	**D**	**Replace text below with relevant item. Replace only if a factor is identified.**			
		[Person type]	[Activity type]	[Error/violation type]	[Organisation]
		[Failed component]	[Failure mechanism]	[Failure origin]	[Organisation]
		[Local condition/ organisational factor]	[Keywords]	[Functional area]	[Organisation]

FEEDBACK ON USING THE CFF: (Document any problems you had using the Contributing Factors Framework here)

4 D: Tick the factors that correspond to absent or failed defences.

Appendix 1.2 Coding template (level crossings)

Record number: [this is the record number of the occurrence in your database]	**Report prepared by:** [Name] **Date prepared:** [Date]

OCCURRENCE DESCRIPTION (ON-S1 and OC-G1 categories)		
[Text description]	**Date:**	[Date]
	Location:	[Location]
	Organisation:	[Organisations (*add row for each organisation*)]

Occurrence Type: (include all ON-S1 and OC-G1 Categories for events that occurred)		
Occurrence type:	**Occurrence cat:**	**Occurrence sub-cat[5]:**
Level crossing occurrence		

INDIVIDUAL/TEAM ACTIONS								
Observed behaviour (of vehicle driver) *(tick the relevant box)*		**Stopped then proceeded**		**Did not stop**		**Unknown**		
		Stopped on crossing		**Drove around or through the gates**				
Findings/short description	**D**	**Person type**		**Activity type**		**Error/violation type**		**Organisation**

TECHNICAL FAILURES					
Findings/short description	**D**	**Failed component**	**Failure mechanism**	**Failure origin**	**Organisation**

LOCAL CONDITIONS and ORGANISATIONAL FACTORS					
Findings/short description	**D**	**Local condition/ organisational factor**	**Keyword**	**Functional area (affected by the failure)**	**Organisation**

NON-CONTRIBUTING SAFETY ISSUES *(identified safety issues that did not contribute to this occurrence)*					
Findings/short description	**D**	**Replace text below with relevant item. Replace only if a factor is identified.**			
		[Person type]	[Activity type]	[Error/violation type]	[Organisation]
		[Failed component]	[Failure mechanism]	[Failure origin]	[Organisation]
		[Local condition/ organisational factor]	[Keywords]	[Functional area]	[Organisation]

FEEDBACK ON USING THE CFF: (Document any problems using the Contributing Factors Framework here)

Appendix 2 ~ Coding framework ~ level crossing occurrences

Local conditions and organisational factors

Personal factors*
Knowledge, skills and experience*
Task demands*
Physical environment*
Social environment*
Procedures*
Training and assessment*
Equipment, plant and infrastructure*
People management*
Organisational management*
External organisational influences*

Functional area

Freight handling
Infrastructure construction and maintenance
Off-train operations
On-train operations
Passenger management
Rollingstock construction and maintenance
Road environment
Emergency management

Technical failures

Failed component

Rollingstock

Bogies
Braking systems
Car-body
Coupler/drawgear
Load restraining equipment
On board traction systems
On board train protection systems
Other rollingstock component

Infrastructure

Bridge
Buildings
Cuttings
Drains/flood mitigation systems
Lineside rolling stock fault detection systems
Overhead power systems
Road-rail interfaces
Switches/crossings
Track
Track protection devices
Track support
Tunnels
Other infrastructure component

Signalling and communications

Communication systems
Control interface equipment
Interlocking systems
Traffic control
Train detection systems
Wayside signalling equipment
Other signalling and communications component

Other

Other vehicles

Failure mechanism

Corrosion
Deformation
Electrical discontinuity
Fracture
Mechanical discontinuity
Software/firmware anomaly
Wear
Other failure mechanism
Unknown failure mechanism

Failure origin

Design
Manufacture
Installation / commissioning
Operation
Maintenance
Decommissioning
Unknown failure origin

Individual/team actions

Person type

Infrastructure maintainers
Network controllers
Rollingstock maintainers
Train crew
Station staff
Terminal staff
Light passenger vehicle drivers
Heavy freight vehicle drivers
Emergency services staff
Other persons

Activity type

Preparation and planning
Operating equipment
Communicating
Monitoring and checking
Handover/takeover
Other activity type

Observed behaviour *(vehicle driver only)*

Stopped then proceeded
Did not stop
Drove around or through gate
Stopped on crossing
Other
Unknown

Error/violation type

Error
Violation
Unknown error/violation

5 Note: If coding a level crossing occurrence, in addition to the ONS1 and OC-G1 classification, the type of protection provided at the level crossing should be included in the occurrence sub-category. See p 27 for list of protection types (listed in the right column).