



# ERA SAFETY UNIT – SAFETY REPORTING SECTOR

## Guidance on good reporting practice

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0. DOCUMENT INFORMATION

0.1. Amendment Record

*Table 1 : Status of the Document.*

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# 1. INTRODUCTION

## 1.1. Scope and Field of Application

Annex V of the Railway Safety Directive 2004/49/EC (RSD) describes the *principal content of an accident and incident investigation report*.

The use of this reporting structure by the investigation body is not mandatory as stated in the RSD, as we can read under Article 23.1: *An investigation of an accident or incident referred to in Article 19 shall be the subject of reports in a form appropriate to the type and seriousness of the accident or incident and the relevance of the investigation findings.*

It is on the other hand a good blueprint for investigation reporting, and therefore strongly recommended in Article 23.2: *The report shall, as close as possible, follow the reporting structure laid down in Annex V.*

To ensure a high quality of reporting and to improve dissemination of safety information and discussion at European level, it is important to achieve a common understanding and approach to reporting of the elements of Annex V by all National Investigation Bodies (NIBs). The aim of this Guidance is therefore to arrive at a common understanding of the different elements of Annex V and the need to report on them in the accident investigation report, and simultaneously to give evidence of “good reporting practice”.

For reasons of practicality and traceability, this document will follow the sequence and order of Annex V. It should be made clear however that the focus of this Guidance is only on the relevant content and purpose of each element of Annex V; not on the reporting structure itself, not on the organisation of the investigation process and not on investigation methods to use.

On the other hand, the objective of an accident investigation report should not only be to report accurately on the accident mechanism and its causes and to formulate recommendations to improve railway safety, but also to demonstrate that the investigation has been conducted at a high level of professionalism. Therefore, it should enable investigators to indicate and argue all relevant steps of the investigation process they followed.

To emphasise this, throughout this Guidance, all elements discussed will be linked with the steps that are defined in the generic occurrence investigation process introduced by Fig. 1. and that represents a number of generic phases that are common in existing practices for occurrence investigation and reporting in railway and other industries {ref.2}, {ref.3}, {ref.4}, {ref.9}.

This Guidance is prepared by the European Railway Agency (ERA), with the support of Task Force 5 of the Network of NIBs “Good Reporting practice”.

As the Agency is aware that there might be specific national characteristics due to implementations of the RSD, this Guidance is intended as a support to NIBs in their understanding of Annex V. It is not intended to give guidance on specific national legislation, neither to be used as a substitute for the RSD.

This Guidance is not legally binding.

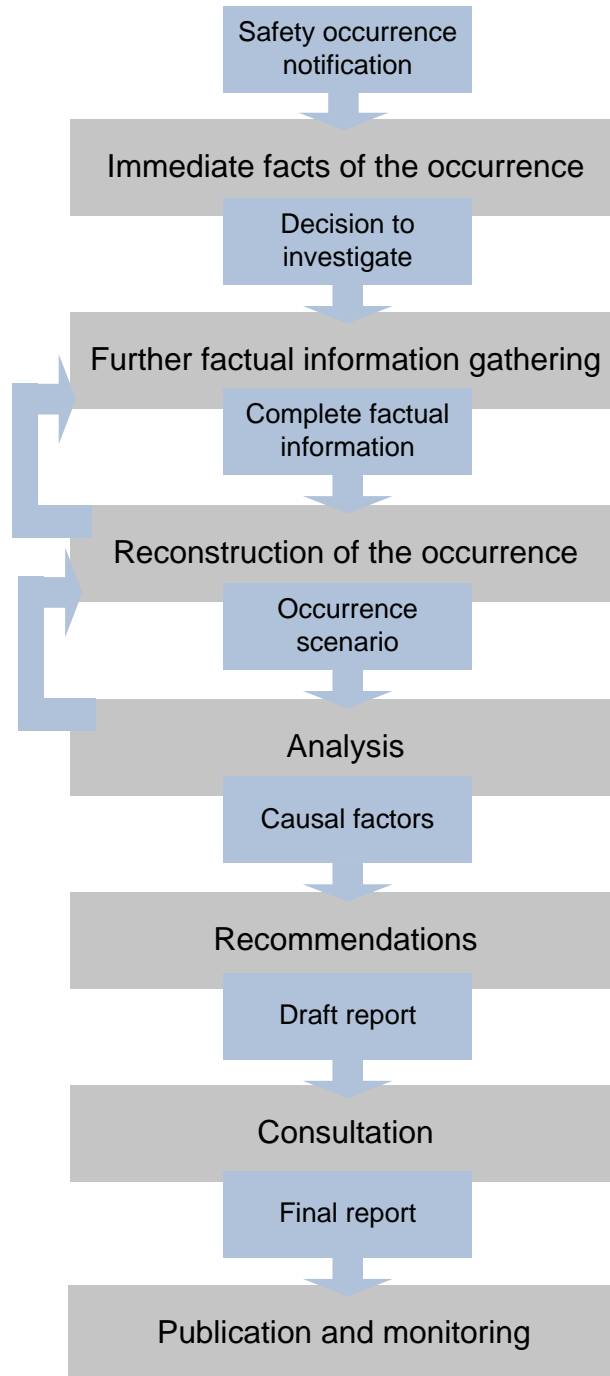


Fig.1: The generic occurrence investigation process –adapted after Johnson



## 1.2. Document Description

- 1.2.1. The document is divided into the following parts :
- (a) Chapter 0. contains the document history and table of contents;
  - (b) Chapter 1. defines the scope and field of application of the Guidance;
  - (c) Chapter 2. describes evidence on Annex V;
- 1.2.2. To facilitate the reading of this Guidance, the original text of Annex V of the RSD is quoted where relevant.  
*To differentiate the text of the RSD, it is presented in Italic Font, exactly as here.*

## 1.3. Reference Documents

**Table 2 : Table of Reference Documents.**

{Ref. N°}	Title	Reference	Version
	Railway Safety Directive 2004/49/EC	2004/49/EC	29 April 2004
	Australian Standard Railway safety management - Part 7: Railway safety investigation	AS 4292.7-2006	5 January 2006
	Guidelines for Investigation of Safety Occurrences in ATM	EUROCONTROL	3 March 2003
	Manual of Aircraft Accident and Incident Investigation - Part IV: Reporting	ICAO DOC 9756	First edition - 2003
	Implementation Guidance for Annex 1 and appendix to Directive 2004/49/EC	ERA_SU_GUID_CSIs	Final – 30/11/2008
	Guidelines on the systemic occurrence analysis methodology (SOAM)	EAM 2 / GUI 8	Released – 17/11/2005
	Australian Standard: Guidelines for railway safety investigations	AS 5022-2001	Published – 14/09/2001 (withdrawn)
	TSI relating to the control-command and signalling subsystem of the trans-European conventional rail system	2006/679/EC	28/03/2006
	Johnson – Failure in Safety-Critical Systems: A handbook of incident and accident reporting	ISBN 0-85261-784-4	Oct 2003



2. THE CONTENT OF ANNEX V

2.1. Summary

*The summary shall contain a short description of the occurrence, when and where it took place and its consequences. It shall state the direct causes as well as contributing factors and underlying causes established by the investigation. The main recommendations shall be quoted and information shall be given on the addressees.*

The content of a good summary is clearly stated in Annex V.

This element is meant to be an executive summary of the Final Report and should as such only contain key facts, causes (direct/underlying), and recommendations and to whom they are addressed. It is a good intention that the summary should not try to exceed one page in length, taking into account that it should give information to understand what happened, when, where, why and how, and who was involved when read independently.

The term “*main recommendations*” cannot refer to a prioritisation of recommendations, since this is neither the task nor the responsibility of NIBs. In principle all recommendations should be quoted as written in the Final Report. When this is not feasible in the summary, e.g. because of the high number of recommendations, e.g. some countries refer to the domains where the formulated recommendations apply upon, as in the following example.

*There are nine safety recommendations made in this report:*

*Four recommendations, addressed to the NSA, cover the areas of:*

- reviews of the competency management system, the operational safety management systems, its current rules and procedures*
- identifying safety process indicators*

*Three recommendations, addressed to the NSA, cover the areas of:*

- the implementation of processes to improve visibility of equipment representing a derailment risk*
- the modification to control centre systems*
- the production of a common rule book and procedures*

*Two recommendations are addressed to organisations involved in the rescue after the accident. They are related to the rescue operation*

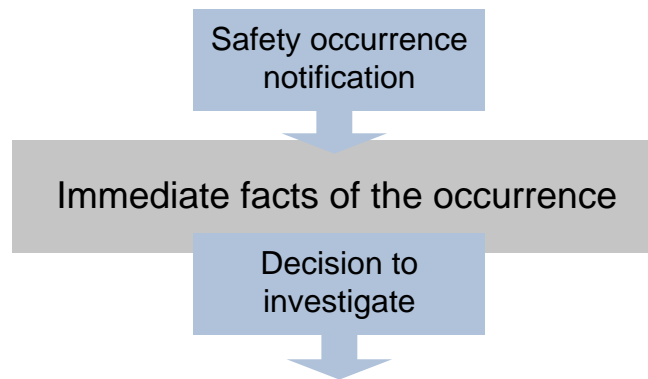
In order to improve the dissemination of safety information and lessons learned at European level, the ERA has adopted the policy to systematically translate all relevant parts of the final accident investigation reports that are published in its Public Database. The Summary, as an important element to be translated, should therefore be clearly indicated and easy to find in the report.



## 2.2. **Immediate facts of the occurrence**

- *The occurrence*
- *The background of the occurrence*
- *Fatalities, injuries and material damage*
- *External circumstances*

When an occurrence is notified to the responsible authority, the NIB will decide on the required level of investigation, based on the immediate facts of the occurrence, received from other parties or gathered through their own preliminary on site investigation,.



In most of the reports reviewed, this kind of information is reproduced in a text format. But actually, the information on the immediate facts of an occurrence is nothing more than an extended notification. Therefore the solution to present most of this information in a table format, as used by some MS, is also acceptable and sometimes even clearer.

### 2.2.1. **The Occurrence**

- *date, exact time and location of the occurrence,*
- *description of the events and the accident site including the efforts of the rescue and emergency services,*
- *the decision to establish an investigation, the composition of the team of investigators and the conduct of the investigation.*

#### 2.2.1.1 *date, exact time and location of the occurrence*

This information needs no further comment. An appropriate format to report it in could be:

- *date:* day of the week, day, month and year (dd/mm/yyyy)
- *exact time:* hour(24):minutes (hh:mm)
- *location of the occurrence:* city or town, type of railway system (rail, metro, light rail), type of location (open line, station, marshalling yard, ... but also e.g. switches and crossing, level crossing, bridge, viaduct, tunnel, plain, line), track number and track kilometre marker, GPS-coordinates







The following is an example of good practice:

*The accident occurred on 6 November 2006 at 17:16 on the regional railway line from [redacted] to [redacted] (line 302B), at the railway crossing at km 112.545, in [redacted], between the stations [redacted] and [redacted].*

2.2.1.2

*description of the events and the accident site including the efforts of the rescue and emergency services*

Since we already have a short description of the occurrence under the chapter “Summary” and a complete description of the event chain under chapter 4 “Analysis and conclusions”, this *description of the events* could be limited to the notification of the type of train movements, the occurrence type and the complete set of associated events/accidents. Most MS combine this short description of events with the information required under 2.2.1.1., as e.g. in the following example:

*On Wednesday, 5 september 2007 at 05:51 hrs, the two rear wagons of the goods train n° 66024 derailed on the main line between [redacted] and [redacted] station, at milepost 16.60km, about 200m from the platform at [redacted] station. Following the derailment, one of the derailed wagons protruded into the gauge of the neighbouring track and was hit by goods train n° 5722 a few minutes after derailing. Train 5722 remained on the track after the collision.*

The *description of the accident site* is in some of the reports shown on an accompanying drawing complete with measurement of the situation after the accident, as is common practice for car accidents.

Also *the efforts of the rescue and emergency services* are referred to elsewhere in Annex V, namely under the item *background of the occurrence* (trigger and chain of events of railway and public emergency plan -2.2.2.6 and 2.2.2.7). As a general rule it can be emphasised here that, in order to improve the readability of a report, any unnecessary repetition of information should be avoided.

2.2.1.3

*the decision to establish an investigation*

Accident investigation reports, when mentioning the decision to investigate, should not limit the explanation to the mention of the legal framework. This is of course important, but the explicit criteria, used to decide to open an investigation, should be cited here as well. For further explanation on these criteria in the context of the RSD we refer to the ERA Guidance on Art 19. Other, national criteria can be used in addition. The following is an example of good practice:

*The accident could have been more serious in slightly different conditions, which lead to the decision to start an investigation, in line with Article 19-2 of the European Directive 2004/49 EC. The technical investigation is executed in line with the framework defined by the Law n° 2002-3 of 3<sup>th</sup> January 2002 and the Decree n°2004-85 of 26<sup>th</sup> January 2004.*

Also the scope of the investigation should be mentioned in this part of the report. Firstly, accident investigation reports should state clearly that, in line with the requirements of the RSD, *The investigation shall in no case be concerned with apportioning blame or liability.* (Art. 19 (4)) and ... *the objective ... is possible improvement of railway safety and the prevention of accidents* (Art. 19 (1)). This could be completed with the intended depth (time limitations, available resources ...), breadth (technical limits, geographical limits





...) and possibly the wider context (previous incidence of this type of occurrence ...) of the investigation. As e.g. in the following example:

On 27<sup>th</sup> May 2004, in a letter to the Lower Chamber of the Parliament, the Council for Transport Safety stated that ‘in the case of such a serious accident, the Council will always launch an investigation into the causes’. However, if it emerges that this collision was once again due to a SPAD, the question emerges as to whether a fundamental investigation into the underlying causes is still necessary. These underlying causes have been described in detail in investigation reports for comparable train collisions as a result of SPADs (█ in 1992, █ in 1999)...

In addition, any decision to limit or even stop an opened investigation should also be stated, justified and commented in this section.

2.2.1.4 the composition of the team of investigators

An investigation may involve either a single authority or organisation, or a number of organisations working jointly in various configurations. This should be clearly indicated in the report.

Some MS consider the final accident investigation report as the product of the entire NIB, and only mention the report as “published by the NIB”.

Opposite to this practice of “Branch”-reports, other MS clearly indicate all experts that took part in the investigation, with indication of the “investigator-in-charge” (Art 3 (j)), and for every investigator at least the indication of his function and the organisation he is working for, as in the following example:

Composition of the Safety Board investigation team:
(Name 1) investigator in charge
(Name 2) secretary
(Name 3) investigator
(Name 4) investigator
(Name 5) analyst
(Name 6) investigator
In support of the Safety Board investigation team, a number of experts have been hired in the following domains: synthesis of accident investigations (Firm name 1), railway technology and safety management (Firm name 2), juridical aspects (Firm name 3) and managerial-organisational aspect(Firm name 4).

2.2.1.5 the conduct of the investigation

It is stated clearly in the RSD that The investigation shall be carried out with as much openness as possible ... (Art 22 (3)). To meet this requirement it is important that the conduct of the investigation is documented in the investigation report. To do so, and without being exhaustive, the following information could be included in the report:

- the channel through which the occurrence has been notified to the NIB, just like the exact time of the notification,





- the period and course of the investigation, with mention of the timing of the different stages in the investigation, e.g.:

*The investigation was started on the 30th January 2007 with the approval of the Action Plan. On the 3th May 2007 the provisional findings, conclusions and recommendations have been discussed with the Commission and on 27th June 2007 with the Investigation Board. After consultation of experts in the field of safety management and verification by the concerned parties, the draft report has been discussed by the Investigation Board on the 30th October 2007, the 15th January 2008 and 20th May 2008. Between 20th June 2008 and 18th July 2008, all concerned parties had the possibility to send in a written reaction. After processing the reactions, the final report has been approved by the Investigation Board on 23th September 2008.*

- the results of reports, made by RU and IM, based on their own investigations
- the technical resources, techniques and methodologies used in the different stages of the investigation, e.g.:

*Information was obtained from the following sources:*

- *RU and IM accident investigation*
- *technical documentation on rolling stock*
- *safety plans, safety cases and relevant documentation*
- *results from technical tests*
- *legislation, standards and directives*
- *managerial agreements*
- *minutes from steering groups in the period from 2002-2006*

*The following research methods were used:*

- *interviews with staff from the concerned parties (Party 1, Party 2, ...)*
- *analysis of documents*
- *technical inspection in lab*
- *visit of maintenance workshop*
- *visit of accident site*

*The following analysis techniques were used:*

- *timeline analysis*
- *TRIPOD*
- *analysis of actors*

*Second opinion:*

*The analysis of the derailment and of the safety management has been assessed by expert external to the NIB, respectively a international authority in the field of railway technique and an expert in the field of safety management from the chemical industry.*

Note that relevant reports of experts can be put in an annex.

- the parties and/or persons (subject to the protection of identity of the person) relevant to the investigation,
- all steps undertaken to give the concerned parties *an opportunity to submit their opinions and views to the investigation* (Art 22 (3)) , e.g.:

*The draft report has been presented, for assessment on factual inaccuracies, to the following concerned bodies:*

- *Local Authorities*
- *RU and IM*
- *Independent Safety Assessor*
- *Suppliers of switches, interlocking system and rolling stock*
- *NSA*





2.2.2. ***The background of the occurrence***

- *staff and contractors involved and other parties and witnesses,*
- *the trains and their composition including the registration numbers of the items of rolling stock involved,*
- *the description of the infrastructure and signalling system – track types, switches, interlocking, signals, train protection,*
- *means of communication,*
- *works carried out at or in the vicinity of the site,*
- *trigger of the railway emergency plan and its chain of events,*
- *trigger of the emergency plan of the public rescue services, the police and the medical services and its chain of events.*

We remind here that standard general definitions have been developed in the CSI working group.

2.2.2.1. *staff and contractors involved and other parties and witnesses*

The investigation report should at least identify all the organisations involved, and consequently for each organisation all staff directly involved, with mention of the following information: function at the moment of the accident and other relevant information of importance for the accident (e.g. age and gender -only if appropriate and pertinent- , qualifications with date of issue and validity of licence -if applicable-, experience, history ...).

Where relevant, also other parties and witnesses could be identified in a similar way, always taking care of the protection of identity of persons.

2.2.2.2. *the trains and their composition including the registration numbers of the items of rolling stock involved*

The investigation report should contain the train number (which will give an indication on the type of traffic), and the composition of the train. When appropriate and relevant, this information could be extended with:

- for passenger trains, the registration number of the locomotive and the number and type of passenger carriages
- for freight trains, the registration number of the locomotive and a list with the registration numbers of all wagons

The presence of dangerous goods as well as any further information on train characteristics should only be provided when relevant for the understanding of the mechanism of the occurrence.

2.2.2.3. *the description of the infrastructure and signalling system – track types, switches, interlocking, signals, train protection*

The actual reporting practice is very different amongst MS. An appropriate form to report on these different technical issues, when relevant for the understanding of the mechanism of the occurrence, could be:





- *track types*: rail type (incl. rail head profile, design linear mass, steel grade), type of rail fastening system, type of track sleepers and bearers, type of embankment and reference speed
- *switches*: type of points and means of detection and locking
- *interlocking*: category of interlocking (mechanical, relays based, electronic), type of control-command system and type of train detection system (track circuit, axle-counters, on-board equipment)
- *signals*: unique signal number and type of signal (mechanical, light or LED)
- *train protection*: category (class A or class B, with mention of type following {Ref. 8})

*The control-command subsystem is that set of functions that are essential for the safe control of the railway traffic, and that are essential the operation, including those required under degraded conditions. Because of the mobility of the onboard part, the control-command subsystem is divided in two parts: on board assembly and track-side assembly.*

*Within the control-command subsystem two classes of train protection and radio communication are defined:*

*Class A: the unified control-command system*

*Class B: control-command systems and applications existing before entry into force of the Directive 2001/16/EC, limited to those listed in Annex B of the TSI relating to the control-command and signalling subsystem of the trans-European conventional rail system 2006/679/EC (ref {Ref. 8}): ALSN, ASFA, ATB, ATP-VR/RHK, BACC, CAWS and ATP, Crocodile, Ebicab, EVM, GW ATP, Indusi/PZB, KVB, LS, LZB, MEMOR II+, RETB, RSDD/SCMT, SELCAB, SHP, TBL, TPWS, TVM, ZUB 123.*

For accidents on level crossings, it seems also appropriate to indicate the type of level crossing, according to the classification that is stated in {Ref. 5}.

*'Level crossing with crossing user side automatic protection and/or warning' means a level crossing where the crossing protection and/or warning are activated by the approaching train.*

*These level crossings are classified by:*

- automatic user side warning*
- automatic user side protection*
- automatic user side protection and warning*
- automatic user side protection and warning, and rail side protection*  
*- rail side protection means, signal or other train protection system that only permits a train to proceed if the level crossing is user-side protected and free from incursion; the latter by means of surveillance and/or obstacle detection.*

*'Passive level crossing' means a level crossing without any form of warning system and/or protection activated when it is unsafe for the user to traverse the crossing.*

#### 2.2.2.4. *means of communication*

The means of communication reported on, should cover all applicable communications (train/train, train/ground, ground/ground), including with emergency services and for each, at least the possible type of communications should be mentioned (duplex/simplex voice communication, use of operating signals/tones, selective calls, data transmission). {Ref. 8} also provides a list with existing systems that could be used as a reference.



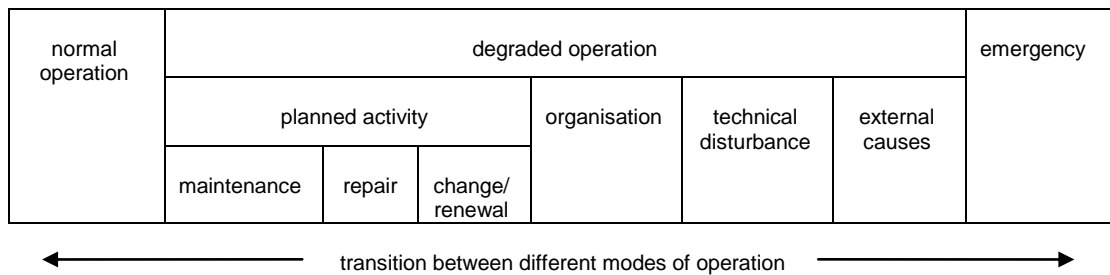


2.2.2.5. *works carried out at or in the vicinity of the site*

The intention of this section is to consider whether works, carried out at or in the vicinity of the site, contributed in setting the stage for the occurrence. But works are not the only source of degraded operations and also the transition between different operational phases is a known contributing factor for many occurrences. A more indicative approach could then be to consider the relevance of reporting on the operational phase the train was running in.

The following table could be used to do so. It identifies 3 main operational phases, being “normal operation”, “disturbed” or “degraded operation” and “emergency situations”. Within the degraded operations, a subdivision is made, following the action causing this degradation, i.e.: “planned activities” (as “maintenance”, “repair” and “change” or “renewal”), “disturbed organisation”, “technical disturbance” and “external causes”.

Operational phase



2.2.2.6. *trigger of the railway emergency plan and its chain of events*

Each railway organisation must set up an emergency plan with the purpose of reducing or limiting the consequences of an occurrence. Such an emergency plan identifies and specifies the actions, alerts and information to be given for each different type and level of occurrence.

When relevant for the occurrence, all actions taken and alerts given should be recorded in the investigation report. This can be done most clearly in chronological order, including for each action, details of: date (dd/mm/yyyy), exact time (hh:mm), the initiator of the action and a description of the action taken.

Without being exhaustive, the following actions could be included:

- alert of staff with responsibility for emergency management and the response time
- protection of hindrances within the clearance
- measures taken to protect against railway risks (overhead line, adjacent track, ...)
- information given on the presence of dangerous goods
- emergency instructions for passengers
- logistics (e.g. to clear the occurrence site)
- co-ordination with the public emergency plan





2.2.2.7. *trigger of the emergency plan of the public rescue services, the police and the medical services and its chain of events*

The public emergency plan is an extra layer upon the railway emergency plan. It could be reported in the same way, with special attention to the following aspects (without being exhaustive):

- the first notification to the emergency services and the response time
- the co-ordination of all disciplines within the emergency plan (incl. communications)
- the actions of public rescue services
- the actions of medical services
- the actions of the police
- logistics (e.g. assistance by civil services)
- the dissemination of information to the public

2.2.3. **Fatalities, injuries and material damage**

- *passengers and third parties, staff, including contractors,*
- *cargo, luggage and other property,*
- *rolling stock, infrastructure and the environment.*

2.2.3.1. *passengers and third parties, staff, including contractors*

ERA’s public database already records casualty information in the following format:

	passenger	staff	level crossing user	unauthorised persons	others
fatality					
serious injury					

It seems logical that the accident investigation report provides the same information, in a format appropriate to the circumstances.

2.2.3.2. *cargo, luggage and other property*

Here, all known compensation for loss of or damage to property of passengers, staff or third parties should be reported, with at least a short description of the damage and, if available, an estimation of the total cost in euro. In most cases however, it is very unlikely that a NIB will know any information about passenger’s luggage and property. Those MS with a local currency could indicate the currency used in the report, including the actual exchange rate.

2.2.3.3. *rolling stock, infrastructure and the environment*

At least a short description and, if available, an estimation of the total cost in euro for the replacement or repair of damaged rolling stock and railway installations should be reported. Those MS with a local currency could indicate the currency used in the report, including the actual exchange rate.



Also damage to the environment has to be taken into account. If available (e.g. from the NSA), this could be extended with the costs that are to be met by RU/IM in order to restore the damaged area to its state before the occurrence. The main cases belonging to this category should be:

- pollution of an area by liquid, solid or gas release of goods
- material damages to an area (e.g. trees pulled down by rolling stock in motion)
- fires in an area inside or outside the railway premises (e.g. fires of trees caused by rolling stock in motion)

Another factor that some MS add in their investigation report, to have an additional indication on the consequences of the occurrence, is delays as a consequence of the occurrence both on the railway lines where the accident took place as on the other affected lines (incl. disturbances and re-routing of traffic). Additionally this could be extended with an estimation of the costs of these delays. More information on the calculation of these costs can be found in {Ref. 5}.

#### 2.2.4. **External circumstances**

— *weather conditions and geographical references.*

##### 2.2.4.1. *weather conditions*

The accident investigation report should also provide a brief statement on the general weather condition at the time and place of the occurrence. Only when relevant to the occurrence, the following information could be included: precipitation, snow, avalanches, visibility, wind speed and direction, temperature...

##### 2.2.4.2. *geographical references*

Only when relevant to the occurrence, the following information could be included: natural forms and conditions on landscape, platforms, tunnels, cuttings, embankments, track rising and falling gradients, track curvature, track cant deficiency, rail inclination, other visual obstructions, soil conditions, lighting, protection against electric shock, ... To improve the readability of the report, it is good practice to group information on infrastructure elements with the information provided under 2.2.2.3.







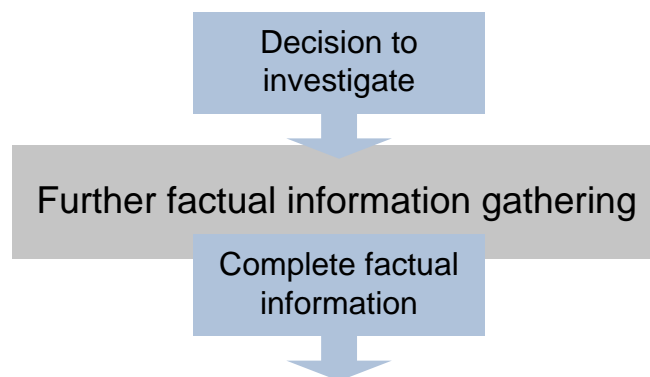
2.3.

**Record of investigations and inquiries**

- *Summary of testimonies (subject to the protection of identity of the person)*
- *The safety management system*
- *Rules and regulations*
- *Functioning of rolling stock and technical installations*
- *Documentation on the operating system*
- *Man-machine-organisation interface*
- *Previous occurrences of a similar character*

In the next stage, the investigation body is responsible for the identification and collection of all relevant evidence relating to the occurrence, including documentation, site and equipment inspections, and results of interviews with individuals including staff, witnesses and representatives of organisations.

Reporting on this phase of the investigation process can be descriptive in character and should provide a comprehensive record of the facts and circumstances established in the investigation in the aim of understanding **what** happened, **when** and **where** it happened and **who** was involved. This information will support subsequent steps in the investigation.



The purpose of this chapter in Annex V is to give an indication of the minimum set of factual information that should be available, because it is considered essential for the development of the analysis, conclusions and, where appropriate, safety recommendations. This sequence should begin as far back in time as is necessary to include the significant events which preceded the accident.

In principle, the significance of the facts should not be explained in this factual information part because such discussions should be presented in the analysis part. Some NIBs argue however that mixing both aspects in the report may improve its readability. This also reflects the iterative aspect of the investigation process: after an initial data collection phase, a preliminary analysis can be conducted, which will identify gaps that can be filled by further data gathering. No matter where in the structure of the document it can be found, it is important that the final report contains a description of all the events and circumstances that are directly related to the occurrence.



Another important aspect of this phase in the accident investigation process is to define the responsibility for data gathering. This is necessary to ensure that data is not lost, but also to avoid any later discussion with other organisations that might run their own investigation (judicial authorities, IM, RU, ...). Procedures for factual information gathering after an occurrence should therefore be agreed on, documented and disseminated long before any accident.

2.3.1. **Summary of testimonies (subject to the protection of identity of the person)**

- railway staff, including contractors,
- other witnesses.

The objective of an interview procedure should be to obtain information and further understanding of the occurrence and the organisational factors that shaped it, which cannot be revealed by examination of the site, the available technical data or documents by themselves.

Investigators shall obtain information through interviews in a manner which will reduce as far as practicable the likelihood of that information being used in legal proceedings.

A transcript of the interviews or even a summary of the interviewee's statements should not necessarily be reproduced in the final report. Some MS prefer to include the information gained from interviews directly into the factual information. However, when essential to the analysis and understanding of the occurrence, a valid alternative could be to add the transcript as an appendix to the report. The use of interviews as an investigation technique and the contacted parties and/or persons (under the protection of the identity of the person) should in any case be mentioned as part of reporting on "*the conduct of the investigation*".

In view of the importance of investigating not only the sharp end factors of an occurrence (direct and immediate causes and contributory factors) but also the blunt end factors (underlying and root causes), all persons involved in the occurrence -in every sense possible- could be the subject of an interview. Therefore the category of "representatives of organisations (including management)" could be added to the existing categories in Ann. V.

2.3.2. **The safety management system**

- the framework organisation and how orders are given and carried out,
- requirements on staff and how they are enforced,
- routines for internal checks and audits and their results
- interface between different actors involved with the infrastructure.

It is clear that, when relevant to the occurrence, the final report should provide pertinent information on any organisation and its (safety) management, whose activities or (deficiencies in the) organisational structure and functions may have directly or indirectly influenced the separate events in the accident mechanism.

The safety management system reflects an organisation's filling in of its responsibility for safety, and is defined in the RSD as "*the organisation and arrangements established by an infrastructure manager or a railway undertaking to ensure the safe management*





of its operations”. The purpose of having aspects of it reported in the investigation report is to draw a clear picture of the framework that is designed to control the safety of the railway system at all levels. Therefore this item should be considered in combination with “*Rules and regulations*” (2.3.3).

As relevant elements of a safety management system at this level, the following constituent parts could be taken into account:

**4 Management processes** that deal with how to accomplish tasks and how to evaluate and adapt them to the changing environment

- **Management Commitment:** An organisation should outline the principles and core values according to which the organisation and staff operate, thus giving evidence of the organisation’s management commitment to the development and improvement of working ethics and providing staff with clear guidance for action to consolidate safety culture and safety awareness within the organisation. Corporate safety targets need to be set and broken down at all levels of the organisation.
- **Monitoring:** An organisation, through all levels, should rely on a structured monitoring system, to ensure delivery (both technical and behavioural) meets expectations, to initiate further analysis and to provide decision-makers with adequate information to make appropriate decisions about risks.
- **Organisational Learning:** The organisation should analyse appropriate data to evaluate where continual improvement of both safety performance and the effectiveness of the SMS can be made. This should include data generated as a result of monitoring and from all other relevant sources (including proactive internal information on hazards). Organisations should also ensure the management of all change/transition.
- **Risk Assessment:** Organisations must have a system in place to control changes/new projects and manage related risks, taking into account also occupational safety. Changes can apply to technique/technologies, operational procedures/rules/ standards and organisational structure at all levels. The SMS needs to ensure that risk assessment is applied where appropriate.

And **4 support processes** that are supporting both the operational and management processes, and that are necessary to run the business:

- **Structure and Responsibility:** An organisation must clearly identify the areas of responsibility and define how control by the management on different levels is secured. Delegation of responsibilities and tasks should be formal and approved, to make sure that the accountability for safety belongs to all levels of management.
- **Competence management:** An organisation must ensure that all staff with a responsibility in the safety management system is competent to perform their tasks and that staff skills and knowledge are maintained, in all circumstances.
- **Information:** The exchange of relevant (safety) information is crucial within and amongst organisations. It is therefore important that defined reporting channels and interfaces exist, within a structured process, to ensure that all information is conveyed to the right person/role/function in a prompt and clear way.
- **Documentation:** To ensure the traceability of processes and procedures relating railway safety, the safety management system must be systematically documented in all relevant parts. Document and data control procedures must be defined; documents and records must be readily available for consultation and/or verification.

A more detailed description of these systemic factors is available in the Guidance on Causational Classification (ref. – tbd).





### 2.3.3. **Rules and regulations**

- *relevant Community and national rules and regulations,*
- *other rules such as operating rules, local instructions, staff requirements, maintenance prescriptions and applicable standards.*

Where applicable, the *relevant Community and national rules and regulations*, should be commented to explain the role and responsibilities of the different parties involved (obviously NSA, IM and RU, but also manufacturers, NOBOs, ...) and the way they should interact. The result should be a clear view on how safety constraints are enforced at the highest hierarchical levels in a MS.

The *other rules* that are recorded in the report should be representative of the way the safety of operations is organised within the relevant organisation, from the personnel performing safety critical tasks, supervisor and line management, all the way up to the top management, with a sidestep to the designer. This is nothing else than the actual roll out of a company's "safety management system" or, in other words, the way safety is integrated in a company's **operational processes** that create, produce, and deliver the products and services that customers want.

Once this safety control framework is made clear, it should be used, in the analysis phase of the investigation, to examine why the controls at each hierarchical level, as well within the particular organisation as including controls between the different players in the railway industry, were inadequate to maintain the constraints on safe behaviour such that a particular event in the accident mechanism occurred.

### 2.3.4. **Functioning of rolling stock and technical installations**

- *signalling and control command system, including registration from automatic data recorders,*
- *infrastructure,*
- *communication equipment,*
- *rolling stock, including registration from automatic data recorders.*

It is important to include all pertinent material failures and component malfunctions in an investigation report, and to indicate whether they occurred prior to or at the occurrence. It is essential that failed or malfunctioning components which are deemed to be significant to the accident or which required examination or analysis be described. Annex I provides a checklist of technical items of evidence which may be collected, based on {Ref. 7}.

Relevant results of special technical investigations, examinations and laboratory tests, should also be included in the investigation report, but always accompanied by a statement on the significance of the results obtained. The inclusion of drawings or photographs of specific failures, in the text or as an appendix, will enhance the report.

The investigation report could also provide information recorded by data recorders, but only those parts of the read-out reports which are pertinent to the analysis and findings. As the results of technical investigations, also this information should be accompanied by a statement on the significance of the results obtained. Additional information on the data recorders that can be provided is: manufacturer, model, number of parameters recorded, recording medium and duration of the recording





If data was not recorded or could not be extracted, then the reason for the malfunction or loss of data should be described, including techniques used to extract data and any problems encountered.

2.3.5. **Documentation on the operating system**

- *measures taken by staff for traffic control and signalling,*
- *exchange of verbal messages in connection with the occurrence, including documentation from recordings,*
- *measures taken to protect and safeguard the site of the occurrence.*

This part should describe in detail the way the railway system was operated before, during and immediate after the occurrence.

The reported sequence should begin as far back in time as is necessary to include the significant events which preceded the accident. Reporting on *measures taken to protect and safeguard the site of the occurrence* here could overlap with reporting on *the railway emergency plan and its chain of events* (2.2.2.6) which should be avoided. It could however be argued that reporting on the roll out of both the railway as the public emergency plan better fits within this chapter of Annex V, where also all other activities that are connected to the occurrence are documented. As a general rule we repeat here that, in order to improve the readability of a report, any unnecessary repetition of information should be avoided.

Transcripts or extracts from the voice recordings should be in the investigation report or its appendices only when essential to the analysis and understanding of the occurrence.

2.3.6. **Man-machine-organisation interface**

- *working time applied to the staff involved,*
- *medical and personal circumstances with influence on the occurrence, including existence of physical or psychological stress,*
- *design of equipment with impact on man-machine interface.*

It is commonly accepted that all actions take place in a context, and that this context can be described as a combination of individual, technological and organisational components.

The aim of this item is to guide the investigator into gathering data on factors that affect the performance and the interaction of these components. Unfortunately only a very limited share of what is generally known as the basic **performance shaping factors** is presented in Annex V, and so the reporting on them is, in general, very poor.

To improve this practice, the following factors could systematically be considered and taken into account in the investigation, and reported on when relevant:

- **Training/Experience:** The level and quality of training, together with the operational experience, determines how well prepared people are for the task at hand or for the situation.
- **Procedures:** The quality, accuracy, relevance, availability and workability of all written or electronic data for the task under consideration. (This does not include verbal instructions from supervisors, shift handover logs etc., which are considered to be Communication.)





- **Technical Availability:** Missing or inappropriate maintenance, inspections and/or readiness checks can impact the availability or performance of equipment/tools/functions.
- **Design:** The equipment, displays and controls, layout, quality, and quantity of information available from instrumentation/interfaces, and the interaction of the operator/crew with the equipment to carry out tasks. The in-/adequacy of computer software is also included in this factor as well as the impact of design on the reliability, availability, safety and maintainability of technological/organisational components.
- **Communication:** The exchange of information (written, verbal, or non-verbal) among the operators or between operators and sources outside. (Information gathering from the interface is not considered as communication, but should rather be classified under the factor Design).
- **Ambient Conditions:** The physical, environmental conditions that have a significant impact on the performance of the system components, like temperature, sound, illumination, weather conditions ...
- **Person Related Conditions:** The temporary or permanent characteristics of an individual that determine whether or not he is physically and mentally fit to perform the task at the required time.
- **Working conditions:** The psychological working conditions, including the social environment, that have a significant impact on performance.
- **Supervision:** The planning, prioritising and organising of job tasks can affect individual and crew performance. This includes consideration of coordination, command and control.

A more detailed description of these situational factors is available in the Guidance on Causational Classification (ref. – tbd).

### 2.3.7. *Previous occurrences of a similar character*

Investigators should not only consider the particular occurrence being investigated but should also identify, when possible, whether there have been any previous occurrences in their own country and also in other EU member states.

This general overview of the context of an occurrence can help strengthen acceptance of recommendations from the investigation, and should therefore be mentioned in the accident investigation report. However, the (historical) relevance of any previous occurrence should be clear.







## 2.4. **Analysis and conclusions**

- *Final account of the event chain*
- *Discussion*
- *Conclusions*
- *Additional observations*

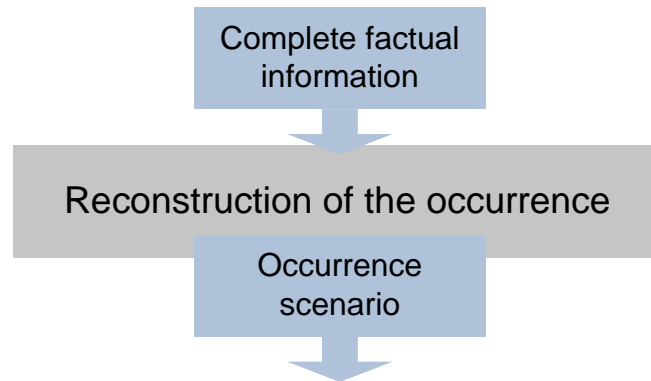
This chapter of Annex V encloses different phases of the occurrence investigation. Firstly mentioned is the stage where, based on the complete factual information, the probable accident mechanism is reconstructed. Also described is the need for a structured and in depth analysis of the collected data that leads to a conclusion on the organisational and other underlying factors that shaped the occurrence.

### 2.4.1. **Final account of the event chain**

— *establishing the conclusions on the occurrence, based on the facts established in heading 3.*

2.4.1.1 The reconstruction of an occurrence is a transition phase between the immediate reporting of an occurrence and the subsequent analysis that identifies the causal factors, which lead to the occurrence.

The purpose of this step is to describe **how** the occurrence happened. The output should be a description of the events, adequately supported by evidence, which clearly explains the sequence and relationship between events that led up to the occurrences and effectively the outcome.



The information presented in the report, should be based on established facts. Evidence which facilitated the reconstruction of the sequence of events should be mentioned. Any part or system which had a bearing on the accident as well as operational procedures, performance limitations and other circumstances which played a role in the accident should be reported on. The objective is to enable the reader to fully understand how the accident happened.

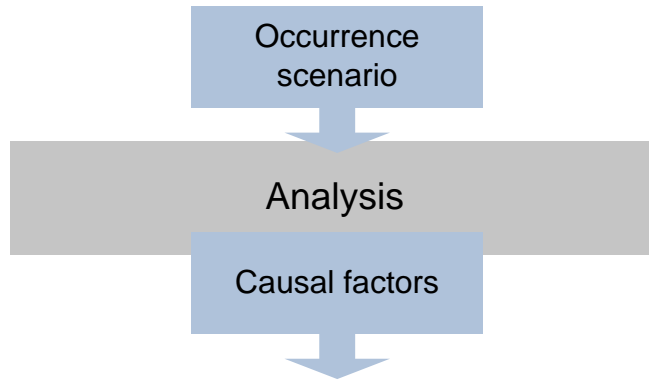




2.4.2. **Discussion**

— *analysis of the facts established in heading 3 with the aim of drawing conclusions as to the causes of the occurrence and the performance of the rescue services.*

In this phase, the aim is to analyse and explain all the reasons **why** the occurrence took place in the way that it did, starting from the assumed occurrence scenario –based on the evidence known at that moment.



This process may identify the need for further factual information gathering. The exact nature of this overall iterative process is generally determined by both the available resources and the opportunity to improve safety in an organisational way.

2.4.2.1. *conclusions as to the causes of the occurrence*

The RSD (Art 3 (o)) defines ‘causes’ as *actions, omission, events or conditions, or a combination thereof, which led to the accident or incident.* If eliminated or avoided, these causes would have mitigated the resulting injuries or damage.

The determination of the causes should be based on a thorough, impartial and objective analysis of all the available evidence. No new information should be introduced in the causes. Any condition, act or circumstance that was a causal factor in the accident should however be clearly identified.

Significant events and factors that were investigated in detail, but eliminated as possible causes in the analysis, should also be stated in the report, just as areas of ambiguity. When there is insufficient evidence to establish why an accident occurred, there should be no hesitation in stating that causes remain undetermined.

Finally, the list of causes includes both the immediate causes and the deeper or systemic factors that shaped the occurrence. To arrive at this list, guidance can be found in the 3 causational levels that are defined under point 4.3 of Annex V, being ‘Conclusions’ (see also 2.4.3 of this report).

2.4.2.2. *conclusions as to the performance of the rescue services*

A good working emergency plan is an important control measure to limit or reduce the consequences of an occurrence. Therefore all railway organisations must set up an







emergency plan identifying and specifying the different types and levels (critical, non-critical etc.) of emergencies that might occur. Each plan should be periodically reviewed to ensure that it is up to date and it should provide the details of the actions, alerts and information to be given in case of an emergency.

For each type of emergency the plan should clearly identify and define:

- the different parties/staff interested/involved
- the interfaces between RU, IM and relevant public authorities
- the references for emergency related activities and actions
- processes and procedures to be set in place according to the type of emergency

Rather than just *draw conclusions as to the performance of the rescue services*, the investigation report should form a judgement on the effectiveness and efficiency of both the internal (railway) and the external (public) emergency plan.

A similar analysis, as for the causes of the occurrence, into the organisational factors that shaped the actual (dis-)functioning of the emergency plan can and should be conducted.

### 2.4.3. **Conclusions**

- *direct and immediate causes of the occurrence including contributory factors relating to actions taken by persons involved or the condition of rolling stock or technical installations,*
- *underlying causes relating to skills procedures and maintenance,*
- *root causes relating to the regulatory framework conditions and application of the safety management system.*

2.4.3.1. Under this item ‘Conclusions’ you would only expect a list summarising or describing causal factors, with a cross-reference to the detailed analysis of the findings and evidence earlier in the report. The 3 causational levels that are introduced here should however guide the investigators in the structured and in depth analyses of the occurrence.

A specific guidance with this objective is developed in Task Force 2 on accident causation classification. The results of this development should be integrated in Annex V under the item ‘Discussion’ (to be renamed into ‘Analysis’?). The item ‘Conclusions’ could then be reserved for a summarising list or description, to create a direct link to the following recommendations.

In order to improve the dissemination of safety information and lessons learned at European level, the ERA has adopted the policy to systematically translate all relevant parts of the final accident investigation reports that are published in its Public Database. To help this process, the summary and conclusion should be clearly indicated in the report.

### 2.4.4. **Additional observations**

- *deficiencies and shortcomings established during the investigation, but without relevance to the conclusions on causes.*

2.4.4.1. During railway accident investigations, safety issues are often identified which did not contribute to the investigated occurrence but which nevertheless, are safety deficiencies. These safety deficiencies should be reported in the accident investigation report.

Also other, not safety related observations, that were found during the investigation and are important to report on, can be integrated into the investigation report.





## 2.5. **Measures that have been taken**

— Record of measures already taken or adopted as a consequence of the occurrence.

Annex V foresees only the reporting of measures already taken as a consequence of the occurrence. This presupposes some form of consultation with relevant parties during the investigation process.

Art 22.3 of the RSD yet goes a lot further by stating that: *The relevant infrastructure manager and railway undertakings, the safety authority, victims and their relatives, owners of damaged property, manufacturers, the emergency services involved and representatives of staff and users shall be regularly informed of the investigation and its progress and, as far as practicable, shall be given an opportunity to submit their opinions and views to the investigation and be allowed to comment on the information in draft reports.*

Based on this, it can be concluded that there should be at least an established mechanism to allow comments on the draft version of an accident investigation report. This consultation phase is important to gain a better understanding of both the occurrence and the investigation by all concerned parties, to validate the findings of the investigation and to raise the rate of acceptance of later recommendations. This process and the results of it should consequently be reported in the investigation report.



Several MS already apply, at least partly, such a review or consultation phase. The way they deal with the results of it, is however very different.

In some MS for example, the comments of the concerned and consulted parties are used in an informal way to inform the subsequent redrafting of the final report. The investigator then has considerable freedom over the extent to which he incorporates any changes into his final report. Some also provide feedback to the consulted parties informing them how their comments have been addressed. Alternatively, other NIBs insert these additional comments as a brief appendix to the final report, which is submitted to the regulator.

Both ways can be valuable and acceptable, and any practice should of course follow the relevant national legislation on this point. What is important, in the light of transparency, is that the process as such is mentioned in the investigation report. If however the consultation process should result in any disagreements regarding safety deficiencies or safety actions, these shall be noted in the report.

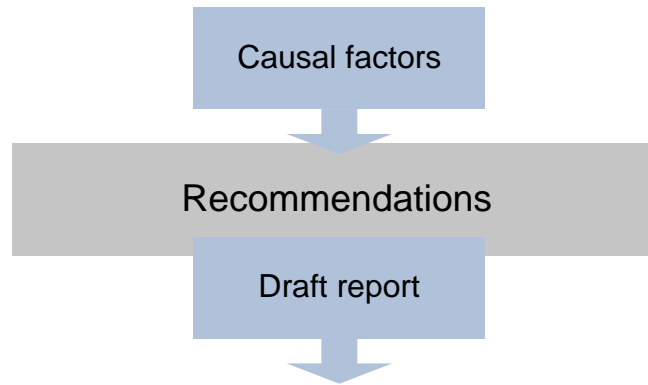
The most appropriate way to report upon this process is in relation with the required documentation of the complete conduct of the investigation (see 2.2.1.5).





**2.6. Recommendations**

The main product from any particular occurrence investigation should be the recommendations that are made in the final report. A recommendation should describe the safety problem and provide justification for safety actions.



**2.6.1. Origin of recommendations**

It should always be possible to understand the reason why a recommendation is issued. This can be realised by creating a clear cross reference to the conclusion(s) the recommendation is based upon or by adding an introductory phrase. This may consist in describing, for each category of causes and causal factors identified:

- a short recall of the influence of this factor in the production of the accident, or in the aggravation of its consequences;
- the exploration and analysis of possible preventive orientations and actions that could play a suitable preventive role in this field;
- if necessary, selection and justification of actions to be proposed in a formal recommendation.

Remember that this approach, which aims to identify preventive actions fastly by stakeholders, may not assign any objective determination of responsibilities.

**2.6.2. Drafting of recommendations**

The way in which safety recommendations are drafted is important. They should guide the affected parties on what safety goal is to be achieved rather than give prescriptive solutions.

General guidelines on formulation and drafting recommendations:

- For clarity, each recommendation should only address one issue.
- If there is more than one recommendation in a report it is useful to number them and group them e.g. according to the addressee (in most cases the NSA) There should be a clear link between one identified cause or contributory factor and a recommendation, unless it is related to an observation not directly linked with the accident or incident.
- A recommendation should be drafted succinctly, avoiding the use of unnecessary or ambiguous words.



- The wording should be such that there is clarity regarding what action/change is required. The addressee must clearly understand which action the NIB recommends.
- The wording of a recommendation should facilitate clear assessment whether the recommended measure is implemented entirely, partly or not at all.
- There should be normally no prioritisation between the issued recommendations. However, if necessary from the viewpoint of the NIB, the urgency of a recommended action may be highlighted.
- Usually a Safety Recommendation should guide the affected parties on what safety objective is to be achieved rather than give prescriptive solutions.

More information on this topic can be found in the guidance on Art.25 of the RSD (ref. – tbd).

In order to improve the dissemination of safety information and lessons learned at European level, the Agency has adopted a policy to systematically translate all relevant parts of the final accident investigation reports that are published in its Public Database. It is clear that also the Recommendations are an important element to be translated, and therefore should be clearly indicated and easy to find in the report.





ANNEX I – CHECKLIST OF TECHNICAL ITEMS OF EVIDENCE WHICH MAY BE COLLECTED

The following checklist comprises items of evidence which may need to be collected following a railway occurrence. This list, based on {Ref. 7} is NOT an exhaustive list

- a) Human factors information
- b) Original copies of train documentation including, where appropriate:
  - i. Train brake certificate
  - ii. Train consist form
  - iii. Dangerous goods documentation
  - iv. Safeworking forms
- c) Train control, signaller, or driver voice recordings:
  - i. Hard copy printout
  - ii. Audio tape
- d) Locomotive or train recording equipment download and analysis:
  - i. Data logger memory module
  - ii. Speed recorder data
  - iii. Data logger or other data analysis report
- e) Track observations, measurements and tests:
  - i. Gauge
  - ii. Superelevation
  - iii. Line
  - iv. Top
  - v. Curvature
  - vi. Track alignment
  - vii. Depression tests
  - viii. Marks on rails and sleepers
  - ix. Rail profile
  - x. Rail fastenings
- f) Signal testing:
  - i. Signal function test
  - ii. Signal sighting test
  - iii. Locking test
  - iv. Aspect test
  - v. Data logging records
- g) Rolling stock measurement and testing:
  - i. Air brake testing
  - ii. Wheel profile measurement
  - iii. Twist testing of vehicles
  - iv. Vehicle weight measurement
  - v. Testing of bogies, damping, springs, and centre pivot point
  - vi. Sidebearer clearance measurement
  - vii. Braking distance testing
- h) Weather condition information:
  - i. Light conditions
  - ii. Rainfall and quantity
  - iii. Wind conditions
  - iv. Temperature
- i) Ultrasonic testing of metal components
  - i. Wheels
  - ii. Axles
  - iii. Bogies
  - iv. Underframes



- j) Geotechnical examinations:
  - i. Track formation
  - ii. Embankments
  - iii. Tunnels
  - iv. Bridges
- k) Environmental testing and measurement:
  - i. Soil
  - ii. Water
  - iii. Noise
  - iv. Vibration

