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European Railways Accident Investigation Boards and actions to prevent further accidents: Best practices and gaps to fill

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1. Abstract

A Railway National Investigation Accident Body (NIB) exists in each European country. It is often part of the Ministry of Transport but is normally operationally independent. Its purpose is to investigate accidents and hazardous situations in order to improve safety and to prevent further accidents from occurring.

This paper focuses firstly on the public reports published by six NIBs. Huge differences exist between countries in terms of annual number of published reports, and the same could be stated for the quantity and the quality of the information they provide.

Secondly, the document insists on why it is important to publish comprehensive reports and thematic studies that refer also to similar cases dealt with by foreign NIBs, and in collaboration with the latter.

Thirdly, this contribution promotes tight and clear communication between national NIBs, their Railway National Safety Authorities (NSA) and the European Railway Agency (ERA). Such multi-lateral collaborations, including also Infrastructure Managers (IM) and Railway Companies (RU), are paramount in the quest to increase significantly and rapidly the safety level in railways, and thus to avert accidents that wait to happen.

2. Introduction

A Railway Accident Investigation Body (NIB) exists in each European country. Its purpose is to investigate accidents and hazardous situations in order to improve safety as well as to prevent further accidents from occurring. Let Carolyn Griffiths, Chief Inspector of Rail Accidents, define its scope[1]:

> *"Our purpose for investigating an accident or incident is to improve the safety of the railways, and to prevent further accidents from occurring.*
>
> *We achieve this by identifying the causes of accidents and other aspects that made the outcome worse.*
>
> *Our investigations are entirely independent and are focused solely on safety improvement - we do not apportion blame or liability, nor do we enforce law or carry out prosecutions."*

All NIB follow the same objective, stating their independence and refraining from dealing with liability issues.

The reality is somehow different. Independence of NIB is effective during the investigation but, sometimes and in some countries, this independence could be questioned when they formulate recommendations. In particular, the ratio cost/advantage of a recommended action is often taken into account by NIB before writing a recommendation. In fact, such an evaluation should be made by the National Safety Authorities (NSA) or, even, by the railways themselves. Moreover, accident[2] reports published by NIB are used in courts and some verdicts are based on them.

All these reasons make it important to obtain high quality reports from NIB. Standardizing the structure of reports through Europe can also help NIB, NSA and safety consultants and researchers to compare similar accidents, even if reports are written in different languages. For that, it is also important to collect those reports in the European ERAIL database and to develop a more performing filtering tool.

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[1] Extracted from http://raib.gov.uk/home/index.cfm.

[2] In this paper, if nothing is specified, accident is the generic term for accident, incident, or near miss (see also glossary)

3. NIB Public reports

Some preambles of the European Directive 2004/49/CE:

> *"Serious accidents on the railways are rare. However, they can have disastrous consequences and raise concern among the public about the safety performance of the railway system. All such accidents should, therefore, be investigated from a safety perspective to avoid recurrence and the results of the investigations should be made public[3]. Other accidents and incidents could be significant precursors to serious accidents and should also be subject to safety investigations, when it is necessary." [23]*

> *"The reports on investigations and any findings and recommendations provide crucial information for the further improvement of railway safety and should be made publicly available at Community level. Safety recommendations should be acted upon by the addressees and actions reported back to the investigating body." [25]*

This European Directive gives also the definition of a serious accident:

> *""serious accident" means any train collision or derailment of trains, resulting in the death of at least one person or serious injuries to five or more persons or extensive damage to rolling stock, the infrastructure or the environment, and any other similar accident with an obvious impact on railway safety regulation or the management of safety; "extensive damage" means damage that can immediately be assessed by the investigating body to cost at least EUR 2 million in total." [art.3 – definition (l)]*

European Directive 2004/49/CE transposes the preamble [23] to art. 19, al.1:

> *"Member States shall ensure that an investigation is carried out by the investigating body referred to in Article 21 after serious accidents on the railway system, the objective of which is possible improvement of railway safety and the prevention of accidents"*

and the preamble [25] to art. 23, al. 1 and al.2:

> *"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. The reports shall state the objectives of the investigations as referred to in Article 19(1) and contain, where appropriate, safety recommendations."*

> *The investigating body shall make public the final report in the shortest possible time and normally not later than 12 months after the date of the occurrence. The report shall, as close as possible, follow the reporting structure laid down in Annex V[4]...."*

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[3] Underscores and bold type are add by the author.

[4] See explanations in Annexe 5.7.2 of the present document.

3.1 Geographic scope

Analysis of NIB reports requires sufficient knowledge of the language in which they are written. This limitation has leaded this author to make a first selection based on the three Swiss official languages: German, French and Italian. This practicality led to selecting Austria, Germany, France and Italy.

The United Kingdom was a very interesting case regarding to the production of railway accident report as each report is very comprehensive and more than 1'300 pages of reports are produced yearly by RAIB.

Switzerland has been added to this list of countries for at least four reasons: a) about 50 reports are published each year, b) reports are written in German, in French or in Italian according to the location of the accident, c) accidents are not only those from the national network but also from various "private" railways, and d) Switzerland is not part of the European Union.

3.2 Accessibility and search tools

3.2.1 Accessibility

The accessibility of reports is of great importance when one has to learn rapidly from occurrences related to safety and to prevent similar accidents.
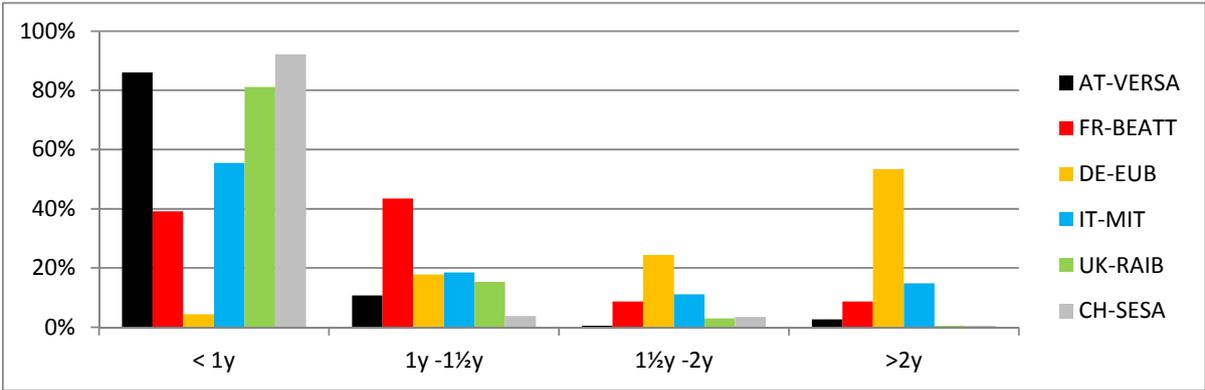

Figure 3.1: Availability of reports after the date of occurrence

Germany and - to a lesser extent - France and Italy have a significant part of their investigations reports published later than 1½ year after the event. Except for Switzerland, where deep investigations are very rare, the delay between the accident and the publication of the report generally exceeds 1 year.

For some accidents (derailments hard to analyse, accidents with international implications, material expertise, etc..), the risk of not respecting the deadline of publication is high.

Proposal 1, concerning the deadline between the accident occurrence and the publication of the report:

> The investigation body shall by all means try to release the final report in the shortest possible time. If it becomes clear that a final report will be not ready to be published within 18 months, an intermediate report shall be published within this time frame.

3.2.2 Search tools

		Date of occurrence	Type of accident	Cause of accident
Austria	AT-VERSA	Yes	No	No
France	FR-BEATT	Yes	No	No
Germany	DE-EUB	Yes	**Yes**	No
Italy	IT-MIT	**No**	No	No
United Kingdom	UK-RAIB	Yes[5]	No	**Yes**
Switzerland	CH-SESA	Yes	**Yes**	No
European Union	EU-ERAIL	Yes	**Yes**	**Yes**

Table 3.2: Ability of NIB databases to organize and to filter reports

At this time, ERAIL database is with no doubt the best tool to search within a single report or among a group of investigation reports. Today, with the exception of CH-SESA, all final reports are included in the ERAIL database.

Proposal 2a, concerning the relation between NIB databases and ERAIL:

> *A link to the ERAIL database shall be clearly visible on each NIB accident report main page.*

Proposal 2b, concerning the relation between Switzerland and ERA:

> *CH-SESA should transmit its final report to ERAIL the same way as other European countries.*

The quality of the filter tool of ERAIL is not sufficient to list "similar accidents" and lists of proposed items are not totally consistent.

Proposal 3a, concerning the filter "occurrence type":

> *Le list of "occurrence types" provided by the ERAIL filter should be enhanced.*

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[5] Not totally true (cf. §.5.5.1)

Some examples shown in §.5.7.2 show the need for such a revision. A clear partition of types of accidents has to be proposed with, if possible, no overlap and a minimum of cases to be put in a unique "other" category.

Proposal 3b, concerning the filter "cause":

> *The list of "causes" provided the ERAIL filter should be developed.*

ERAIL proposes 23 different causes, whilst RAIB proposes 49 (cf. tab.5.5.0). It should be taken into account that a cause is a contributory factor, and not a consequence.

Today, the "similar accident" list provided by ERAIL when a report is chosen is not very useful (cf. §.5.7.2). With performing "occurrence type" and "cause" filters working close together the "similar accident" list provided by ERAIL can be valuable.

Proposal 3c, concerning the construction of the "similar accident" list

> *The "similar accident" list of ERAIL shall be built using a combination of the "cause" and "occurrence type" filters.*

Proposal 3d, concerning the completeness of the "similar accident" list

> *The "similar accident" list of ERAIL shall list all the accident reports obtained by combination of the "cause" and "occurrence type" filters.*

3.3   Recommendation, learnings points and actions already taken

The following table indicates the percentage of reports containing no recommendations.
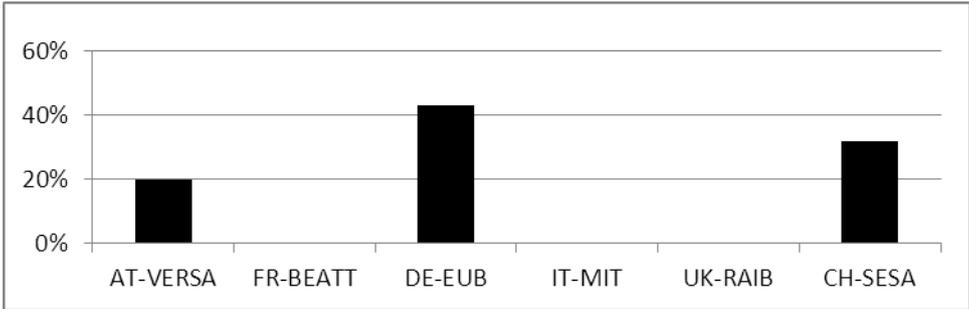

Figure 3.3: Percentage of reports mentioning neither "actions already taken"
nor learnings points, nor recommendations

It seems than countries with a German cultural heritage are more reluctant to address recommendations. Best practice is found in the RAIB reports. Their reader can take note all the findings of the accident pinpointed by NIB inspectors:

- Actions already taken. Such measures can be of great help to prevent similar accidents through Europe.

- Recommendations. Even if recommendations are not mandatory for other countries, they can be of great help to prevent similar accidents. Systematically, recommendations are made by RAIB in their reports.

- Learning points. Even for very short reports (Bulletins), RAIB present learning points.

Even if neither recommendation nor "action already taken" is mentioned, each event has something to teach. Even if no change has to be made to the system or to rules and procedures, learning point help railways to insist on specific points during staff training or evaluation.

Proposal 4a, concerning actions already taken, learnings points and recommendations in the summary part of the report:

> *At least in the summary part, reports shall clearly mention actions already taken, learnings point and recommendations.*

Proposal 4b, concerning mention of actions already taken, learnings points and recommendations in a report or in a short report:

> *At least one "action already taken", one recommendation or one learning point should be reported.*

3.4   Production, content and structure

3.4.1   Production and content

It's amazing how big the difference between countries is. No direct explanations can be found.
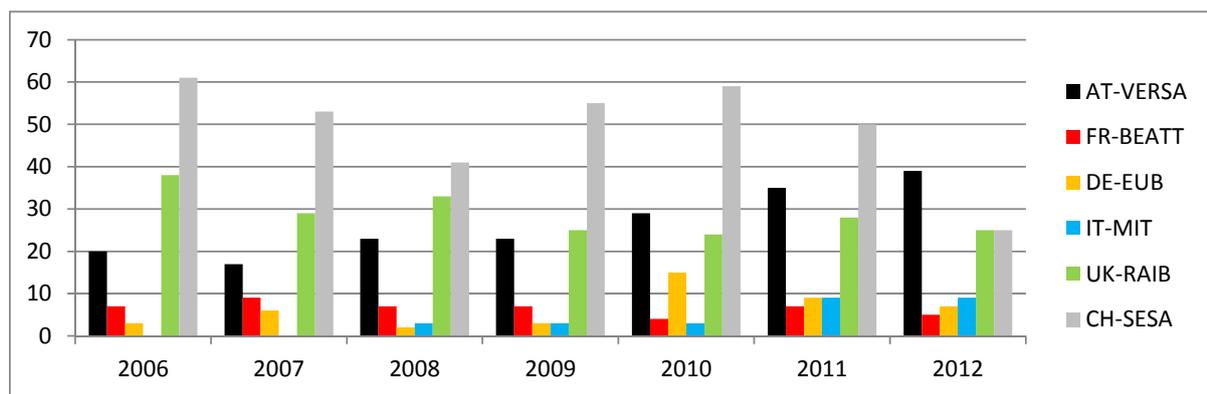

Figure 3.4: Number of final reports produced per year

Proposal 5, concerning decision to investigate a case and to produce a report:

> *Conditions leading automatically to investigate a case and to produce reports could be fixed at a European level.*
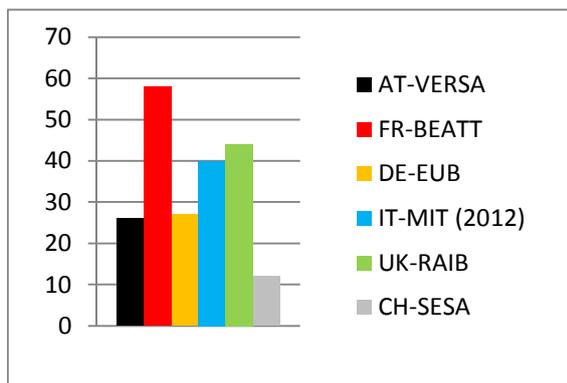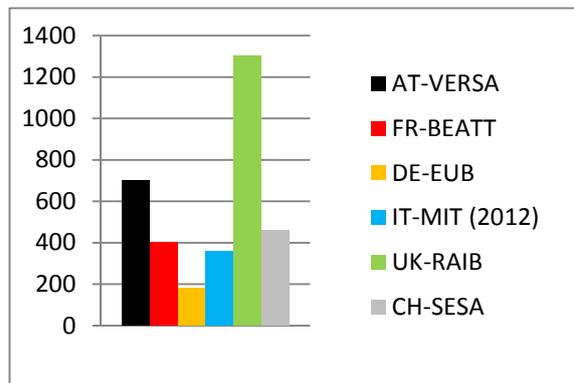
Figure 3.5: Mean number of pages
per report

Figure 3.6: Number of report pages
produced per year

Proposal 6, concerning the depth of the investigation:

> *The depth of the investigation should be increased in some countries, except if the NSA compares itself similar accidents.*

Proposal 7, concerning NIB staff:

> *The NIB staff shall be sized according to the consequences of application of proposals 5 and 6.*

In this paper, the five categories of accidents and near misses (NM) are: LC Collision[6], RS-RS Collision, Collision against Obstacle/Person, Derailment and Other.

They do not match exactly the categories of the Directive 2004/49/CE:

> *"accident" means an unwanted or unintended sudden event or a specific chain of such events which have harmful consequences; accidents are divided into the following categories: collisions, derailments, level-crossing accidents, accidents to persons caused by rolling stock in motion, fires and others;" (art.3 def. k).*

Near miss (NM) reports were also considered in this study as their analysis can prevent serious accidents.

Some near miss situations cannot strictly be attributed to a specific category. By example, a runaway could lead to a RS-RS collision or a derailment.

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[6] LC Collision: Collision or Near Miss (NM) at Level Crossing (LC) between a railway move and a LC user. RS-RS Collision: Collision or NM between one movement (train, shunting, runaway) and another stalled or moving Rolling Stock (RS), both RS respecting the gauge.

Collision against Obstacle/Person: collision or NM between one movement and an Obstacle/Person entering its gauge, or direct or indirect collision due to an object associated to the movement leaving the RS gauge. Accidents concerning a person and a platform or a door at station are place in the category "other".
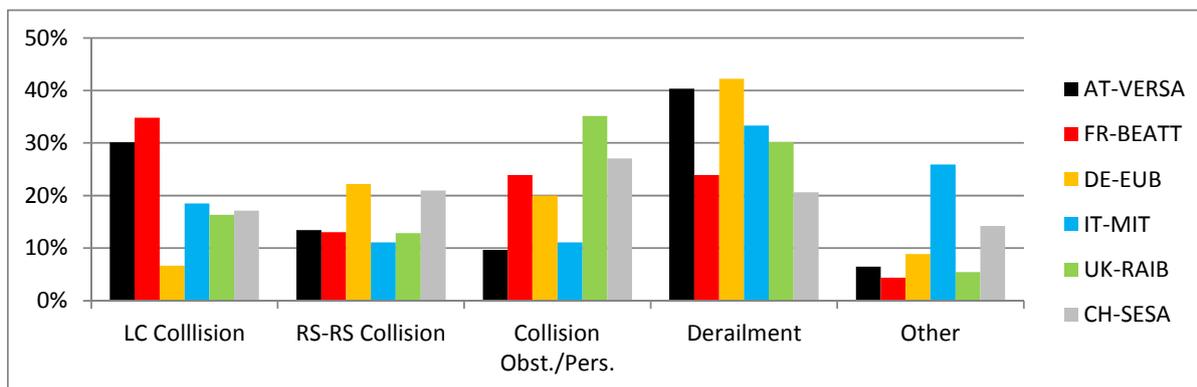
Figure 3.7[7]: Percentage of reports according to the five main event categories
(a NM is normally count either in the RS-RS Collision or the Derailment category)

The proportion of NM reports is quite low, except in the UK, where one report over five is a NM report. However, analyses of NM can play an important role in the accident prevention process.
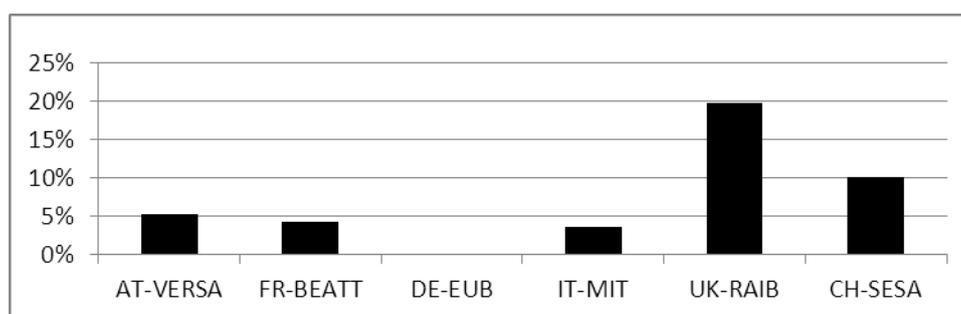

Figure 3.8: Percentage of Near miss reports

Proposal 8, concerning reports about NM:

> *NIB shall be informed about NM, in particular about SPAD[8]. NIB could decide to investigate the case.*

3.4.2 Structure

According to the Directive 2004_49_EC, the structure and principal content of investigation report shall be organized in six main sections: Summary, immediate fact of the occurrence, record of investigations and inquiries, analysis and conclusions, measures that have been taken, recommendations.

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[7]   Short reports and Bulletins are included

[8]   SPAD: Signal Passed At Danger

Proposal 9a, concerning the main structure of reports

> *Each final report shall be organized in six main sections named according to the Directive. These sections will be numbered from one to six.*

Proposal 9b, concerning the structure of the sections of the reports

> *Each report main sections should be divided in chapters. Chapters should be named and numbered according to a European template.*

Proposal 9c, concerning the structure of short reports

> *Short reports shall be organized in three sections: Description, investigation and analysis, and findings. Short reports should normally not exceed 10 pages.*

The summary section is of very important, in particular if the report is not written in English.

Understanding a report written in a foreign language is sometimes quite difficult. It's even often hard to find in the report the important parts that need to be translated. Following the example or the European Accident Statement form, ERA, NIBs and stakeholders should develop a European Accident Investigation Summary form.

Proposal 10, concerning a European standard summary form:

> *A European Investigation Summary Form (EISF) shall be developed. Numbering and coded answers in structured and restricted lists will help foreign language readers to understand. Sentences in the national language of the investigation report will be clearly grouped to ease the translation.*

An example of such EISF is given in Annex 5.7.4.

Coordination between proposals 3 (ERAL filtering) and 10 (EISF) will be of great benefit.

4. Main conclusion and recommendation

Huge differences exist effectively between countries in terms of annual number of published reports, quantity of the information they provide, easiness to find similar events, and understanding reports written in foreign language.

Centralisation of standardized reports in the ERAIL database has to be promoted. For that, the 10 proposals contained in this paper should be examined carefully by NIB, NSA and ERA according to the legal framework they are working within.

5. Annexes: Six country reports and ERAIL

5.1 Austria

5.1.1 Reports: accessibility and general data

Main Web page:

http://www.bea-tt.developpement-durable.gouv.fr/les-enquetes-techniques-r3.html

This page is hosted on the web site of the Ministry of Transport.

From this page one can access:

- Reports (http://versa.bmvit.gv.at/index.php?id=219)

- Short and Special reports (http://versa.bmvit.gv.at/index.php?id=337)

In each of those two web pages, reports are listed chronologically according to the date of the accident/incident from the more to the less recent ones. There is no possibility to filter or organise this list according to criteria such as type of accident, causes or consequences.

The collection of reports available from the web page of "Versa" began in year 2008[9].
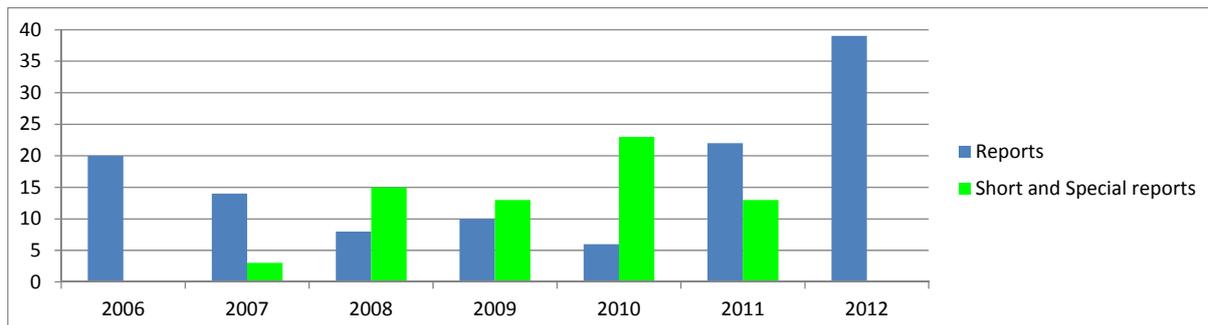

Figure 5.1.1   Number of reports per year (average: 26½)

The production of reports was continuously increasing these last years. "Short and special" reports can be shorter than 5 pages or longer than 90 pages (cf. fig. 5.1.2). Therefore, since year 2012, only "standard" reports were produced.

4 reports contain more than 100 pages. All four are dealing with derailments.

The average number of pages produced is 700 per year.

86% of reports are published less than one year after the accident/incident. One derailment investigation took more than 18 months before being published and three RS-RS collisions were investigated for more than 2 years.

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[9] Reports of years 2006 and 2007 are issued from the private collection of the author.

A third of the number of reports has dealt with collisions at Level Crossing (LC) and about 40% are concerning derailments.
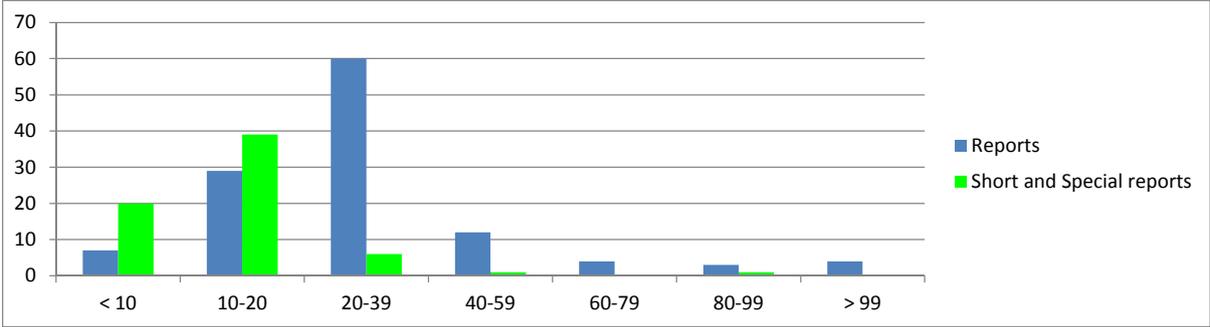

Figure 5.1.2   Number of reports per number of pages
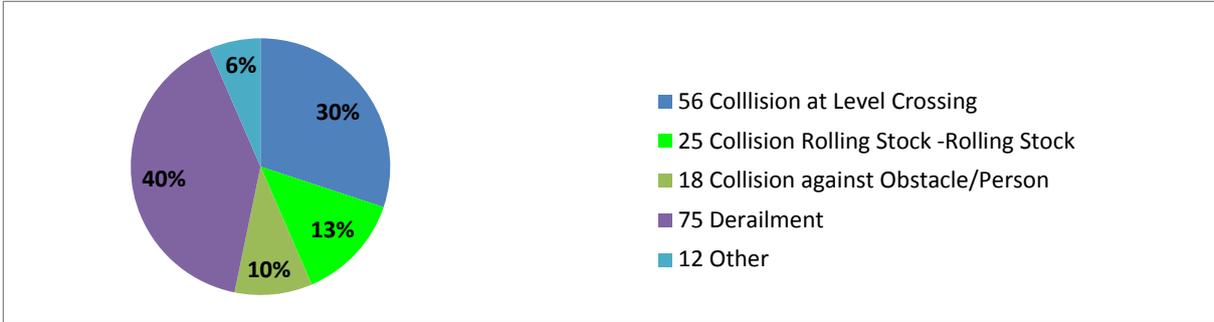(average number of pages per report: 26)

Figure 5.1.3   Number of reports per type of real or possible consequences

5.1.2   Reports: structure and content (2012)

The reports are written in German. Each report follows the same structure: Glossary, introduction, summary (chap. 1), possible summary in English, general data (chap. 2), events preceding the accident (chap. 3), injuries, damage and traffic hindrance (chap. 4), involved parties (chap. 5), key facts and analysis (chap. 6), conclusions (chap. 7), actions already taken (chap. 8), other (chap. 9), cause (chap. 10), position statements taken into account (chap. 11), recommendations (chap. 12) and annexes. The sub-chapters and sub-parts of them are numbered.

If an English summary is added, the numbering of chapters is shift.

The summary contains a short description of events, the immediate cause and the contributory factors. Unfortunately, it mentions neither the recommendations nor to whom they are addressed.

About 20% of reports contain neither recommendations and nor learning points, but some others contain ten or more recommendations.

Reports bring a lot of relevant information thanks to photos, schemes, figures, formulas, abacuses, and outputs of the Juridical Recorder Unit (JRU).

5.2   France

5.2.1   Reports: accessibility and general data

Main Web page: http://www.bea-tt.developpement-durable.gouv.fr/.

This page is hosted on the web site of the Ministry of Transport.

From this page one can access:

- Reports concerning the accidents at LC on the national rail network
(http://www.bea-tt.developpement-durable.gouv.fr/les-passages-a-niveau-r109.html)

- Reports concerning other accidents on the national rail network
(http://www.bea-tt.developpement-durable.gouv.fr/les-transports-ferroviaires-r9.html)

- Reports concerning accidents on other French railway lines and other guided modes
(http://www.bea-tt.developpement-durable.gouv.fr/les-transports-guides-r10.html)

In each of the three web pages, reports are listed chronologically according to the date of the accident/incident from the more to the less recent ones. There is no possibility to filter or organise this list according to criteria such as type of accident, causes or consequences. Nevertheless, this lack of filter is not critical as the total number of reports published is quite small.
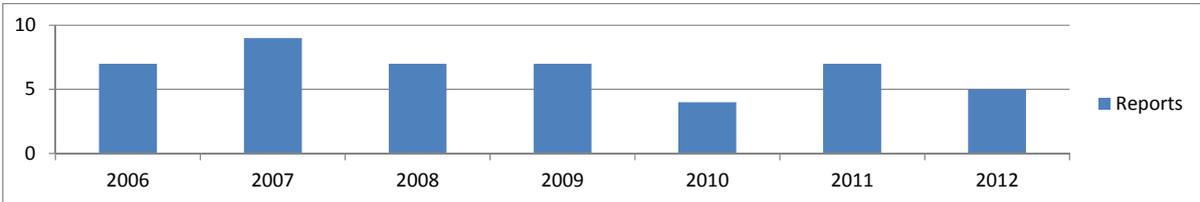

Figure 5.2.1   Number of reports per year (average: 6½)

The production of reports is very low along the years but each report analyses very deeply the accident even when the causes and consequences seem evident.
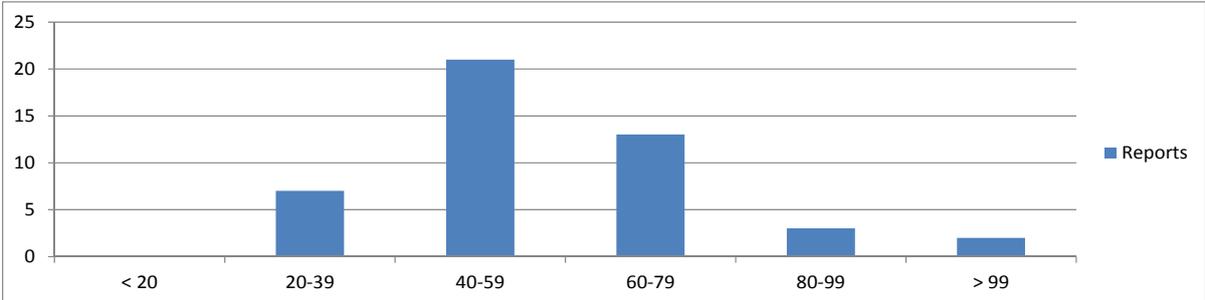

Figure 5.2.2   Number of reports per number of pages
(average number of pages per report: 58)

Two reports contain more than 100 pages. One is dealing with a collision on an international section (Luxembourg-France) with 6 fatalities. The other analyses a brand case in the Eurotunnel between France and the United Kingdom.

The average number of pages produced is 400 per year.

39% of reports are published within one year after the accident/incident and 43% between 1 and 1½ year. Four reports were produced more than 2 years after the date of the event. Among them, we find the two international investigations mentioned just before.

A third of the number of reports has dealt with collisions at LC, a quarter with collisions against an obstacle/person and another quarter with derailments. One has to be careful with these percentages as the number of reports is quite small.
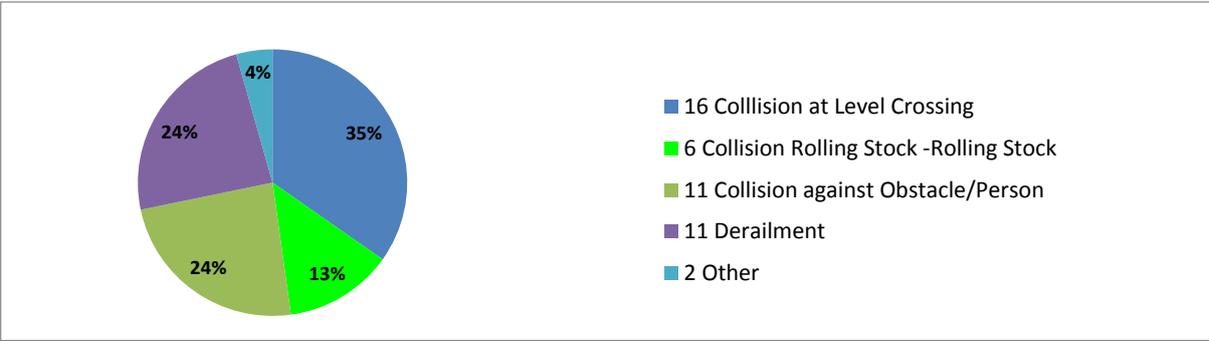

Figure 5.2.3   Number of reports per type of real or possible consequences

5.2.2   Reports: structure and content (2012)

The reports are written in French. Each report follows the same structure: Glossary, summary, immediate fact of the occurrence (chap. 1), accident context (chap. 2), record of investigations and inquiries (chap. 3), sequence of events and rescue (chap. 4), analysis of causes and contributory factors (chap. 5), conclusions and recommendations (chap. 6) and annexes. The sub-chapters and sub-parts of them are numbered.

In one report the chapter 3 was divided in two chapters and the numbering of later chapters was shift.

The summary contains a short description of events, the immediate cause, the contributory factors, the recommendations and to whom they are addressed.

Each report contains at least one recommendation, action already taken or learning point.

About 50% of reports contain 3 to 5 recommendations.

Reports bring a lot of relevant information thanks to photos, schemes, figures, formulas, and outputs of the JRU.

5.3   Germany

5.3.1   Reports: accessibility and general data (2012)

Main Web page: http://www.eisenbahn-unfalluntersuchung.de/SiteGlobals/Forms/Suche/EUB/DE/EUB_Untersuchungsberichte_StartFormular.html?nn=1075760. This page is hosted on its own web site.

The reports are listed chronologically according to the date of the accident/incident from the more to the less recent ones but this order can be inverted. It is also possible to list the reports according to the date of events or the location the event took place. Finally it is possible to list or to filter events according the type of accident.

The seven consequence types are: accident at level crossing, rolling stock brand, accident of person, special collision, special railway operation accident, train derailment, train collision.
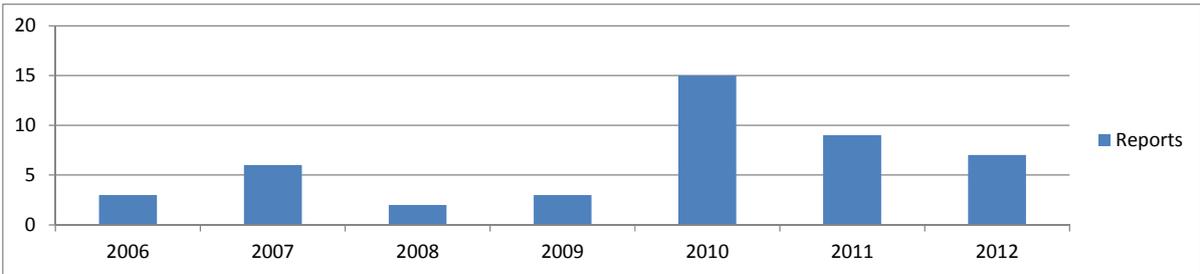

Figure 5.3.1   Number of reports per year (average: 6½)

The production of reports is low and varies along the years. Normally, reports do not contain many pages.
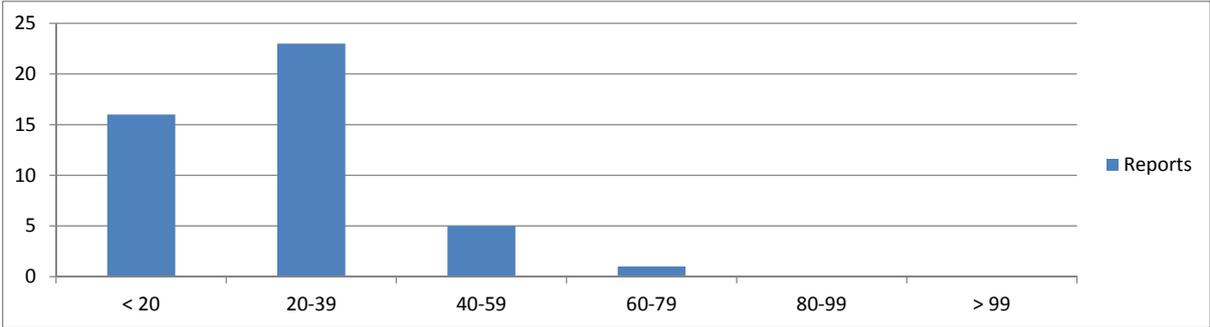

Figure 5.3.2   Number of reports per number of pages
(average number of pages per report: 27)

Only one report contains more than 60 pages. It is dealing with a train collision with more than 10 injured people.

The average number of pages produced is 180 per year.

Only 4% of reports were published less than one year after the accident/incident, but 53% have being published later than 2 years after the date of the event.

Surprisingly, only a few numbers of reports has dealt with a collision at LC. 40% has explained collisions A fifth has studied derailment and another fifth RS-RS. However, we have to be careful with these percentages as the number of reports is quite small.
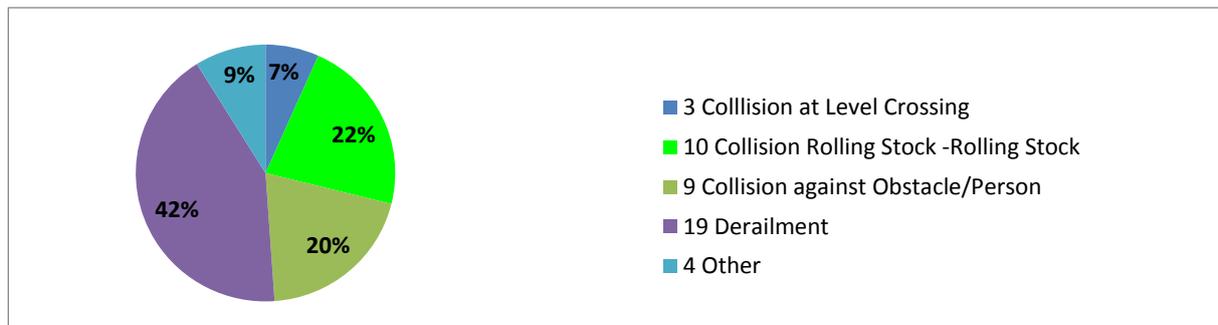

Figure 5.3.3   Number of reports per type of real or possible consequences

5.3.2   Reports: structure and content (2012)

The reports are written in German. Each report follows the same structure: Possible introduction (chap. 0), summary (chap. 1), opening remarks (chap. 2), event description (chap. 3), analysis (chap. 4), evaluation and conclusions (chap. 5), actions already taken (chap. 6), recommendations (chap. 7) and annexes. The sub-chapters and sub-parts of them are numbered.

Chapters 6 and 7 are omitted if they are irrelevant. If chapter 6 is omitted, then chapter 7 is renumbered 6.

The summary contains a short description of events, the consequences, the immediate cause and sometimes the contributory factors and the actions already taken. Unfortunately, it mentions neither the recommendations nor to whom they are addressed.

More than half the number of reports contains no recommendations.

Reports bring a lot of relevant information thanks to photos, schemes, figures, formulas, and outputs of the JRU.

5.4   Italy

5.4.1   Reports: accessibility and general data (2012)

Main Web page: http://www.mit.gov.it/mit/site.php?o=vc&lm=2&id_cat=223. This page is hosted on the web site of the Ministry of Transport.

The reports are listed chronologically according to the date of the report publication from the more to the less recent ones. There is no possibility to filter or organised this list according to criteria such as date of occurrence, type of accident, cause or consequence. Nevertheless, this lack of filter is not critical as the total number of reports published is quite small.
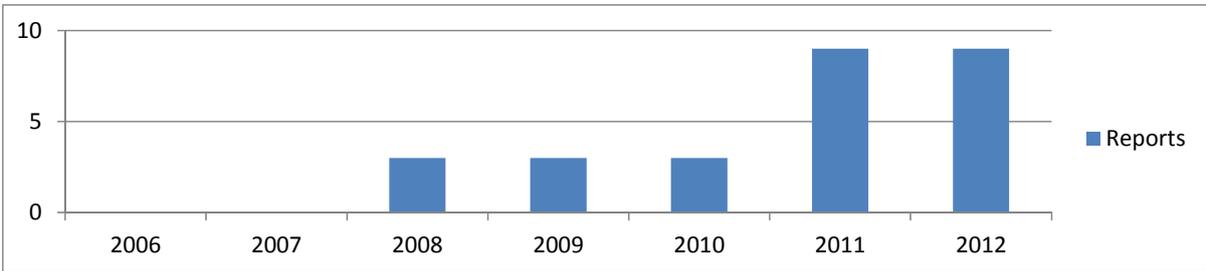

Figure 5.4.1   Number of reports per year (average 2006-2007:0, 08-10:3, 11-12:9)

The production of reports is very low but the number of report per year has tripled in year 2011. The variation of the length of the reports is quite high.
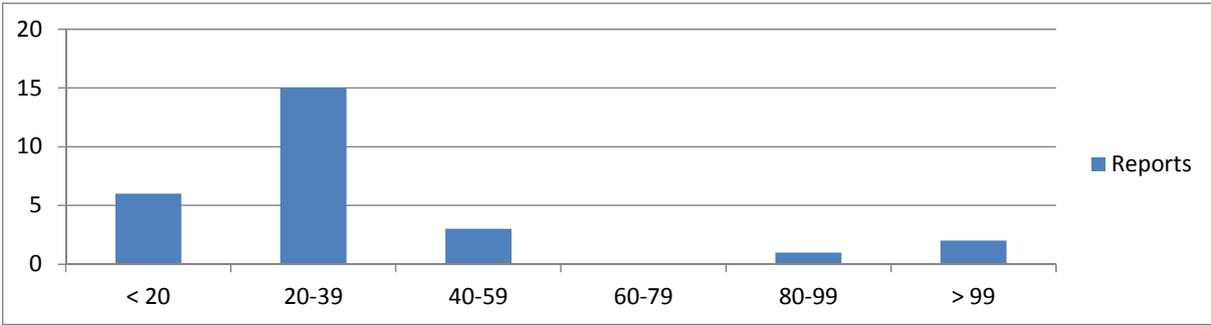

Figure 5.4.2   Number of reports per number of pages
(average number of pages per report: 28 for the first group, 110 for the last one)

Two reports contain more than 100 pages. Both are dealing with derailment. One of two is even completed by a small video explaining the different hypothesis.

Between 2008 and 2012, the average number of pages produced is 150 per year.

56% of reports are published less than one year after the accident/incident. Four reports are published later than two years after the event. Among them, one can find the two reports with very complex analysis of derailments (the reports with more than 100 pages).

A third of the number of reports has dealt with derailment and a fifth with collisions at LC. We have to be careful with these percentages as the number of reports is quite small.
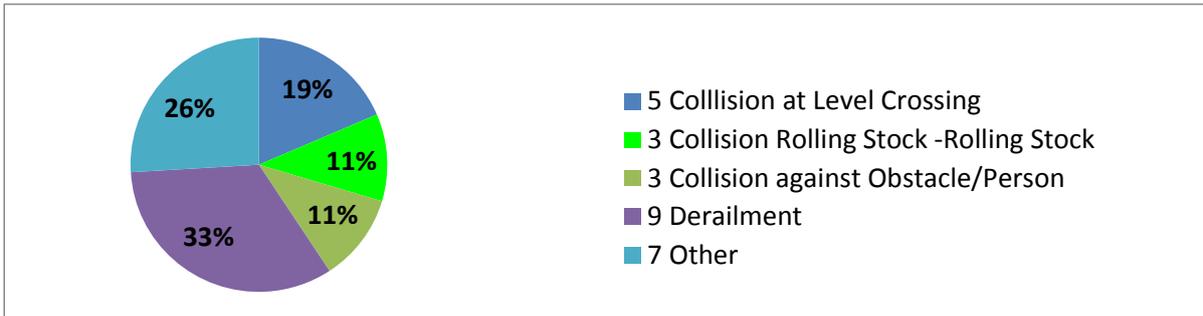
Figure 5.4.3   Number of reports per type of real or possible consequences

5.4.2   Reports: structure and content (2012)

The reports are written in Italian. The computerized version is a scanning of the paper version. Each report follows its own structure. However, chapter, sub-chapters and sub-parts of them are numbered.

The summary contains only a short description of events.

Reports bring some relevant information thanks to photos and schemes, figures, formulas, and outputs of the JRU. Unfortunately, annexes are not available.

50% of the reports contain 3 and 5 recommendations.

5.5   The United Kingdom of Great Britain

5.5.1   Reports: accessibility and general data

Main Web page: http://raib.gov.uk/publications/investigation_reports.cfm. This page is hosted on the web site of the government.

Reports and Bulletins are listed chronologically according to the date of the report publication from the more to the less recent ones. Bulletins are very short reports with no recommendations but learning points.

The date of the accident/incident can be found in the title of the report. A filter (http://raib.gov.uk/publications/search_publications.cfm) can help us to find all reports the incident happened between two dates, but chronological order is not respected.

The web page

http://raib.gov.uk/publications/immediate_cause_and_causal_factors_database/immediate_cause___investigation_reports.cfm gives the opportunity to use a two level filter to group investigation reports according to the immediate cause of the accident/incident. There are 49 immediate cause categories.

Filter (1st step)	Filter (2nd step)	# of reports[10]
Third party	- Third party	35
Signalling & Telecommunications	- Interlocking and control circuitry (eg electronic / relay / mechanical)	1
	- Level crossing equipment (eg barriers, signals)	3
	- Signal control (eg box, control centres)	1
	- Train detection and block signalling (eg track circuits, axle counters)	1
Infrastructure	- Bridges, viaducts, structures (eg retaining walls)	7
	- Formation, earthworks, land use	6
	- Level crossings (not signalling - eg sighting, surface, signage)	4
	- Obstruction on the line	3
	- Power supply (eg substations / contact line / catenary / 3rd rail conductor rail)	3
	- Track - plain line (eg rails, joints, rail components, bearers) layout / design	18
	- Track - switches & crossings (eg switch machine, detection, stretchers, locking, layout / design)	14
	- Tunnels	3
Operations and engineering activities	- Degraded mode operations (eg level crossings, signalling)	1
	- Operation and management of level crossings (hazard identification and risk assessment)	2
	- Protection of staff and trains during engineering, when working (eg maintenance and possession planning issues, including near	14

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[10]   Stand: 23rd of March 2015

	miss/injury/death of employees undertaking maintenance or repairs)	
	- Shunting and yard management	2
	- Train dispatch (eg platform/ dispatch staff/ hand-signalling)	5
	- Train driving	23
	- Train management (eg guard, train manager)	1
	- Train operation & control (eg management, movement instructions & effective communication)	7
Locomotive or Traction	- Braking System	2
	- Coupling system	1
	- Doors	1
	- Power collection (pantograph / shoe-gear)	2
	- Traction system (control / supply / drive / motors / aux power)	1
	- Wheel / axle / bogies and suspension	1
Wagons	- Braking System	3
	- Coupling system	2
	- Doors	2
	- Gauge infringement	3
	- Vehicle / track interaction (or wheel rail interface)	9
	- Vehicle structure	2
	- Wheel / axle / bogies and suspension	3
Multiple Units	- Coupling system	1
	- Traction system (control / supply / drive / motors / aux power)	1
	- Vehicle / track interaction (or wheel rail interface)	2
	- Vehicle structure	1
	- Wheel / axle / bogies and suspension	1
Carriages	- Doors	2
	- Wheel / axle / bogies and suspension	2
Maintenance Vehicles RRV / OTM / Trolleys / Tampers	- Braking System	7
	- Coupling system	1
	- Human machine interface - cab / ergonomics / environment -- Road Rail Vehicles (RRV)	1
		1
	- Traction system (control / supply / drive / motors / aux power)	1
	- Vehicle structure	2
	- Wheel / axle / bogies and suspension	1
Steam Engines	- Boiler, smoke box, or fire box	2
	- Control and communications	2

Table 5.5.0   List and classification of reports according to the immediate cause
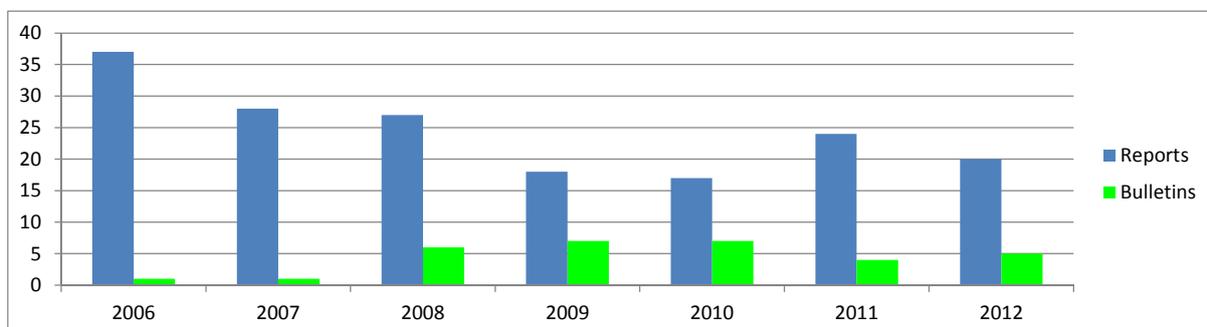

Figure 5.5.1   Number of reports per year (average: 24½)

The production of reports is quite high. Variations are normal. Normally, reports contain many pages. Bulletins have only a small number of pages.

Three reports contain more than 100 pages. Two of them are dealing with a train derailment and the last one is the famous Eurotunnel brand (cf. §.5.2.1).

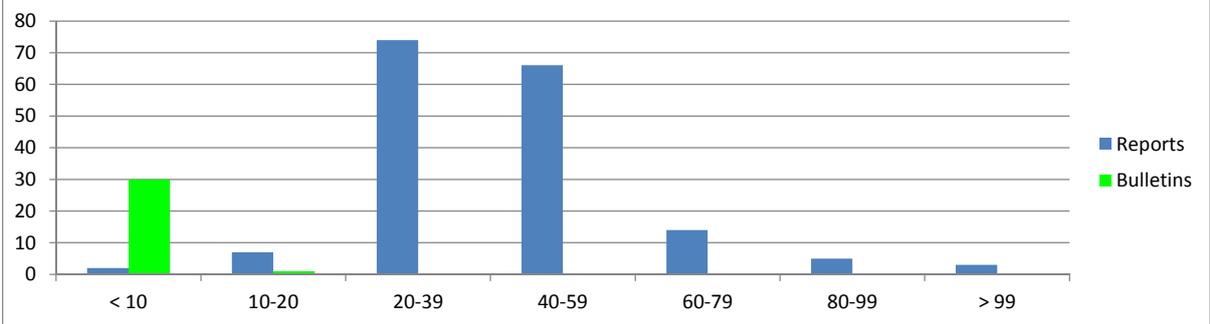The very important average number of pages produced is 1'300 per year.

Figure 5.5.2 Number of reports per number of pages
(average number of pages per report: 44 / per bulletin: 5½)

81% of reports are published less than one year after the accident/incident and only 3% were published between 1½ and 2 year.

No report, produced but RAIB alone, took more than two years before being published.

A third of the number of reports has dealt with collisions against an obstacle/person and another third has examined derailments.
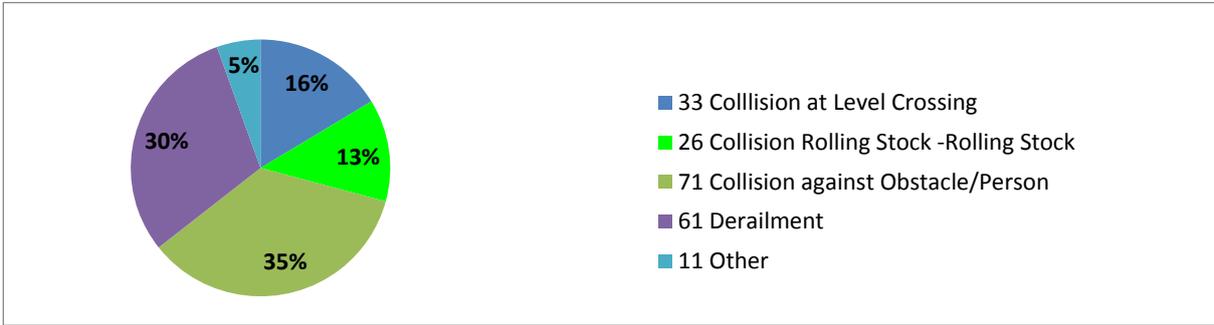

Figure 5.5.3 Number of reports per type of real or possible consequences

5.5.2 Reports: structure and content (2012)

The reports are written in English. Each report follows the same structure: summary, introduction, the accident, the investigation, key facts and analysis, summary of conclusions, previous RAIB recommendations relevant to this investigation, actions reported as already taken or in progress relevant to this report, learnings points, and appendices. Chapters and sub-chapter have non-numbered headers. Each text paragraph is numbered but the total number of text paragraphs in a report varies a lot.

The summary contains a short description of events, the factors having led to the accident and the nature of each recommendation and its addresses as well.

A report contains at least one recommendation or learning point or action already taken. A bulletin contains at least one learning point.

Reports bring a lot of relevant information thanks to photos, schemes, figures, formulas, and outputs of the JRU. The highlighting of recommendations in light pink helps to find them rapidly.

RAIB reports are based on a very good template but chapters and sub-chapters should be numbered.

5.6 Switzerland

5.6.1 Reports: accessibility and general data

Main Web page for French speakers:
http://www.sust.admin.ch/fr/dokumentation_bahnen_schiffe_berichte_ueber_ereignisse_such
en.html. This page is hosted on the web site of the government.

The last reports are listed chronologically according to the date of the report publication from the more to the less recent ones.

The web page
http://www.sust.admin.ch/fr/dokumentation_bahnen_schiffe_berichte_ueber_ereignisse_such
en.html offers the possibility to filter events according to the date of the occurrence of the accident/incident or according to the kind of accident/incident.

The 14 kinds of accidents are: with electricity, shunting, person, staff, collision, collision at protected LC, collision at unprotected LC, load displacement, derailment, brand, near miss, axle break, coupling break and other.
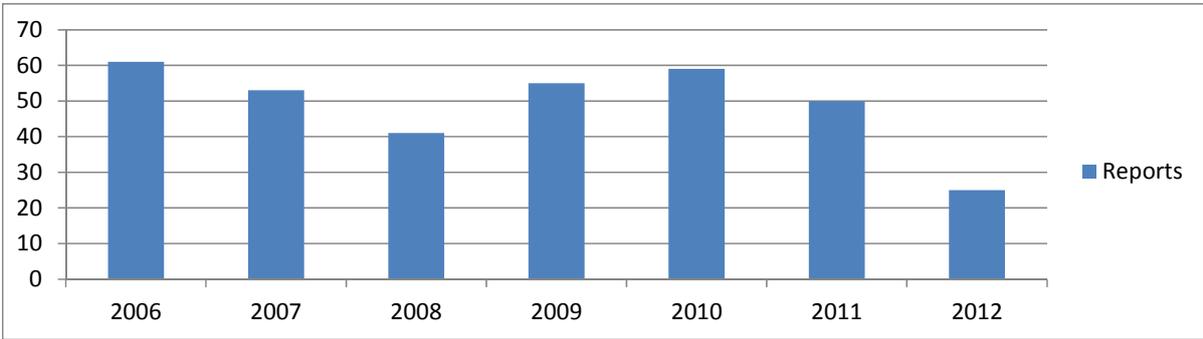

Figure 5.6.1   Number of reports per year (average: 49)

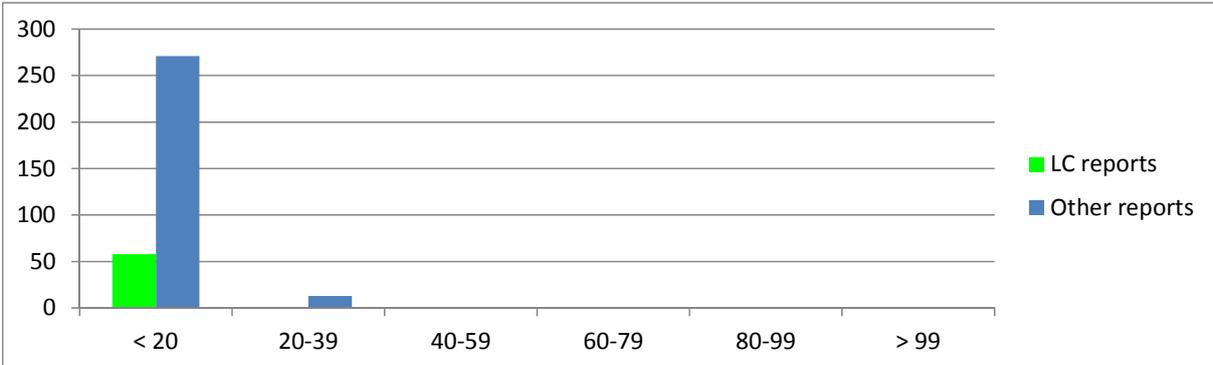The production of reports is very high but reports do not contain many pages.

Figure 5.6.2   Number of reports per number of pages
(average number of pages per report: 12)

27

Only one report contains more than 60 pages. It deals with a train collision with more than 10 injured people.

The average number of pages produced is 460 per year.

92% of reports are published less than one year after the accident/incident, and only 1% was produced later than 2 years after the date of the event.

Collision against an obstacle/person is one quarter of the events. A forth has dealt with collisions against obstacle/person. A fifth has explained derailment as another fifth has explained RS-RS collisions.
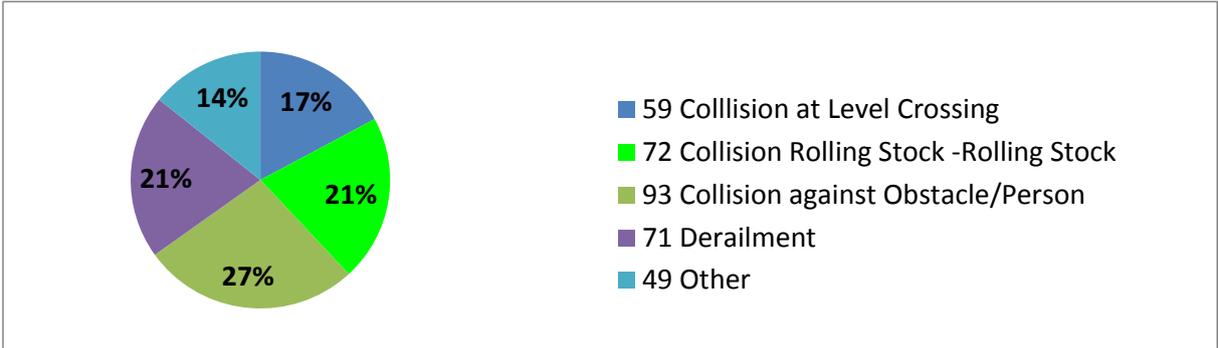

Figure 5.6.3   Number of reports per type of real or possible consequences

5.6.2   Reports: structure and content (2012)

The reports are written in German, French or Italian, according to the location the accident/incident took place.

Each report follows the same structure: summary (chap. 0), establishment of facts (chap. 1), analysis (chap. 2), conclusions (chap. 3), recommendations (chap. 4), and annexes. The sub-chapters and sub-parts of them are numbered.

The summary contains a short description of the event, the investigation conditions, the causes and the recommendations.

Reports bring a lot of relevant information thanks to photos, schemes, figures, formulas, and outputs of the JRU.

More than 35% of the number of reports contains neither recommendations, nor explicit learning points, nor actions already taken.

5.7 European Railway Agency (ERA), NIB Network and ERAIL

5.7.1 Generalities

Main Web page for NIB Investigation reports: http://erail.era.europa.eu/investigations.aspx

One of the core activities of ERA is safety. ERA works in thigh collaboration with NSA but also with NIBs. Beside organizing conferences and workshops with NSA, NIB and stakeholders[11] active in the railway safety sector, ERA groups on its web site the links to NIB Annual Report of the EU States: http://www.era.europa.eu/Core-Activities/Safety/Accident-Investigation/Pages/Networking.aspx . List of NIBs and links to their own web site are available.

According to this web page:

> *"The national investigation bodies meet 2-4 times per year. The meetings allow*
> *the exchange of experience and focus on issues such as the development of*
> *common investigation methods."*

Along the "safety" web pages of ERA, we can gather information about serious accidents in Europe 1990-2009 or Freight train derailment.

Among ERA documents, some are directly in relation with the accident investigation work and report: Guidance for the establishment and work of the national investigation bodies, Guidance on the decision to investigate accidents and incidents, Guidance on good reporting practice, Guidance on safety recommendations (Safety Directive Art. 25)

5.7.2 Reports: accessibility, filtering and general data

Main web page for NIB Investigation reports is: http://erail.era.europa.eu/investigations.aspx

In the ERAIL data base, final report and notifications can easily be found.

The filtering is very performing. It is based on a combination of six different criteria:

- Country. Switzerland and Turkey have already their place in the list, even if they are not in the EU and neither report nor notification is sent by them to ERAIL by then;
- Cause. 23 different causes are listed (cf. with the 49 different causes listed by RAIB in tab. 5.5.0);

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[11] a list of them is kept up to date:
http://www.era.europa.eu/The-Agency/Cooperation/Pages/Associations.aspx

- Occurrence type. This list of 22 items is not easy to use. Some items are consequences, some other causes. Some items are independent of the others, some are not[12];
- Report type. Final report or only notification;
- Year;
- Title. String of characters in the title of the report.

When a report is selected, some information is already available:
- Summary (often summary is void);
- What: Date of occurrence, Local time, Event type, Location name;
- Occurrence description;
- Direct cause description;
- Final Report and Other attachments links.

A list of "similar accidents" is automatically generated. The algorithm used was not known but is probably based on the occurrence type.

The results of the list are unusable: one example: The cause of a train derailment the 27th of December in 2012 in the UK is: "the support under the cess side rail failed as the train was passing over it". One of the "similar" accidents proposed automatically by ERAIL is the train derailment the 28h of January in 2015 in the France: "train derailed while passing on a switch changed of position under the train". These two accidents are totally different. Neither the cause nor the recommendations are "similar".

5.7.3   Reports: structure and content

According to the Directive 2004_49_EC, the structure and principal content of investigation report shall be organized in six main sections: Summary, immediate fact of the occurrence, record of investigations and inquiries, analysis and conclusions, measures that have been taken, recommendations.

In particular:

> *"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. (Annex V)*

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[12] By example, one item is "Train collision near miss" and another "SPAD"; or one item is "Derailment" another "Broken axles"

5.7.4 European Accident Investigation Summary Attempt

The structure of a European Investigation Summary Form (EISF) could be:

1a: Date of accident [dd.mm.yyy]
1b: Time of accident [hh.mm]

2a: Country [chosen in the standard international predefined list]
2b: Locality [free introduction]
2c: GPS-N/S [introduction in a standard format]
2d: GPS-E/W [introduction in a standard format]
2e: "Track configuration" [chosen in an exhaustive standard predefined list][13]
2f: Generic block system [chosen in an exhaustive standard predefined list][14]
2g: Precision about 2e and/or 2f [short description in free language]

3a: Number of fatalities
3b: Number of strong injuries (>24 h in hospital)
3c: Number of slight injuries
3d: Facultative appreciation of material damage [in thousands of Euros]

4a: Circumstances [chosen in an standard predefined list containing "other"]
4b: Circumstances complement [short description in free language]

5a: Consequences [chosen in a standard predefined list][15]
5b: Consequences complement [short description in free language]

6a: Immediate cause [chosen in a standard predefined list]
6b: Contributory factors [one or more items chosen in a standard predefined list]
6c: Contributory factor complement [short description in free language]
6d: Action already being taken [short description in free language]

7a: Recommendations [numbered list of recommendations written in free language][16]

8a: Internet link to the report in the national data base
8b: Internet link to the summary report in the ERAIL data base

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[13] By example: 01-At platform station, 02-At station head, 11-Plain line, … , 21-Yard, 31-Depot, …

[14] By example: Token systems.

[15] By example: … , 34-Derailment followed by a collision, …. , 61-Runaway with near-miss risk, …

[16] Each recommendation has to mention its addresses

6. Abbreviations and Glossary

6.1 Abbreviations

CAPI:	Cantonnement Assisté Par Informatique (Computer-aided telephone block system)
EISF:	European Investigation Summary Form
ERA:	European Railway Agency
ERAIL:	European Railway Accident Information Links
EU:	European Union
IM:	Infrastructure Manager
JRU:	Juridical Recorder Unit
LC:	Level Crossing
NIB:	National Accident Investigation Board (sometimes: NAIB)
NSA:	National Safety Authorities
NM:	Near Miss
RAIB:	Railway Accident Investigation Board (United Kingdom)
RS:	Rolling Stock
RU:	Railway Undertaking
SPAD:	Signal Passed At Danger

6.2 Glossary

Immediate cause:	The condition, event or behaviour that directly resulted in the occurrence.
Learning points:	Sentences to reinforce the importance of compliance with existing safety arrangements Sentences to record good practice and actions already taken by industry bodies that may have a wider application
Near miss:	Incidents which under slightly different conditions might have led to serious accidents

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