

# The investigation of accidents and incidents regarding the safety directive of the European Union

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**ABSTRACT:** The Federal Railway Authority (Eisenbahn-Bundesamt) is the supervision authority for MAGLEV-lines in Germany. This includes the task to investigate accidents and incidents. Rail systems including MAGLEV have a very high safety-level. Nevertheless accidents and incidents can happen. So the investigation of accidents and incidents is important to improve safety continuously. Due to the fact that a commercial MAGLEV-line in Germany doesn't already exist the presentation gives an overview about methods and organisation of the investigation of accidents and incidents for the railway system in Germany.

## 1 INTRODUCTION

*Quae acciderunt, accidere possunt* – translated freely: things which could happen, will happen.

With this quotation from Latin, I would like to introduce my lecture. The English word "accident" is derived from the Latin word "accidere". This means as much as "to happen".

For the term "accident", there are numerous definitions in literature. The safety directive 2004/49/EG about railway safety defines "accident" as follows:

„Accident“ means an unwanted or unintended sudden event or a specific chain of such events which have harmful consequences.

Other definitions from the safety directive:

- „incident“ means any occurrence, other than accident, associated with the operation of trains and affecting the safety of operation.
- „investigation“ means a process conducted for the purpose of accident and incident prevention which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and, when appropriate, the making of safety recommendations.

There can't be any doubt: the railway system is a safe transport system! Why nevertheless does the safety guideline demand expressly the investigation of accidents and incidents in the railway system?

The answer is given in the safety guideline itself in the introductory reason:

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.

In my lecture I will go into the individual elements of this reason.

But first I want to differentiate between the technical investigation of accidents against the juridical investigation of accidents. Although the purpose is different, both investigations should work hand in hand, because both use the same evidence and the same data. I want to point out that the question of blame and liability is not purpose of the technical investigation. Sometimes the cooperation between the juridical authorities and the technical authorities is a little bit difficult, but this would be subject of its own conference.

Therefore my lecture only refers to the technical investigation.

First I would like to introduce the legal framework for accident investigations.

## 2 LEGAL FRAMEWORK

In Germany in accordance to Paragraph 4 of the General Railway Law (AEG), the railway operator is

responsible for the safety of operation. This obligation means however not only to take all necessary measures for the guarantee of safety but in particular also to observe the whole system during daily business operations. This obligation, of course, is also valid in the case of accidents and incidents. The investigation of accidents and incidents therefore is part of the safety management system of each railway operator.

Nevertheless under German law, the railway authorities also are obliged to investigate accidents and incidents.

The importance of independent investigations of accidents and incidents will rise in the current restructuring phase of European railway system from the former system of national railway companies to a single market for rail transport services.

So the safety directive obliges the EU member states to investigate serious accidents in the railway system. In Article 21, the conditions for the status of an independent investigation body are given. The directive further gives many details about the tasks and rights of this body.

### 3 PURPOSE OF INVESTIGATIONS

The purpose of the investigation is defined in the reason part and in Article 19 of the guideline:

- All accidents should be investigated from a safety perspective to avoid recurrence.
- Member states shall ensure that an investigation is carried out after serious accidents on the railway system, the objective of which is possible improvement of railway safety and the prevention of accidents.

Purpose of accident investigation therefore is the improvement of railway safety and the prevention of accidents.

As I pointed out in the introduction, Article 19 Paragraph 4 stipulates that the question of blame or liability is not the purpose of the investigation.

### 4 CRITERIA FOR THE INVESTIGATION OF ACCIDENTS AND INCIDENTS

The safety directive obliges the member states only to the investigation of serious accidents. These are accidents with the following characteristics:

- train collision or derailment of trains, resulting in
  - death of at least one person                    or
  - serious injuries to five or more                or

- extensive damage to rolling stock, the infrastructure or the environment,
- 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 investigation body to cost of at least 2 million Euro.

Purpose of the safety directive is prevention. The subjects of an investigation therefore are, in particular, such events, which seem to detect weak points in the system.

Therefore an important criterion for the investigation of accidents is the question whether an accident could be caused by a systematic failure.

The number of serious accidents fortunately is not large enough to find such failures with a high degree of probability.

There are two ways to increase this number without an increase in the number of accidents:

- investigation of occurrences below the criteria for “serious accident”
- exchange of information with other investigation bodies

Both possibilities are expressly provided in the safety directive:

- Authorisation for the investigation bodies to investigate such accidents and incidents, which under slightly different conditions might have led to serious accidents,
- Obligation for the investigation bodies to inform the European Railway Agency (ERA) and to the exchange experience and opinion.

### 5 THE PILLARS OF ACCIDENT INVESTIGATION

With the liberalisation of the railway sector in the European Union, the conditions also changed for the investigation of accidents. Today there is – like in the most cases in the past – not only one railway company involved, but at least two: railway operator and infrastructure manager.

In practice, there are a number of participants because the engine, the rolling stock and the staff often belong to different companies. Even if the railway operator is responsible for the whole train in practice, there are a lot of particular interests in the case of an accident or incident.

So in the case of accidents and incidents, the finding of the facts is difficult because of the different interests of the involved parties. In this network of interests, a professional proceeding of an accident

investigation in the sense of the national and the European regulations is based on three pillars:

- Independence
- Professional competence
- Local presence

### 5.1 *Independence of the investigation body*

After Article 21 of the safety directive, the investigation body shall be independent in its organisation, legal structure and decision-making from any infrastructure manager, railway operator and all other parties whose interests could conflict with the task entrusted to the investigation body. The investigation body furthermore must be functionally independent from the safety authority.

Since 1998, a special unit in the Federal Railway Authority of Germany (EBA) is working in the sense of the safety directive. Some minor adaptations in the organisation will be necessary to fulfil the requirements of the safety directive with regard to the independence.

### 5.2 *Professional competence*

Already in the introductory reason, the safety directive points out the importance of professional competence: for each occurrence, the investigation body should establish the relevant investigation group with necessary expertise to find the immediate cause and underlying causes.

Particularly against the background of different interests of the involved parties, the importance of expertise and professional competence of the railway operation will rise in the future.

Already today the organisation within the EBA guarantees a very high level of professional competence for the investigation of accidents and incidents.

In addition, there is a network of independent experts who will be engaged in the investigation if special examinations such as material testing are necessary.

### 5.3 *Local presence*

Apart from independence and the professional competence, the local presence of the investigation body is essential from the following reasons:

- In the case of serious accidents, public and politics expect fast and professional clarification
- in the case of other accidents, the railway infrastructure manager expects to open the line again as soon as possible

Therefore the investigation of accidents must begin as soon as possible. The local presence of the investigation body therefore is a precondition for a professional investigation.

The safety directive supports this conclusion, because according to Article 20 the investigation bodies must be given as soon as possible:

- access to the site of the accident and incident as well as to the rolling stock involved, the relevant infrastructure and traffic control and signaling installations
- the right to an immediate listing and controlled removal of wreckage, infrastructure installations or components for examination or analysis purposes,
- access to and use of the contents of on-board recorders and equipment for recording of verbal messages and registration of the operation of the signaling and traffic control system
- access to the results of examinations of the train staff and other railway staff involved in the accident or incident.

With these stipulations, the directive is obviously based on the assumption that the investigation body is present at the site of the accident.

What does “local presence” mean in practise? Nobody knows when and where an accident will happen. Also the probability is small that an accident happens directly under the window of the investigation body office. And for economic reasons, it is hardly realistic to fill each operation facility of the railway network with staff of the investigation body. By exchange of experience with the accident investigation bodies in our neighbouring states, I come to the conclusion that the accessibility of each point in the network within 2 - 3 hours is a generally accepted criterion. Exceptions depending upon weather conditions or traffic situation in the road network must probably also be accepted.

The requirement to the local presence, of course, also includes the requirement to the accessibility "around the clock". Therefore the accessibility of the investigation body and the capacity to act are to be guaranteed also outside of office hours.

## 6 PROCEEDING OF AN INVESTIGATION

The proceeding of an accident investigation can be split up in the following phases:

- Report of an accident or incident
- Identification of the involved parties
- Collection of the facts
- Search for the causes
- Documentation
- Statistic analysis

The safety directive gives instructions for all of these phases.

### 6.1 *Report of an accident or incident*

An occurrence can be investigated only if the investigation body gets information about an accident or incident. Therefore the safety directive obliges the member states to ensure that railway operators and infrastructure managers report accidents and incidents as soon as possible.

In Germany there is an agreement between EBA and German Railways about a reporting system consisting of

- immediate report in cases of serious accidents
- daily status report of other accidents and serious incidents
- collective report of all other irregularities.

### 6.2 *Identification of the involved parties*

As I already stated, in the open market in the European railway system, usually more than one railway operator is involved in an accident or incident. In particular freight trains are assembled of wagons of several owners and from several countries. So it is important to find out which railway operators are involved because in a lot of cases, other parties have to be brought into the investigation.

Generally the investigation body of the member state where an accident or incident occurs is responsible for the investigation. But if railway operators of another member state are involved, the investigation body of this member state must be invited to take part in the investigation. In Germany, the supervision authority for most railway operators are the authorities of the 16 Federal States. They have to be involved, too, if such a railway operator is involved in an accident or incident.

So it might sound trivial but in a lot of cases, it is quite difficult to determine the involved parties.

### 6.3 *Collection of the facts*

In the railway system - in contrast to the road system - all safety-relevant system reactions and control actions are documented. This can take place both via technical mechanisms (e.g. on-board-recorders) as well as via written notes of the operational procedures. So in most cases, it is possible to reconstruct a train run completely.

Therefore the main task after an accident or an incident is to collect all relevant operational data before they are overwritten in subsequent operation. The search for and the documentation of derailing hints or deformations at railway facilities and vehi-

cles are equally important but usually secondary compared with the documentation of the operational data.

A characteristic in the collection of operational data lies however in the fact that the relevant data are stored not only in the proximity of the accident site. In individual cases, the safe-guarding of data must take place quite far away from the accident site.

Therefore it is very important that the staff of the investigation body have professional competence in railway operation as well as knowledge of the local situation. They must know which data are collected where and how they have to be safe-guarded.

### 6.4 *Search for the causes*

The search for the causes is an iterative process, which starts with the reconstruction of the train run. After all data are collected, they first have to be edited. For example, the data of the distance usually refer to a relative place and don't correspond to the mileage of the line. In addition, the system times of the different independent recording systems are not correlated with one another, so that in practice differences of several minutes can occur.

So it is necessary to reconstruct the train run with the help of suitable points of reference in the location.

If the reconstruction is completed, then in most cases it is possible to understand what exactly happened.

This doesn't answer the question of the causes. In most cases, there is not only one cause but a combination of several causes. In particular, if actions of the operational staff led to an accident or incident, then further investigations are necessary. These investigations concern the suitability and the training of the staff as well as the organisation of the railway operator.

### 6.5 *Documentation and statistic analysis*

The investigation shall be carried out with as much openness as possible, so that all parties can be heard and share the results. This is one of the stipulations of the safety directive. Therefore the documentation of all steps is as important as the preparation of a final report.

The investigation of an accident or an incidence has to be concluded with a final report. The formal arrangement of the report is strictly fixed in Appendix V of the safety directive.

The report has to be delivered to all involved parties as well as the ERA; in addition it has to be published.

It is one of the main tasks of the investigation body to look for necessary consequences of the investigation of an accident or an incident. Therefore the safety directive dedicates an individual chapter to the consequences of an investigation.

The investigation body can give safety recommendations to the safety authority or other institutions. The addressees of a safety recommendation must report the initiated measures to the investigation body once a year.

From my point of view, the safety recommendation is a very strong instrument because the addressee of such a recommendation must have very good reasons not to follow a safety recommendation.

## 6.6 *Statistic analysis*

All data of an accident or an incident are collected in an accident data bank. There must be systematic analysis to find out possible weak points in the system, even in cases where no complete investigation occurred, such as in cases of minor accidents or incidents.

This statistic data base can also be a basis for risk analysis. In Germany each year, the data of about 7000 occurrences are collected in the accident data bank. However, only a very small portion of these are serious accidents.

## 7 CONCLUSION

With the safety directive, the European Union gave the member states a manual which shall maintain and possibly improve the high standard of safety in the railway system. The investigation of accidents and incidents is an important instrument to reach this aim.