

Moving Europe towards a sustainable and safe railway system without frontiers.

Clarification note

Elements of an in-depth safety investigation – ERA expectations

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1. Introduction

During the 50th NIB network meeting, the Agency was requested to produce written guidance of what are their expectation for a safety investigation that would satisfy the requirements of the Railway Safety Directive (RSD, (EU) 2016/798) to improve railway safety and the prevention of accidents in a sustainable way, and what criteria would be used by ERA to assess the quality of investigations.

As is clear from the RSD, the role of the NIBs in contributing to push the entire railway system towards a more sustainable and safe performance by learning from accidents, cannot be overestimated. Their contribution is crucial, and the final reports produced, while possibly only a partial representation of the overall impact an NIB can have with its independent investigations, are an important and tangible witness to the efforts being made. Or to put it in other words: the focus of each NIB investigation also becomes the focus for future improvement for the railway sector. In this context, a NIB's investigation should be 'systemic', meaning that it should go beyond understanding what happened and even why, and it should also be seen as a tool for explaining, testing, and possibly even questioning the functioning of the existing framework for railway safety.

We are aware that these objectives are ambitious, and their achievement does not depend solely on the efforts of the NIBs. Multiple elements, both linked to the organisation of NIBs themselves as to the external context in which they operate, can disrupt and/or hinder the investigation process and thereby influence the focus of their investigations. Such factors, if they stand in the way of sustainable improvement, must however be highlighted and addressed separately and should not be an excuse for not making the most of the energy and time invested in accident investigations for the continuous improvement of the European rail system.

The elements that lead to such a systemic accident investigation, as described below, are therefore those that the Agency expects to lead the NIBs to live up to the role placed on them by the RSD.

2. Elements of a good accident investigation

2.1. Clear description of the sequence of events

The investigation should result in a factual, independent, and clear description of the events that have occurred; a picture that paints the narrative of the accident, with all the involved "actors" and their contribution to the chain of events¹. This picture should contain all related events leading up to the accident, in terms of the condition of technical systems and the operational actions and decisions, so that the reader is provided with a realistic sense of what happened and how the accident developed, from its start until the end of the actions of the rescue services (if any).

This description of the occurrence satisfies requirement 3 (b) of the Annex to Regulation (EU) 2020/572 on the reporting structure to be followed for railway accident and incident investigation reports.

2.2. Understanding the context of performance, decisions, and actions

For the above events that have shown in some way to be contributing to the accident, the context that explains them should be described. For actions and decisions of individuals and teams, this means understanding why it made sense for these people to do what they did. This contains an understanding of both the goals they were likely pursuing until the time of the accident (not anticipating or expecting the negative outcome made clear by the accident) as well as the situation they were working in as it was known or perceived by them (considering that the "after-the-fact world" may have very little to do with the actual situation that produced the behaviour under investigation).

¹ Note that missing elements or not taking a decision could also contribute.

While procedures or regulations, which can be found to have been applicable in hindsight, can definitely help an investigator in his or her understanding of the context of performed activities, eventual inconsistencies between rules and actual behaviour do not explain the “why” of the behaviour in question. Non-compliance with a rule of procedure does not explain observed behaviour. A good understanding of performance goes beyond referring to procedures, physically available data or standards of good practice. It requires finding out what was important to the involved persons and why, which may be based on interviews but also other techniques like observations in substituted workplaces or a review of the assumptions with a group of peers.

Several models exist that can help an investigator in identifying and understanding these “Human factors”. It is important that the chosen model is neutral (i.e. not focusing on human error for blame but rather looking for understanding variabilities in performance) and covering situational and organisational influences on human performance (e.g. training, time-pressure, work environment, supervision etc.). Even more important for investigators is to understand the limits of their knowledge and to recognise when additional expertise might be needed. This effort should then satisfy requirement 4 (c) of the Annex to Regulation (EU) 2020/572 on the reporting structure to be followed for railway accident and incident investigation reports.

In relation to technical systems (equipment and/or software), the analysis should establish a justification that can explain why a certain component was found in a certain state and/or was performing in a certain way.

While this analysis logically starts with variability in the process or system performance that forms the sequence of events provided under 2.1, a similar logic should be applied also for decisions that are related to process implementation (i.e. providing adequate resources and means to ensure a correct functioning) and process control (i.e. ensuring the sustainable control of risks related to all activities), which means that decisions and actions taken in the context of activities covered by the following point 2.3 (SMS) and 2.4 (wider railway system) should be analysed and understood in a similar way.

2.3. Analysis of Safety Management Systems

Safety Management Systems (SMS) form the cornerstone for managing the safety of operations in the European railway system. The concept was first introduced via the Railway Safety Directive, 2004/49/EC, and the certification/authorisation of the SMS forms a mandatory condition for RUs/IMs for carrying out their operational activities.

According to the definition of SMS provided by the Railway Safety Directive (RSD, (EU) 2016/798) it contains “*all arrangements and procedures established by an infrastructure manager or a railway undertaking to ensure the safe management of its operations*”, which covers a very large scope of operational and (safety) management processes. On the other hand, it’s not the purpose of an accident investigation to perform a full SMS audit. The challenge is therefore to link the appropriate elements of the SMS with the findings close to the sequence of events. It will be important at this stage to take also into account the elements of the SMS of other previous similar accident investigations and to compare them.

Simply listing the relevant processes and procedures that are part of the SMS documentation is not satisfying the requirements under point 4 (d) of the Annex to Regulation (EU) 2020/572 on the reporting structure to be followed for railway accident and incident investigation reports. The functioning of these processes should be analysed (and their situational performance understood, as described under 2.2) and in essence the investigation of the SMS of relevant operational parties in the accident should allow the NIB to state on how these organisations were fulfilling their obligation under the RSD to ensure the safe operation of the rail system and the control of risks associated with it, for those risks that are related to the accident under investigation.

Starting from the sequence of events, this can be done in a structured way by focusing on the one hand on those processes that ensure the correct functioning of the operational system (e.g. competence management, document management, maintenance, planning, etc.), and on the other hand on those

processes that ensure the sustainable control of operational risks (e.g. risk management, performance monitoring, continuous improvement, etc.). It should be noted that this is an iterative process in which each new analysed process could lead to the need to analyse the further SMS processes that ensure adequate implementation and control.

2.4. Analysis of the wider railway system

In order to ensure that the railway system is built with safe and interoperable products and sub-systems, and operated and maintained safely, the European railway legislation has designed a layered system of control mechanisms (control loops) between the different actors, containing the following internal and external levels of control of compliance with the applicable requirements, and consistent application of the legislation.

A first level of control, as already described in 2.3, is mandatory only for stakeholders subject to the obligation of having in place a certified management system: The RUs, IMs, and ECMs. According to Regulation 762/2018 on the CSM for SMS, and the ECM Regulation 2019/779, the RU/IM/ECM management system must contain “internal control mechanisms”, known as “internal monitoring”, and the identification and management of risk control measures. The monitoring processes and procedures of the RU/IM/ECM management system must comply with the Commission Regulation (EU) No 1078/2012 on the CSM for monitoring.

A second level of control is formed by the certification of the RU, IM and ECM management system. The certification of a management system confirms formally the capability of the considered actor to manage safely its business, including the actor’s capability to monitor internally the correct implementation, and the effectiveness, of the management system provisions. Depending on the actor, the operations, and where relevant, on the choice of the Member State, the certification is done by:

- ERA, with the support of relevant NSAs, for cross-border operations, or for domestic operations if the RU applies to ERA;
- the NSA for domestic operations only, if the RU applies to the NSA;
- ECM Certification Body for an ECM;

A third level of control, closely related to the second, is the supervision/surveillance of the RU, IM and ECM that have a certified management system. Supervision/surveillance of the management system ensures that the considered actor continually, effectively and correctly applies the provisions of its management system, taking any necessary corrective, or preventive, measures in case a non-compliance is detected. Regardless of whether the safety certification is carried out by ERA or an NSA :

- the NSA is responsible for the supervision of the continual, effective and correct application of the provisions in the SMS’s of RUs and IMs operating in their country;
- the ECM Certification Body is responsible for the surveillance of the continual, effective and correct application of the provisions in the maintenance system of the ECM it certified;

The accreditation or recognition of relevant conformity assessment bodies form a fourth level of control. Where needed, an assessment of conformity with the applicable EU rules, National Rules (NRs) and safety legislation by relevant conformity assessment bodies (CABs) is required. The following conformity assessment bodies are defined in the EU railway legislation : Notified Bodies (NoBo), Designated Bodies (DeBo), Assessment Bodies (AsBo), and ECM Certification Bodies (ECM CBs). Depending on the choice of the Member State where the CABs are located, statement of competence of CABs is done as follows :

- NoBo are notified by the Member State based on a beforehand accreditation or recognition, except if the Member State entitles the NSA to act as NoBo;
- DeBo are designated under the full control and responsibility of the Member State;

- AsBo are accredited by the National Accreditation Body (NAB), or recognised by the NSA, except if the Member State entitles the NSA to act as AsBo;
- ECM CBs are accredited by the NAB, or recognised by the NSA, except if the Member State entitles the NSA to act as ECM CB;

As a fifth level of control, normally accreditation and recognition automatically imply a regular surveillance of the CABs to ensure that the CABs keep their competence, and continually and effectively carry out the conformity assessments that are in the scope of their accreditation/recognition. The use of accreditation, and the obligation of the national accreditation bodies to comply with section § 7.9 of the ISO/IEC 17011 standard, guarantees that such regular surveillance of CABs takes place.

In addition, the European Cooperation for Accreditation (EA) organises regularly a system of rigorous and transparent Peer Evaluations between the national accreditation bodies. Those provisions provide the assurance of equivalence between accredited AsBos (ECM Certification Bodies) regardless the country where they are accredited.

Article 33 of the 4th Railway Package Agency Regulation 2016/796, finally, requests ERA to monitor the performance and decision-making of NSAs through audits and inspections. This includes the monitoring of the effectiveness of the supervision by NSAs of safety management systems of RUs and IMs.

Certainly, the capability of the first layer should be investigated, which may lead to the need of focusing on of one or more of these different layers. When thus relevant for the investigation, also their capability to adequately perform their tasks should be properly analysed. As mentioned under 2.2, also here, non-compliance with rules or procedures does not explain why decisions were (or were not) taken. As for the analysis under 2.2, it is important for investigators to recognise when additional expertise might be needed.

2.5. Safety vision and safety culture

Unlike the SMS, that is providing the formal foundation for safety management by defining and prescribing what is required through control and implementation processes and arrangements, safety culture is not something that can be agreed between management and workers or between a safety authority and a regulated company solely based on rules or standards. Culture should rather be seen as “emerging where people interact and have to accomplish something together”, as shared pattern of acting and thinking. It should therefore be obvious that safety culture can only be used in the context of an accident investigation as a description of group behaviours and not as an explanation for individually observed behaviour.

Furthermore, safety culture should not be seen as the cause of a certain behaviour but rather as a starting point to identify the elements that made the creation/maintenance of the observed behaviours possible. A first step further in the investigation could then be to understand the safety strategy that is used by the organisation(s) and define whether this could lead to sustainable and safe performance: (How) do they focus on major railway risks when taking safety related decisions? What mechanisms are in place and what expertise is used to understand workplace reality. This, in turn, could then lead to the analysis of the “growing conditions” that are known to influence the development of a positive safety culture like the signs given by management through organisational decision and managerial behaviour (listening attitude, recognition, sanctioning, etc.) and the concrete implementation of the safety strategy in the SMS.

2.6. The production of recommendations

The investigation of adverse events is not an objective as such. The effort should lead to improving safety performance, lessons need to be learned and the right counter measures need to be taken at the appropriate level(s), preferably by changing an organisation's performance in an intended direction. An investigation should therefore support the development of appropriate countermeasures at organisational levels, as opposed to countermeasures that are focused on individual workers. In the same context, an accident

investigation should also be direct and satisfying. Direct, in a sense that the investigation should provide results that do not require the collection of additional data before the needed controls can be identified and implemented. The results should also be satisfying for individuals that may demand results from an investigation and allow the production of recommendations that can persuade management to act.

This can be achieved by establishing a clear 'link-by-link' approach where the judgement about whether a safety factor contributed to the development of an occurrence is made in terms of its relationship to another contributing safety factor. In contrast, other types of investigations (particularly those whose purpose is to determine responsibility) generally use a 'relative-to occurrence' approach. With the 'relative-to-occurrence' approach, judgements of contribution are made in terms of the safety factor's relationship to the occurrence itself. As an example, using the 'relative-to occurrence' approach, it would be very difficult to argue that the rostering of a train driver caused a train to collide with a buffer stop. In a 'link-by-link' approach however, it can be made clear that the collision was the result of the train driver reacting late for braking, due to fatigue that was a direct result of the decision to give him consecutive shifts without a break. According to ATSB, that is promoting this 'link-by-link' approach that explains the path from the sequence of events to the issued recommendation, clear advantages are: 1) more safety issues being identified and communicated, particularly those more remote from the occurrence, 2) a richer description of the factors involved in the development of an occurrence and thus better learning opportunities, 3) less potential for determining blame or liability and thus less potential for the existence of barriers to learning.

A possible strategy that can also help to convince the adoption and implementation of a recommendation is legislation based and requires to focus recommendations on the role and responsibilities of the different actors responsible for the different control layers with a clear reference to the prescriptions and requirements provided by the EU legal framework.

3. Conclusions

With the functions put on them by the RSD, the NIBs, through their accident investigation activities, play a pivotal role in learning lessons for the future improvement of safety of the railway system. To be able to achieve this adequately, the scope and the quality of the investigations performed by the NIBs is all-important.

Factors that define this quality and that are considered elements of a good, systemic accident investigation are:

- Clearly describing the sequence of events
- Understanding the context of performance, decisions, and actions at all levels in the railway system
- Analysing the relevant elements of the (S)MS of all concerned operators
- Analysing the performance of all relevant control levels in the wider railway system
- Dealing consciously with non-tangible elements of safety management, such as safety vision and culture
- Producing recommendations that, while providing a clear link with the accident under investigation, focus on the roles and responsibilities of involved actors, as prescribed by the EU legal framework

The Agency considers that it is the role of the NIB Network to ensure, with support of the Agency when and where appropriate, that all investigations by its members strive to cover these elements.