INTEGRATED SAFETY MANAGEMENT SYSTEM OF THE RAILWAY TRANSPORT

ZINTEGROWANY SYSTEM ZARZĄDZANIA BEZPIECZEŃSTWEM TRANSPORTU KOLEJOWEGO

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Abstract. The railway transport safety is the basic criterion responsible for its functioning evaluation, furthermore, it decides about its efficiency and also about the wide perceived grade of transport service quality. All parties, who are involved in the railway transport apply safety related procedures and they carry out the risk assessment regarding the process, which they perform for the railway engineering. In the article, there has been presented the present prevailing condition, but also the new legal requirements, connected with the safety in railway transport at the stage of design, manufacturing as well as the repair of products belonging to the railway transport, and also within the process of transport and management of both the railway infrastructure and railway sidings.

Keywords: railway transport, safety, Safety Management System

Streszczenie. Bezpieczeństwo transportu kolejowego jest podstawowym kryterium oceny jego funkcjonowania, decyduje o jego sprawności jak również o szeroko rozumianej jakości oferowanej usługi przewozowej. Wszystkie podmioty zainteresowane w transport kolejowy powinni stosować procedury związane z bezpieczeństwem i przeprowadzając ocenę ryzyka związanego z procesem jaki wykonują dla kolejnictwa. W artykule przedstawiono stan obecny i nowe wymagania prawne związane z bezpieczeństwem w transporcie kolejowym na etapie projektowania, produkcji i naprawy wyrobów z nim związanych, w procesie przewozu i zarządzania infrastrukturą kolejową i bocznicami.

Słowa kluczowe: transport kolejowy, bezpieczeństwo, System Zarządzania Bezpieczeństwem
1. Introduction

The described in this article, the analysis of the Safety Management System of Poland’s Railway Transport is the first attempt of illustrating the problem in total. In this publication there have been presented both the scope of analysis as well as the first of its areas – subjects involved in the railway transport.

There have been in the railway transport safety assurance involved (in various degree) the following groups of the subjects, who represent:

- Railway carriers,
- Managers of infrastructure,
- User of the railway siding,
- Railway rolling stock producers,
- Rolling Stock Repair Works

All of those above presented do have in accordance with the Directives [1,2] an obligation to both apply the procedures related to safety as well as to make the risk assessment connected with the process, which they perform for the railway system – figure No 1.

With reference to these Organizations, there have been described in brief the principles of risk assessment carrying out in safety management with taking into consideration the legal requirements and recommendations of the management models as well as the procedures of risk assessment.
The result of this analysis carrying out will be the construction of the model of the Integrated Safety Management System for the transport in Poland (the common elements for the railway subjects) together with the description of the actual condition of the safety in railway transport in Poland.

The final scientific description will include practically not yet described human factor in the railway transport in prevention in favour of railway transport safety both with the aspect of qualification as well as the requirements for workers directly bounded up with the railway traffic as well as the professional risk assessment of those workers (3-7).

The final stage of the work will be the possibilities analysis of the use of the proposed model in other transport modes.

2. Subjects involved in the railway transport safety

2.1. Executive bodies

**Carrier and Manager of the Railway Infrastructure**

From the year 2011 each railway carrier as well as the infrastructure manager in Poland should produce evidence of the built and implemented Safety Management System (SMS). The necessity of the Safety Management System introduction results from the Directive 2004/49/EC of the European Parliament as well as the European Council on the safety of Community’s railways.

This Directive provides for compulsory implementation of the Safety Management Systems SMS referring to the railway carriers as well as the managers of infrastructure within the Article No 9. It has been reflected in Polish legislation in the Act on Railway Transport and range of regulations, among others in the Minister of transport Regulation of 19 March 2007 on the Safety Management System in the railway transport (upon Article 18, Law of 28 March 2003 on railway transport, the consolidated text of the Act of 19 January 2007).

The Safety Management System devoted for both railway carrier as well as for the infrastructure manager, must ensure the supervision over all the risk types, which are related to their activity gender together with the services rendered to them including maintenance services and materials delivery together with the involvement of subcontractors.

The Safety Management System SMS, takes into consideration the risk caused by third parties activity results, when justified and appropriate, however, without prejudice to the liability, resulting from existing national and international rules.
The Safety Management System of the infrastructure manager in comparison with this one of the railway carrier is more detailed as far as the number, type and the scope of activity of service providers acting within his railway system is concerned: with the increase of contacts with partners the Safety Management System of the manager of infrastructure should take into account proper and actual level of complexity of the services rendered by the manager.

The Safety Management System of each of the infrastructure manager, should then take into consideration the effects of different railway enterprises activities in the railway system and to supply all the railway carriers with measures enabling them to act in accordance with TSI and domestic safety laws as well as with the conditions laid down in their certificates of safety. Moreover it should have been developed all the time on purpose of emergency procedures coordination devoted to manager of infrastructure and all the railway carriers acting within certain infrastructure network.

**User of the railway siding**

Railway sidings are most often connected with the above described railway subjects. In case of carrier these are the technical resources, which enable the correct functioning of the railway rolling stock. The adhesion of the railway sidings to the manager of infrastructure makes possible the performance of process, which lies in the loading of goods.

In the above presented cases, railway sidings can become a part of the Safety Management System and enter automatically in the scope of the risk analysis. There exist however the subjects (for example the producers of the multi-dimensional manufactures or very heavy ones), who possess merely the railway sidings. Requirements for railway sidings in range of safety are simplified in comparison to these ones which are placed in front of the carriers and managers of railway infrastructure.

Act on Railway Transport concerning the safety of the railway transport defines three basic technical and organizational conditions assuring:
1. Safe conduct of the railway traffic;
2. Safe railway vehicles operation;
3. Protection against fire as well the environment protection.

Figure No 2 presents requirements of documentation indispensable for obtaining a Safety Certificate of the railway siding.

The simplified risk assessment analysis (for example checklist method or FMEA) should be carried out, when the railway siding has not been involved into the risk assessment resulting from the SMS.)
Railway producer
When making the analysis of the railway accidents causes we cannot overlook the impact that has got the producers activity on safety in the railway transport. The producer, who manufactures both elements and the railway vehicles is obliged to carry out both the product risk analysis and also the project one. As far as the manufacturer is concerned, then in the scope of product risk analysis come all of its life cycle stages: concepts and design process; logistics and order of the parts of product; production; installation; verification and validation; operating and servicing as well as utilization.

Documents needed to apply for a Certificate of Safety for the railway siding

| Certificate of release to operation the buildings and equipments’ type designed for the railway traffic conduct |
| Internal rules specification determining technical specifications as well as the principles and requirements concerning the safe manner of conduct the railway traffic and the railway infrastructure maintenance, the organizational rules and requirements connected with the maintenance and operating of the railway vehicles |
| Certificate of release to operation the types of the railway vehicles |
| Statement about the possession of certificates of technical efficiency about the railway vehicles under operation |
| Statement confirming that the staff positions, directly connected with conduct and safety of the railway traffic, are filled with the employees, who fulfill the conditions defined in regulations issued under Article 22 of the Act |
| Work Rules of the railway siding workers agreed by the manager of the railway infrastructure with which the railway siding is connected |

Figure No 2. Safety Certificate of the railway siding

Such a wide scope of the liability results strictly from the Civil Code in compliance with which, the producer, who manufactures a dangerous product in the field of His / Her economic activity, is responsible for damage caused by this product to anyone. There exist here derogation under Article 449 KC, which refers to replacement of liability for damage caused by this dangerous product, to such a liability can be held:

− Product co-authors (Raw material or material manufacturers, manufacturers of spare parts of the product);
− Persons making themselves out to the producer so called (quasi-producers);
− Importers;
− Dangerous product vendors (when there are no possibilities to identify the producer).
The importance of producer responsibility and the scale of the problem may be illustrated by the fact, that from not long time ago (under the Act of 22 May 2003 on compulsory insurance … Journal of Laws No. 124, item 1151 and 1152) appeared the opportunity of the producer’s risk insurance. Subject of such kind of an insurance is manufacturer’s liability for damage towards either the person or a property caused to anyone in connection with the operational use, application or consumption of the product or group of products defined in the insurance contract.

On the other hand in accordance with the requirements of the newest standards of management in the enterprises including the railway branch – the IRIS Standard the producer is obliged to carry out the analyses, which allow to define the possibility of performance and to estimate the potential degree of risk in the following criteria:

- Punctuality of product delivery
- Compliance with the accepted economical plan
- Fulfillment of the specific Client’s demands
- Fulfillment of the binding legal, normative requirements as well as the recommendations coming from the railway institutions
- Assurance of the indispensable recognition and the company’s position in the market

The separate requirements are placed towards (under the Railway Transport Act as amended on 20 April 2004 and subsequent amendments), the structural subsystems or the interoperability elements for the Trans-European railway system i.e. for the conventional railways and the high speed railways on the territory of Poland. Those elements should have been given under the conformity assessment together with the essential requirements for railway interoperability by the notified certifying body. This certifying body after making an assessment issues an intermediate certificate of the subsystem conformity all together with the type-examinations as well as the investigations of the subsystem construction to the producer.

The Subsystem producer (or his entitled representative, importer, investor, manager of infrastructure or the railway carrier), who has put the subsystem or the interoperability element under the conformity assessment together with the principal requirements concerning the railway interoperability or in scope of the subsystem under the preliminary assessment and has received the appropriate certificate, He issues:

- Declaration of the compatibility subsystem verification – for the subsystem
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- Declaration of the compatibility of the element of interoperability – for the element of interoperability
- Indirect declaration of subsystem compatibility verification – for the subsystem

Additionally, according to the recently and universally introduced IRIS Standard, the producer is obliged already not only to carrying out the safety analysis (with recommendation of the FMEA method) but also to the RAMS analysis in order to assure augmentation of the Reliability, Availability, Maintainability as well as the products’ safety.

Similarly to the risk analysis, the railway producer is obliged to carry out the RAMS analysis i.e. for all stages of the product’s life cycle [6].

Rolling Stock Repair Works
One of the important issues demanding the solution for achieving the railway interoperability in the whole European Union territory is unification of legal and technical requirements for rolling stock maintenance. This is not only due to the necessity of Directive 2008/57 on the railway interoperability requirements fulfilment but also the Directive 2004/49 on railway traffic safety revised by the Directive 2008/110.

The unification of requirements for the railway rolling stock maintenance has got then two aspects, namely:
- Standardization of technical procedures and the conditions of performance of inspections and repairs to all eligible institutions, which will allow carriers to order services in any country of the European Union (particularly important for freight wagons);
- Ensuring the traffic safety by meeting the stringent requirements associated with maintaining the vehicles in good technical condition.

New rules will result in inter alia to facilitate international traffic and the mutual recognition of competence by the railway companies in respect of services provided for the maintenance of railway rolling stock.

As a result this should also lead to creation of the market of services for the maintenance of the rolling stock both in the individual Member States and throughout the European Union.

Legal basis for the unification of law in the conditions of maintenance of rolling Stock is Directive 2008/57 amending the previous Directives on interoperability of conventional rail and high speed, whose Article 1 states, that its purpose is: “...establish the conditions to be met to achieve interoperability within the Community’s railways in a manner consistent with Directive 2004/49/EC (on Railway Safety)
This conditions relate to design, construction, release to service, modernization, renewal, operations and maintenance of the parts of this system put into service after the entry into force of this Directive, as well as the professional qualifications and health and safety requirements of the staff, who participated in its operation and maintenance.”

This Directive imposes also an obligation on Member States (Article 10), that shall take all necessary steps to ensure, that the components of interoperability [...] were used in their area of use - as intended- and properly installed and maintained.”

In an Annex II to the Directive the maintenance was listed as a subsystem for operational issues.

In Annex III in which are set out the essential requirements for the subsystems for the maintenance of rolling stock have been identified the following areas of regulation:

1. Health and safety: technical equipment and procedures used in maintenance centres must ensure the safe operation of the subsystem and do not constitute a threat to the health and safety

2. Environmental protection: technical equipment and procedures used in maintenance centres cannot exceed the permissible levels of nuisance to the surrounding environment

3. Technical compliance: facilities designed for the maintenance work for conventional rolling stock must be such as to enable a safe, convenient transport services carried out by the whole rolling stock for which they were designed

In December 2008 was published by the revision of Directive 2004/49 the Directive 2008/110. The new legal regulation alter fundamentally the practice and organization of maintenance of rolling stock in the European Union. The principal changes, which it introduces, relate to the conditions of the certification of the plants performing services, engaged in the maintenance of rolling stock.

The legal system should cover the two issues as far as the maintenance of rolling stock is concerned:

- Authorization for the introduction of new rolling stock in service (must be submitted to an initial maintenance plan and arrangements for its development)
- Certification system of safety management in the railway company in the field of rolling stock maintenance issues, the company must first submit its knowledge of a plan for maintaining the rolling stock and rules of its preparation and the ability to manage the maintenance
process and secondly, the ability to implement these rules directly or through the subcontractors.

The enumerated legal acts should regulate these issues in the following order:

- Corresponding TSI specification should specify the rules to evaluate the preliminary plan and maintenance rules for the introduction of the vehicle (equipment) for the operation and content of the documentation for maintenance process realization.
- CSM indicators should establish the rules for the assessment of maintenance of rolling stock for national railway safety authorities (in Poland – The Office of Railway Transport- UTK) responsible for the authorization process prior to entering the service.
- CST indicators should describe the tasks to be performed by them (national railway safety authorities) in the process of safety certification.
- With the help of a separate piece of legislation will be introduced rules for the certification of establishments providing services of rolling stock maintenance.

In this system, the railway company acquires the ability to change the railway rolling stock maintenance principles after entering it into the service in the context of experience in service acquisition. This must be done according to transparent pre-defined rules.

### 2.2. Control and surveillance bodies

Since many years, transport security situation in Poland takes high position in ranking among the EU member states. Thus was established a number of bodies and institutions, that deal with this problem.

Table 1 presents a list of major organizations including the scope of their activities. Very important here is the role of the authorities directly linked to action after accidents under the Ministry of Internal Affairs and Administration (Police, State Fire Brigade and the Border Guard).

Presented above list of organizations dealing with transport security is not complete. There are numerous groups and associations, which in their intentions are directed towards increased security in all modes of transportation.

The two units in Poland responsible for monitoring and safety assessment are the Office of Rail Transport (UTK), and the State Railway Accident Investigation Commission (PKBWK).
Table 1 List of major organizations dealing with security problems in railway transport.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Main scope of activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>European Railway Agency</td>
<td>European Railway Agency's mission is to enhance the security and interoperability of railways throughout Europe</td>
</tr>
<tr>
<td>Ministry of Infrastructure</td>
<td>The task of the ministry is setting policies, as well as design and improvement of solutions to national and international transport, maritime affairs, communications, construction, planning and housing policy and the creation of legislative basis for the development of these departments</td>
</tr>
<tr>
<td>Office of Railway Transport</td>
<td>The main tasks of the Office of Railway Transport include: - Technical supervision of the operation and maintenance of railway lines and rail vehicles; - Monitoring the safety of rail traffic; - Regulation of railway transport; - Licensing of rail transport. Office of Railway Transport also performs the task of monitoring of the development of the railway market, raising standards of safety in railway transport and cooperation with European institutions responsible for operation and development of a common market of railway services</td>
</tr>
<tr>
<td>National Rail Accident Investigation Commission</td>
<td>Study of major accidents, accidents and incidents. The Commission did not rule as to the guilt and responsibility</td>
</tr>
<tr>
<td>Transportation Technical Supervision</td>
<td>Transportation Technical Supervision (in accordance with the Act of 21 December 2000 on technical inspection OJ No. 122, poz.1321) exercise technical supervision over: - Technical equipment installed on the railway area, the railway vehicles and railway sidings tanks, including tanks used in rail, road traffic and inland navigation</td>
</tr>
</tbody>
</table>

3. Summary and conclusions

During the work performed in the Department of Railway Engineering, Silesian University of Technology the main place is occupied by projects for the construction of safety management system for executive bodies described in Section 2.

This work was preceded by a detailed analysis of legal acts and recommendations regarding the criteria that should be satisfied by them [9]. Taking into account the requirements to be met by Safety Management System of organizations listed in Section 2.1. (railway carrier and infrastructure manager) should be taken into consideration, the included in it criteria listed below in the following legal acts and recommendations:

2. Directive 2007/59/EC on the certification of train drivers operating locomotives and trains
3. The Act of 28 March 2003 on Railway Transport
4. Regulation of the Minister of Transport of 5 December 2006
5. Regulation of the Minister of Transport of March 12, 2007
6. Regulation of the Minister of Transport dated from 19 March 2007 on the safety management system in railway transport
7. Minister of Infrastructure Regulation of 18 August 2009 on the common safety indicators (CSI)

Legislation – paragraphs of No. 3, 10.11 – have been changed over the last year (2009), and constructed and implemented before the SMS should be modified in accordance with these above.

Obviously, the built up safety management system should also meet the requirements contained in all the executive acts of the Railway Transport Act of 28 March 2003, with law amendments.

Example of the model describes the map of the processes for the railway carrier covering all aspects affecting the safety of freight-Fig.3

Fig. 3 Map of SMS processes for the carrier of the goods
Development of the models of safety management for all interested parties related to the rail, will allow for their integration in terms of common elements of the system, and to analyze the possibility of using the proposed model in other modes of transport

LIST OF THE LITERATURE

7. Integrated system and means of transport in Poland, edited by Marek Sitarz, Gliwice 2009

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