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## **ROAD SAFETY WITHIN THE “INTEGRATED SYSTEM OF TRANSPORT SAFETY”**

Ryszard Krystek  
Motor Transport Institute  
WARSAW Poland  
E-mail: [rkrystek@pg.gda.pl](mailto:rkrystek@pg.gda.pl)

Lech Michalski  
Gdansk University of Technology  
GDANSK Poland  
E-mail: [michal@pg.gda.pl](mailto:michal@pg.gda.pl)

Joanna Zukowska  
Gdansk University of Technology  
GDANSK Poland  
E-mail: [joanna@pg.gda.pl](mailto:joanna@pg.gda.pl)

Kazimierz Jamroz  
Gdansk University of Technology  
GDANSK Poland  
E-mail: [kjamroz@pg.gda.pl](mailto:kjamroz@pg.gda.pl)

### **ABSTRACT**

The concept of the “Integrated System of Transport Safety” in Poland is a novel solution, built upon the best practices available from only a handful of countries in the world. In the last few decades, the extent of applying integrated transport safety systems to improve transport safety systems has varied; nevertheless, studying the experience of the safest countries in the world we can say that enormous progress has been achieved in this respect. Progress includes both social attitudes and system solutions. Both these issues are of critical importance. Firstly, they involve the recognition of human rights to safety. This, however, raises the question of whether these rights to transport safety are actually respected? Practice shows that the execution of this declaration is very difficult and to a significant extent depends on the insistence and awareness of the public. The paper is documenting the three year research project “Integrated System of Transport Safety” commissioned by the Polish Minister of Science and Higher Education in 2007.

### **1 INTRODUCTION**

In January 2007 Poland’s minister of science and higher education took the decision to award a grant to a Consortium headed by the Gdansk University of Technology for a three year project “Integrated System of Transport Safety”, called “ZEUS” (Krystek ed., 2010). In April



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2010 the project was completed. It was publicly presented on 21-22 April 2010. At the time, following the Smolensk airplane crash (the Polish President and 95 people died in this crash), there was a heated debate about the fallibility of transport safety systems and the importance of independent research into the causes and circumstances of disasters. This means that the final report of the project came immediately under a particularly close scrutiny of specialists and the public. The disaster was a harsh reminder to all of us that transport safety systems do not function properly and it is high time for the conclusions from scientific tests and research to be put into practice.

The concept of the “Integrated System of Transport Safety” in Poland is a novel solution, built upon the best practices available from only a handful of countries in the world. In the last few decades, the extent of applying integrated transport safety systems to improve transport safety systems has varied; nevertheless, studying the experience of the safest countries in the world we can say that enormous progress has been achieved in this respect. Progress includes both social attitudes and system solutions (Zukowska, 2010). Both these issues are of critical importance. First, they involve the recognition of human rights to safety. This, however, raises the question of whether these rights to transport safety are actually respected? Practice shows that the execution of this declaration is very difficult and to a significant extent depends on the insistence and awareness of the public.

Now in the aftermath of another disaster it is time to reconsider the problem of transport unsafety and answer the question of how best to implement scientific conclusions into practice. Our role in society is to study physical events, formulate scientific rules and draw conclusions to be consequently applied in practice to improve the quality of life of the public. With a continually growing demand for transport and economic growth this becomes one of the most important tasks. What is also going to grow is the demand for safety as one of the criteria of living standards. In the world today, however, transport claims about three thousand lives every day, just as many as the number of people killed in the terrorist attack on World Trade Centre in New York in September 2001. We are now spending billions of dollars to fight terrorism and accept that transport, especially aviation, becomes an increasingly frustrating activity due to security measures and their attacks on privacy, something we would not have accepted prior to 2001.

In September 2001, the director of the National Transportation Safety Board NTSB in the US, an organisation which was a precursor of independent safety investigation, said (Kissinger, 2007): *“There is an impression that modern society accepts too easily the death of 3 thousand casualties of transport accidents, as a legitimate tribute for mobility that it enjoys and is so proud of”*. This means we have got so much used to the tribute for mobility that we only notice these disasters resulting in heavy death toll at one place and time. Regrettably, they remain in our memories for a much shorter time than the emotional political declaration made immediately after the disaster about the need for systemic preventive measures.

The experience of countries that have built advanced systems of transport safety management shows that transport safety can only improve if we can integrate the activities across all modes (Vollenhoven, 2001). The reality, however, is the ever growing gap between what we know about good safety policies and effective safety strategies and what is happening in practice. As a consequence, scientific research on transport safety is the key to progress because the results should feed into new legal regulations and procedures for minimising the risk of a disaster (Hauer, 2005).

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The essence of the ZEUS project is integration of transport accident investigation so that the recommendations are used to improve the quality of safety systems (Fig. 1). The public has the right to safety, including the safety of travel, and we cannot allow for people’s safety to be compared against other benefits, especially the preferences of specific social groups or areas of some activities. The public is also entitled to independent opinions about the causes of transport accidents especially if people were killed, injured or even if just exposed to risk of injury or death.

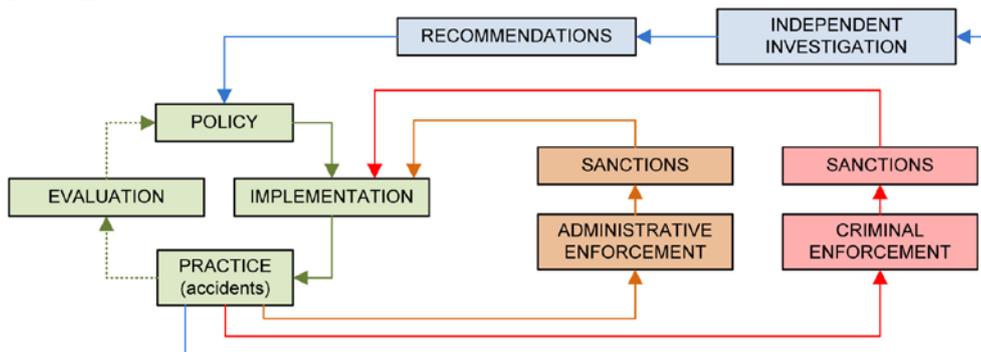


Figure 1. Independent investigations and recommendations within the system of transport safety (Zukowska et al, 2009)

## 2 OBJECTIVES OF THE PROJECT

The initial objective of the project is to integrate efforts to build a transport safety system so that the system does not just respond to a disaster based on public demand but offers a methodical and legal response based on solid and well documented research. Today only several countries worldwide operate such systems. Poland should join them and be part of efforts to build a Europe-wide system of transport safety. The key task leading into the project will be to develop methods to identify how different and how similar safety systems are in road, rail, air and water transport (including the problems of urban and regional transport) in Poland and in Europe. The basic criterion of transport systems planning is “safety first” in which interdisciplinary databases and knowledge bases play a significant role.

The main objective of the project was to develop a model of an integrated transport safety system to aid decision-makers with decisions on new and improved infrastructure and means of transport as well as specialists who implement these decisions. Modern transport is a complex activity and means that politicians, decision-makers and specialists must be able to bring together the goals, strategies and means needed to ensure transport safety. The success of planning and implementing transport safety policies primarily depends on how well we can define the vision, main goal, intermediate objectives and effectiveness indicators. An integrated transport safety system in Poland should cover different elements of the system, most of which are presently addressed across the modes. They are functional, informational, organisational, legal, technical, spatial and human resources elements. To that end we will need new models and tests of the integrated safety system looking at human aspects, environmental protection, technical factors and technologies.

## 3 OVERALL CONCEPT OF THE SYSTEM

Generally speaking, the functions of every system, including the transport safety system, result from the goals that the existing or planned system is to achieve. The functions



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determine the activities and the properties of the system, including the pattern of activities. If we assume that the development of an integrated transport safety system is primarily caused by the need to efficiently curtail the transport-related hazards to human health and the natural environment, we must seek such properties of the system that will make the preventive measures universally applied, long-term, durable and effective. In view of the complexity of individual transport systems, it is desirable that the safety system offer (Michalski, 2010):

- Multimodality; the system should cover all transport modes: road, rail, air and sea transport, and later inland water transport and pipelines.
- Multiple aspects; the goals and detailed functions of the safety system should reflect the many aspects of transport operations and the arising problems, such as: planning, constructing and operating a transport system; levels of management in transport, resulting from the administrative division of the country; epidemiological factors: human, technical, environmental and organisational; types of preventive measures; phases of the process of how consequences and losses occur.
- Integration; it is assumed that the integration of selected goals and functions of the transport safety system will be based on the principle of uniformity and internal coherence of the structures in the different modes. In addition, intermodal integration can only happen if accompanied by intramodal integration.
- Coordination and cooperation; the main areas to be coordinated include transport policy documents and implementation strategies which today are separate for each mode.
- Standardisation and harmonisation; this applies mainly to procedures and methods of integration during the integration.
- Independence; activities within the transport safety system, which – contrary to the underlying intentions – may be subjected to short-term external influence and distortion, especially in the area of transport accident cause assessment, should be conducted with a maximum level of independence. In practice, a true independence of an organisation depends on high ethical standards, the quality and accuracy of the research and studies conducted, financial transparency, the diversity and complementarity of activities and lack of political bias.
- Innovation; this may concern all the functions and components of a safety system – both existing and planned. A special role in developing integrated safety systems can be played by intelligent solutions known as ITS.

In building the goals and functions scheme for an integrated transport safety system, we have followed the idea of the Haddon Matrix (Runyan, 1998). It was assumed that it is composed of four groups of epidemiological factors and three phases of the occurrence of losses. Epidemiological factors affecting the occurrence of loss and damage (harm, damage) include:

- personal factors connected with the person affected by risk,
- factors connected with mechanical or heat energy (impact) transmitted into the person by the transport means in motion,
- physical environmental factors – the properties of the place where the loss occurs,
- social environmental factors – social and legal norms and practice.

The phases of the process of loss occurrence are defined as:

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- pre-event phase, covering everything that decides whether the event occurs or not,
- event phase, covering everything that decides whether the loss occurs or not
- post-event phase, covering everything that decides to what extent the loss can be mitigated or remedied after the event.

To identify epidemiological factors we can agree on a comprehensive set of actions to reduce the consequences of transport accidents. Such a set of preventive measures can apply to the prevention of transport accidents (pre-event phase) and other consequences such as material, environmental, health or life. In this sense technical and medical rescue, although conducted in the post-accident phase, can be treated as prevention of a disability or death in a transport accident or an environmental disaster. Fig. 2 shows the particular position these functions have in the post-accident process.

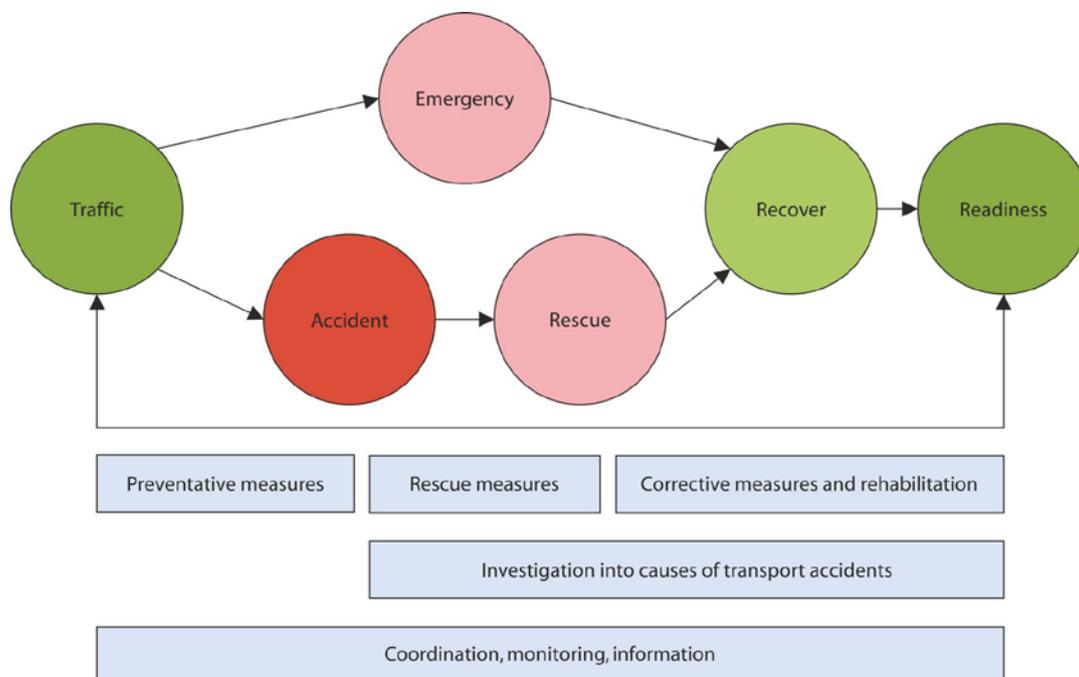


Figure 2. Arrangement of functions during an accident or emergency (Krystek ed., 2010)

In an integrated system of transport safety, preventing the risks of transport and other spheres of activity can be accomplished by making a full use of other measures, such as:

- technical prevention covering collective and individual protection, applied to technical transport infrastructure, transport means, machinery and equipment used in transportation and technological solutions,
- organisational prevention, implemented mainly through education, training and information, and designed to reduce exposure (the control of exposure, time, space, population),
- medical prevention, including psychological prevention, implemented mainly in the pre-event phase (Fig.3).

When an accident happens and after the accident, the basic *activities reducing the consequences* should include:

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- technical, medical and environmental rescue,
- health care of victims of transport accidents,
- social services for victims of transport accidents.

To improve the quality and the effectiveness of prevention and to reduce the consequences what is needed is expert knowledge on the causes of accidents and a public understanding about the risks and the effectiveness of prevention. This would be the role of a system for investigating transport accidents and a system of monitoring and informing about the safety of transport.

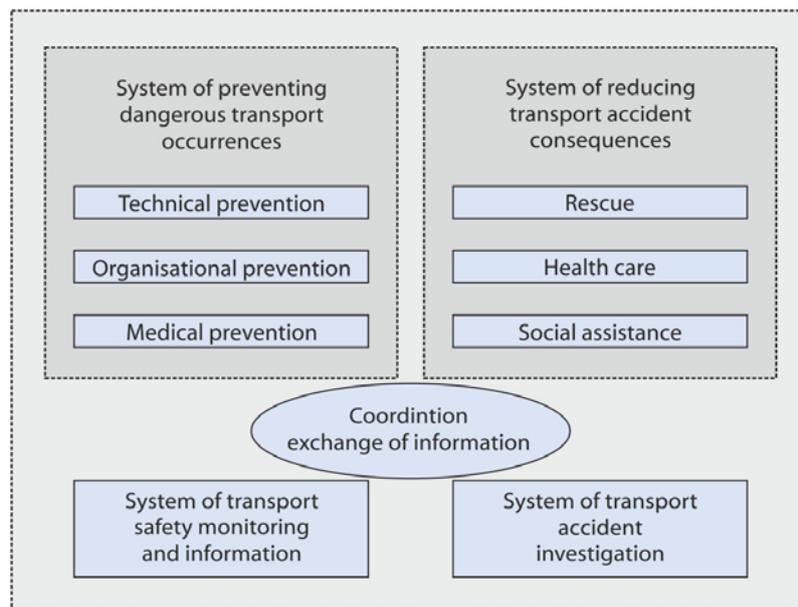


Figure 3. Elements of an integrated system of transport safety (Michalski, 2010)

The purpose of integration in the *system of preventing dangerous transport occurrences* is the current coordination/integration of risk management methods and exchange of information on the technical, organisational and medical measures in place. The basic tasks of organisations responsible for these efforts in transport include: introduction of new regulations and technical specifications, planning of safety policy, developing a strategy for implementing preventive programmes, certification, accreditation, licencing, authorisation, control, safety assessment, safety audits, transport accident investigation and formulation of recommendations, databanks and registers and human resources policy, monitoring, informing and training.

All these tasks should be implemented at all levels of transport administration using the most modern methods of risk management (Jamroz, 2009). In addition, there needs to be cooperation with other systems outside the transport system which have an important impact on the system of transport and its safety. These include: education, spatial development, law, finance, etc.

The purpose of integration in the *system of transport accident investigation* is to make the best possible use of professional staff and the proven methods of research into the accident causes, as well as the introduction of uniform procedures of publicising the results. The principal tasks of the system include the conduct on independent research into the causes of

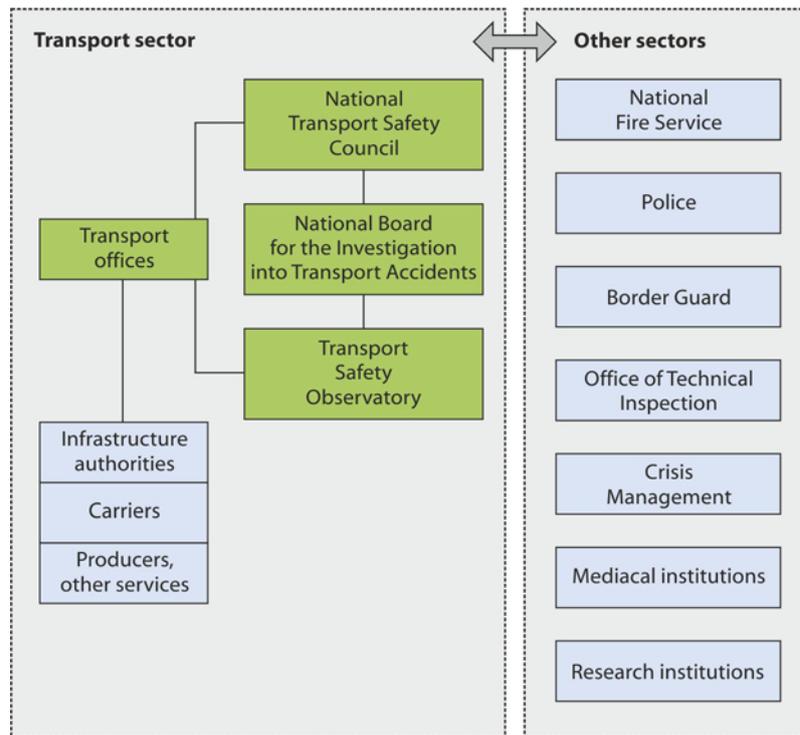
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transport accidents and the formulation of recommendations for reviewing bodies and individual institutions or enterprises, including legislative suggestions.

The purpose of integration in the *transport safety monitoring and information system* is to integrate the understanding of various definitions and the relations between them; databases (setting minimum standards for databases within individual transport modes and the rules of their availability) and the information (uniform information format). Basic activities cover information gathering and processing, results evaluation, programme implementation monitoring and the preparation and distribution of information.

**4 ORGANISATIONAL STRUCTURE OF THE SYSTEM**

The organisational structure of an integrated transport safety system, division into units and the relations between them, is dependent on how the functions and powers are assigned, on the degree of centralisation, the division of labour and the communication technology within the whole system as well as its basic elements, as shown in Fig. 4.



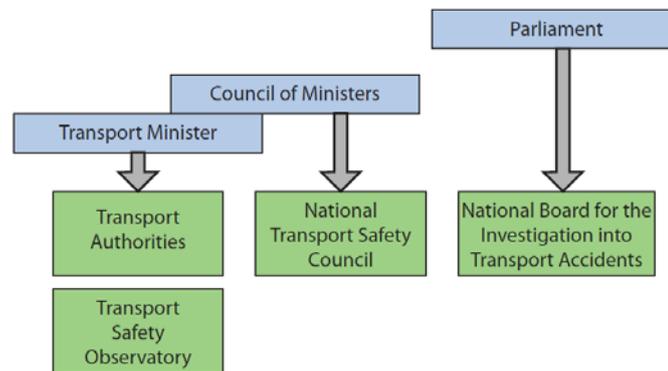
*Figure 4. Institutional structure of an integrated system of transport safety (Michalski, 2010)*

In view of the previously identified requirements and functions, the structure should contain the following unit types:

- coordinating body: one organisation at the national level as the National Transport Safety Council (NTSC), coordinating the activities of all the other units within the transport safety system. Its establishment must be preceded by the establishment of all the chief bodies of the safety system.

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- chief bodies: three institutions in the transport sector, namely the Transport Authority (transport offices) with basic functions, the National Board for the Investigation into Transport Accidents (NBITA) and the Transport Safety Observatory (TSO) for the auxiliary functions. Fig. 5 shows where the respective bodies fit within the structures of the state and the resulting line of reporting.
- cooperating bodies: numerous non-transport organisations with basic and auxiliary functions, mainly the Police, the National Fire Service, Road Transport Inspection as well as emergency response, health care and research institutions;
- subordinate bodies: infrastructure managing entities, carriers and manufacturers under the supervision of transport authorities.



*Fig. 5. Model of the position of an Integrated System of Transport Safety in the structure of a state (Michalski, 2010)*

## 5 CONCLUSION

Intermodal transport system integration is a process of great significance for further development of the transport system and first of all ensures the right to transport safety. It is not a simple matter and the nature of the problem is not only that integration takes considerable time and money to change the quality of the existing subsystems. The integration process is about people in the first place and a change of their perception of what we refer to as a hazard to human life or health in transport. It is only when such change has occurred that there is proper climate for new systemic solutions.

One of which is the formation of a safety culture – a vital constituent element of social development. This term means a lasting value and a priority for every human being or organisation in their efforts to minimise the risk of a loss of life or health resulting from a deficient safety system. In developed societies, the safety culture is becoming a norm also in transportation. This can be exemplified by changes in their approach to safety, which is a priority not only in the national budget but in family budgets as well. This is the so-called “willingness to pay”, in other words the answer to the question: “how much would a citizen be prepared to pay for greater safety, road safety for instance, in order to avoid an accident?” The apparent growth of this amount indicates that safety is becoming increasingly important and is becoming a major criterion in assessing the quality of life.

Modern societies have also accepted other sacrifices connected with various security



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procedures even though they are at the cost of certain freedoms or personal comfort. An example here can be the security procedures introduced in the aftermath of the 11 September 2001 terrorist attack in New York. They involved many elements which would never have been accepted before because of the way in which the notions of “civil liberties”, “personal freedom” and “confidentiality of personal data” were understood. Now, fingerprinting, taking photos, ID document copying or a body search have become a norm during border checks. These sacrifices may have started a growing public interest in transport safety as a public health issue.

Transport safety problems are also becoming a research topic in political sciences. From a sociological standpoint, safety seems to be an easy task; it is enough to convince the public to accept the preventive slogan: “Don't get hurt” to significantly mitigate the hazards to human life and health in transport (and not only). One might even assume that if the process of public education continues, the level of danger will be close to zero, like in the Swedish Vision Zero programme, which assumes that the number of the dead and severely injured in transport accidents should approximate zero. In real life, however, it is difficult to reach a situation like this, to build a structure capable of ensuring safety in confrontation with a suddenly emerging danger. Besides, having a safety system in itself is not enough to ensure safety as a permanent condition. A corporate culture is also needed that will support the system of management and help it to develop.

A thorough assessment of transport safety and the transport safety system demonstrates that despite numerous safety efforts made in the system, the loss to human life and to property as a result of accidents continues to be very high. The examination of transport safety systems in Poland made within the ZEUS project exposes numerous strategic and operational weaknesses of the systems existing in particular transport modes, especially when we put them in the context of the experiences of best-performing countries. This primarily refers to the quality and independence of accident investigation, comprehensive safety information, coordination of procedures and coherence of management methods as well as the possibility of making swift legislative changes to improve safety.

For these reasons, it is recommended that the government administration and the minister in charge of transport in particular, take organisational and legal measures which will foster integration of the transport safety system, via:

- the creation of a uniform system of authorities responsible for safety, with functions of control and supervision;
- the creation of an independent board for the investigation into the causes and the circumstances of transport accidents, covering road, rail, air and water transport;
- the creation of a national transport safety observatory as the principal source of objective and up-to-date knowledge of transport safety in Poland;
- the creation of a transport safety council, responsible for strategic planning and the coordination of the adopted programmes and plans in the process of their implementation;
- the implementation of integrated methods of transport safety analysis including transport risk management.



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