

Lech MICHALSKI<sup>1</sup>  
Joanna ŻUKOWSKA<sup>2</sup>

### **TRANSPORT SAFETY INTEGRATION ISSUES IN MOBILITY AND MODALITY MANAGEMENT**

*It is assumed that just like in other spheres of life, safety of transport will also benefit from integration as a result of more effective prevention and rescue efforts. The need for an integrated approach to many aspects of transport safety legitimises proposals to change the relevant functional and institutional structures in Poland. This problem was addressed in the research project "Integrated Transport Safety System" (acronym ZEUS). The modal structure of transport accidents clearly shows that accident reduction can be achieved by promoting safer means of transport that can be used for particular transport needs. Before this can be achieved, safety management and mobility management must be integrated at the national, regional and local level.*

### **PROBLEMY INTEGRACJI BEZPIECZEŃSTWA W ZARZĄDZANIU MOBILNOŚCIĄ I MODALNOŚCIĄ TRANSPORTU**

*Procesy integracyjne w bezpieczeństwie transportu, podobnie jak w innych dziedzinach, przyczyniają się do skuteczności działań profilaktycznych i ratowniczych. Potrzeba zintegrowanego podejścia do rozwiązywania różnych problemów bezpieczeństwa uprawnia do tworzenia koncepcji i wizji zmian struktur funkcjonalnych i organizacyjnych, odpowiedzialnych za bezpieczeństwo transportu w Polsce. Problem ten jest także przedmiotem projektu badawczego „Zintegrowany system bezpieczeństwa transportu” o nazwie ZEUS. Skuteczna promocja bezpiecznych środków transportu uwarunkowana jest jednak integracją zarządzania bezpieczeństwem i mobilnością na poziomie krajowym, regionalnym i lokalnym.*

## **1. INTRODUCTION**

The system of transport incurs enormous losses. In EU countries transport accidents, especially road accidents, are the number one cause of death for external reasons among

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<sup>1</sup>Faculty of Civil and Environmental Engineering, Gdansk University of Technology, ul .Narutowicza 11/12, 80-952 Gdańsk, Poland, e-mail: michal@pg.gda.pl

<sup>2</sup>Faculty of Civil and Environmental Engineering, Gdansk University of Technology, ul .Narutowicza 11/12, 80-952 Gdańsk, Poland, e-mail: joanna@pg.gda.pl

people aged up to 45 and the total loss is estimated at 200 billion euros annually which is more than the annual budget of the European Commission [1]. Each year Poland loses about 30 billion zloty, more than 2% of its GDP. In Poland the number of people killed in transport is 5,500 annually and injuries are ten times more with 20% of the victims left disabled for the rest of their lives. In Poland's Transport Policy for the Years 2006 – 2025 one of the basic tasks is to "Ensure a safe transport". The Policy identifies development goals and how they should be achieved both in an integrated system and in the particular modes. This leads to the need for effective organisational, technical, legal and financial measures and ways to integrate them to ensure that strategic goals are realised [2].

It is assumed that just like in other spheres of life, safety of transport will also benefit from integration as a result of more effective prevention and rescue efforts. An overview of international experience and domestic transport safety needs suggests that there are at least three areas where integration is required. They are:

- prevention measures carried out by bodies responsible for safety management,
- monitoring of safety and safety information by integrating transport safety databases,
- independent investigations of transport accidents and formulation of recommendations to improve the effectiveness of prevention.

An integrated approach to safety is particularly important in passenger and freight transport which is part of transport chains. Transport chain integration in the broad sense is generally considered the best option for the customer (reliable, comprehensive service) and the service provider (quality, competitiveness). While integrated transport chains mainly cover the carriage, reloading and storage of freight, the advantages they offer in the area of organisation, coordination and technology can also be used in modern passenger transport.

There is an increasing interest on the part of public transport users in transport services offering several types of transport. A safe "door-to-door" journey consisting of different sections using different modes including walking (e.g. to get to a means of transport) is what passengers, residents or tourists expect of a transport system. A safe carriage of goods using even a complex transport chain is a service expected by clients (senders), freight forwarders and operators as well as local communities whose area of residence is cut across by routes of hazardous transport.

A comprehensive approach to improved transport safety means going beyond transport and taking advantage of other transport related policies. Integrated transport policies are a possibility because they involve multiple layer integration within transport and integration with the environment and spatial planning across all levels of public administration. From this point of view spatial policy is significant with its strong impact on transport needs or financial policy which creates market conditions for transport services and ultimately for the modal split. Mobility management instruments are a must today. They create the conditions at source for new transport needs and transport systems modality [3]. It is also important to create market mechanisms which will ensure the right spatial and economic conditions that support safety. The Commission's recent Communication on a sustainable future for transport [4] has identified urbanisation and its impacts on transport as one of the main challenges in making the transport system more sustainable. It calls for effective and coordinated action to address the challenge of urban mobility and suggests a framework at EU level to make it easier for local authorities to take measures. The Action Plan [5] proposes short- and medium-term practical actions to be launched progressively from now until 2012, addressing specific issues related to urban mobility in an integrated way.

Reliability, information, safety and ease of access are vital for attractive bus, metro, tram and trolleybus services, rail or ships. Effective integration, interoperability and interconnection between different transport networks are key features of an efficient transport system. This can facilitate the modal shift towards more environmentally friendly and safe modes of transport.

## 2. MODAL STRUCTURE OF TRANSPORT ACCIDENTS

As shown by the diagnosis of transport safety [6] there is a clear difference between the threats and risks across the modes and across means of urban transport in public transport. Poland's transport accident statistics shows that road accidents are the biggest number, irrespective of the different definitions of accident across the modes. Road accidents make up 99% of all accidents and 94% of transport fatalities (Table 1). Accident rates show a different picture of accident risk. When compared to passenger transport and miles travelled, the annual average number of accidents and casualties between 2003 ÷ 2007 (Table 2) shows safety issues in the modes that are generally considered relatively safe. When transport accident rates are referred to the number of means of transport, rail and aviation have the least favourable rates as does water transport when compared to miles travelled. In passenger transport the best casualty rates referred to passengers carried are in rail transport and in aviation when referred to miles travelled in passenger kilometres. The worst rates of injury per 1 billion passenger kilometres are in road transport. In freight transport water transport has the best accident rates per 1 million tonnes carried. Analysis of transport accident severity shows that aviation accidents are the most severe both in injuries and fatalities.

*Tab.1. Number of transport accidents in Poland*

Mode of transport	Total in 2003 - 2007	Average per year	%
Roads	146000	49200	99.02
Railways	1936	387	0.78
Water	30	6	0.02
Air	447	89	0.18
Total	248413	49682	100.00

*Tab.2. Rate of transport accident in Poland*

Mode of transport	Number of victims per 1 M passengers		Number of victims per 1 M passenger-kilometres	
	killed	injured	Killed	injured
Road	0.32	3.62	18.02	204.93
Railway	1.15	1.04	16.45	14.82
Air	3.54	7.48	1.98	4.19

The outlook for transport safety is somewhat alarming when viewed from the perspective of passenger and goods transport demand [7]. It is estimated that by 2033 Poland will increase its demand for:

- domestic transport by a minimum of 24% in millions of tonnes and by 42% in billions of tonne kilometres; the biggest increase is expected in sea transport, slightly less in motor transport;
- passenger car transport by a minimum of 64% in millions of people and more than 100% in passenger kilometres; the biggest increase is expected in rural areas;
- urban public transport by a minimum of 42% in millions of people and more than 100% in millions of passenger kilometres, but a mere 1-2% increase in tram, bus and trolleybus transport.

Urban public transport as an element of the urban transport system tends to use a single system of means of transport which are part of different modes. Urban public transport and individual transport complement each other and offer the possibility to use single or multi-modal trips in urban areas. Comprehensive traffic surveys in Poland's major cities show that multi-modal trips account for 5 – 8 % of trips with a still minimal use of Park & Ride (using a passenger car and public transport).

Table 3 shows the percentage of fatalities in overall accident victims for the different means of transport. Among tram passengers per 100 injured there are only 0.1 fatalities compared to 1.3 in public buses and 5.1 in non-public buses [8]. This means that public transport vehicles offer a much greater chance of surviving a road accident than the other means and that public transport is safer than non-public transport.

*Table.3. Percentage of fatalities among victims within the mode*

<b>Mode of transport</b>	<b>Percentage of killed within mode</b>
Tramways	0.1
Public buses	1.2
Other buses	5.0
Cars	6.7
Tracks	8.0
Bike	8.7
Motorbike	9.7
Pedestrians	10.4
Trailer	18.4
Average in Poland	8.0

The modal structure of transport accidents clearly shows that accident reduction can be achieved by promoting safer means of transport that can be used for particular transport needs. In the case of urban passenger transport if one part of the journey could be made in public transport rather than a car this would tie in with the objectives of sustainable

development and improve transport safety. Before this can be achieved, mobility management must be integrated at the national, regional and local level.

### 3. SAFETY PROBLEMS IN TRANSPORT CHAINS

In intermodal transport the details of safety principles are developed and implemented by transport unions and enterprises. They are typically similar to health and safety rules of transport companies, depots, warehouses and terminals or to public safety rules. Multimodal transport operators (MTO) have a special role because they take the responsibility for the entire route from the place of reception to the place of issue. The MTO also issues documents for the entire route. Transport operators are the most important element of a multimodal transport system. The functions can be fulfilled by a freight forwarder or rail, road or sea carrier. The operator signs agreements with the other carriers, coordinates their work, takes the risk for his work and that of other carriers. In an effort to reduce accident rates, freight forwarders, carriers and operators introduce:

- driver accountability systems,
- systems that reward drivers with no accidents to encourage them to be careful when driving,
- penalty systems, including dismissal and informing the next employer,
- continuous training involving the police,
- monitoring systems to identify causes of collisions.

There is no uniform approach to safety management or accident and damage analysis.

Safety regulations pay special attention to the carriage of hazardous goods. These are frequently carried using several types of transport. Already in 1951 the United Nations' Economic Committee stated that there was a need for uniform requirements for rail, road and water (inland waterways) transport when carrying hazardous goods. Today the technical requirements set out in the ADR agreement are consistent with the RID regulations for international rail carriage of hazardous goods. This is important for harmonising regulations and measures designed to reduce the risks of hazardous materials. RID and ADR requirements are regularly updated with revisions made every two years. In Poland after several ordinances on the carriage of hazardous goods, Polish Parliament on 28 October 2002 adopted the Hazardous Goods Transport Act (Journal of Laws No. 199, heading 1671 as amended). But despite these integration efforts, transport of hazardous goods still has some weaknesses, such as the role of multimodal (combined) transport. The typical mistakes made in this kind of transport include [9]:

- failure to recognise the different classification and labelling rules for hazardous goods carried in different modes,
- the labelling of transport units is as used in maritime transport rather than in road transport in the case of goods exempt from ADR,
- containers do not have packing certificates during road transport before sea transport.

To ensure safety within the entire transport chain it is important to establish integrated transport authorities at the national level. At present Poland has separate authorities responsible for rail, sea and air transport but no road transport authority.

#### 4. CONCEPT OF INTEGRATED TRANSPORT SAFETY SYSTEM IN POLAND

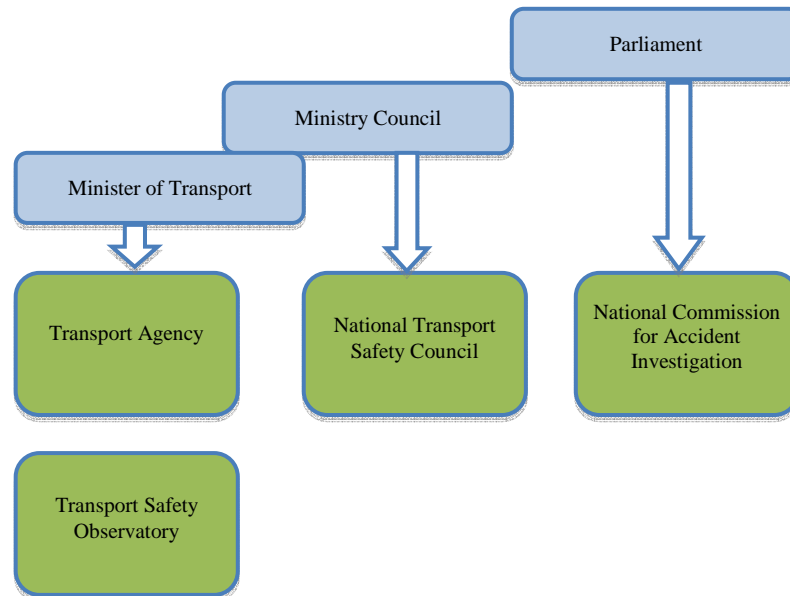
The need for an integrated approach to many aspects of transport safety legitimises proposals to change the relevant functional and institutional structures in Poland. This problem was addressed in the research project “Integrated Transport Safety System” (called ZEUS). The preliminary objective of the project is a conception of the integration of safety management systems in four modes of transport: road, rail, air and water to build one, consistent, thoroughly researched and legally binding system of transport safety within all levels of functioning: administrative, legal, technical, informative and human resource.

The project has identified four areas of integration that can include the following measures:

- prevention: programming of safety improvement, promotion of risk management methods, effectiveness evaluation of safety measures, training of operators and staff, operator licenses,
- monitoring: systematics of terms, integration of accident databases, use of modern monitoring technology,
- accident investigation: procedures and methods of accident investigation, formulation and promotion of recommendations of necessary changes in the safety system,
- rescue: rescue procedures, methods of collaboration, equipment standards.

Nearly all of the areas of integration have to have a development policy to ensure integration with the other modes. In order to integrate the system of transport safety, there must be integration within the modes. This is why ZEUS has dedicated so much effort to developing mode specific integrated systems of safety management. This includes road transport which is clearly the biggest challenge. The system of road transport management is underdeveloped and far from the well organised systems in the other modes.

As regards the institutional structure of an integrated system of transport safety, it has to be said that Poland’s road transport system should be thoroughly redesigned. This would include the development of the existing functions and the appointment of bodies that are already well established in aviation and rail transport (Fig. 1).



*Fig.1. ZEUS' institutional vision of an integrated system of transport safety*

Both modes in Poland have their own transport authorities and accident investigation commissions. For the integration to continue the entire safety system must be brought up to the same standards. Ultimately, the safety management system should be based on three key organisations:

- for integrated transport safety management - Transportation Office,
- for integrated transport safety monitoring - National Transport Safety Observatory,
- for integrated transport accident investigation - National Transport Safety Board,
- for co-ordination – National Transport Safety Council.

The remit of each of these organisations will cover four modes of transport. For this vision to become reality, the modal safety systems as they are today will have to be modified. The change will involve additions, reorganisation or the appointment of new structures.

Apart from the formulation of new tasks and competences of the new organisations, new laws will have to be adopted which may mean a staged process of transformation. How the road safety management system should adapt to the integrated transport safety system is one of the areas covered by the ZEUS project.

## 5. CONCLUSIONS

Modal structures of passenger and freight transport are important for the overall safety of the transport system. This is why changing the structures and transforming them should be one of the essential and pro-active objectives of transport safety management. The basic objectives of an integrated system of transport safety should be to promote transport safety

through modern mobility management and spatial planning with focus on safety. The relevant policy should:

- cover several branches of the economy and use instruments that have an impact on several modes of transport at the same time,
- support multimodal transport of goods (multimodal, intermodal/combined) within integrated transport chains using the safest means of transport,
- promote the unification of intermodal or hazardous goods transport regulations to ensure that accident risk is reduced,
- develop a safe urban passenger transport using the safest modal structure,
- promote the safety of mobility as an aspect of mobility culture in the modern sense.

This is a task for all those involved in transport safety integration, the government, local authorities and non-governmental organisations.

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