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## DIFFERENCES AND MUTUAL CONNECTIONS OF THE TRANSPORT SAFETY SYSTEMS

### ODRĘBNOŚCI I WZAJEMNE POWIĄZANIA SYSTEMÓW BEZPIECZEŃSTWA TRANSPORTU

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**Abstract:** Each day in the world's transport system there are more than 3 thousand fatalities; most of them die in road accidents. From the point of view of the safety management, each of the branch systems is organized differently. The differences concern data bases, institutions managing the transport infrastructure and studying the accidents, systems monitoring the traffic of vehicles, trains and ships. Despite many differences in the functioning of particular branches of transport, there are potentially big possibilities of improving the safety systems through integration activities and utilization of good local and foreign experiences in the whole transport sector.

**Keywords:** transport accidents, transport safety systems

**Streszczenie.** Każdego dnia w systemie transportowym na świecie ginie ponad 3 tys. osób, z czego większość w wypadkach drogowych. Z punktu widzenia zarządzania bezpieczeństwem, każdy z systemów gałęziowych jest zorganizowany w inny sposób. Dotyczy to baz danych, instytucji zarządzających infrastrukturą transportowa i badających wypadki, systemów monitorujących ruch pojazdów, pociągów i statków. Pomimo wielu odrębności w funkcjonowaniu poszczególnych gałęzi transportu potencjalnie istnieją duże możliwości usprawnienia poszczególnych systemów bezpieczeństwa poprzez działania integracyjne i wykorzystanie dobrych doświadczeń krajowych i zagranicznych w całym sektorze transportu.

**Słowa kluczowe:** Wypadki transportowe, systemy bezpieczeństwa transportu

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## **DIFFERENCES AND MUTUAL CONNECTIONS OF THE TRANSPORT SAFETY SYSTEMS**

### **1. Introduction**

Transport system, apart from many internal connections, common objectives and economic tasks is diversified as regards to organization, technical factors, power absorbing ability and impact on the environment, health and human life. Each day in the world's transport system there are more than 3 thousand fatalities; and annual number of fatalities in the EU is approximately 50 thousand.

Transport system with a distinct domination of the motor transport has been shaped in the countries of Western Europe. Such a situation was influenced both by changes in the structure and size of the demand for the cargo transport, and transport policy mostly supporting road transport. Road transport includes almost 75% of all the cargo conveyance, and is distinguished by particularly high use of energy, pollutants emission and accident risk (table 1). Annually, 1.3 million fatalities worldwide are related to road transport. It does not mean, however, that the safety problem in other branches and means of transport characterized by relatively low number of accidents is a marginal problem. Due to the high transport volume of persons and cargo air crash, marine or train accident can mean both great amount of casualties and ecological catastrophe. In passenger transport, total socio-economical costs of sea, air and train accidents are scarce in relation to the costs of road accidents; however, when expressed per one fatality, the highest costs characterize water transport (table 2).

From the point of view of the risk management and using preventive and improvement measures, each of the sector safety systems has advantages which are worth to be spread on the whole transport system, but also obvious disadvantages which can be alleviated or eliminated with the help of experiences originated in other sectors. One can formulate a thesis that apart from many differences in the functioning of particular branches of transport, there are potentially big possibilities of improving the safety systems through integration activities and utilization of common achievements in order to improve the transport safety and particularly road transport safety.



Table 1. Index of the fatalities in different mode of passenger transport in EU for the period 2001-2002 [1]

Mode of transport	Fatalities index	
	per 10 <sup>8</sup> passenger kilometre	per 10 <sup>8</sup> passenger kilometre
Road transport	0,95	28
including: motorcycle/bicycle	13,8	440
on foot	6,4	75
bicycle	5,4	25
car	0,7	25
bus and coach	0,07	2
Passenger ferry	0,25	16
Civil aviation	0,035	8
Rail	0,035	2

Table 2. Costs of the accidents in different mode of transport in EU in 1995 [2]

Mode of transport	Socio-economical costs per one fatality in billion €	
	Total socio-economical costs in million €	Socio-economical costs per one fatality in billion €
Roads	162,00	3,6
Railways	2,74	2,1
Aviation	0,50	2,7
Sea transport	1,78	9,8

## 2. Transport accidents in Poland.

Performing comparative analysis of the accidents in various branches of transport in Poland is limited not by the drawbacks of databases (incomplete DB's, scattering, inaccessibility) but rather by different definitions of the accidents and related terms. And so:

- road accident is defined as road event which is defined as a crash of at least two vehicles, hitting a pedestrian, another traffic participant or a person on the road, collision of a vehicle with an obstruction - which results in bodily harm infringing proper functioning of a human body, health problems of the person who did not cause the accident. Collision is defined as road event resulting in material losses only;
- rail accident is defined as unintended, sudden event or series of events involving a rail-vehicle, resulting in negative consequences for human health, possessions or environment; the accidents include: collisions,



- derailment, events on the railroad crossings, events involving individuals caused by rail-vehicle in motion, fire of a rail-vehicle. Serious accident is defined as an accident caused by collision, train derailment or similar event involving at least one fatality or at least five seriously injured persons, or causing serious damage of the rail-vehicle, infrastructure or environment evaluated for at least 2 million € and having an obvious influence on the safety regulations on the railroad or on safety management;
- maritime accident is defined as event on the sea or linked water involving sinking or disappearance or losing a vessel in another way, abandoning ship, contact with the bottom, surface or underwater obstacle, crashing into a building structure, device or installation, which results in damages to the obstacles or the ship, fire or explosion of the vessel, contamination of the environment, endangering or limiting the safety of the vessel or its crew, disappearance of the man on board of the ship, death or injury of the human being in connection with their work or visit on board of the ship, the ship's behaviour, operation or state of the ship's devices or other elements or the properties of the cargo. Besides "Code for research of maritime catastrophes and accidents" lists the following terms: maritime catastrophe, very serious catastrophe, serious catastrophe as well as the list of their causes;
  - air crash is defined as event connected with the exploitation of an airplane from the moment of boarding by the person intending to perform a flight, until the moment of disembarking all the persons on board, or event during the flight resulting in severe body harm of any person, damage or destruction of the airframe, airplane disappeared and was never found and official rescue mission was cancelled, or the aircraft was located in a place impossible to access. Air catastrophe is defined as air accident involving fatalities or disappearance of passengers, and those who sustained deadly injuries while onboard of the plane, resulting from direct contact with any element of the airplane, direct activity of the jet stream or disappearance of the airplane.

The above shows that the specific character of the operation of particular mode of transport influences the definitions of the accident, differently treating human and material losses as criteria of the accidents.

Statistics of the recorded transport accidents in Poland indicate evident domination of the road accidents, independently of the definition of the accident in particular branches of transport (fig. 1). Against the background of those road accidents, safety of the public transport (mainly municipal transport) looks advantageously. More reliable combination is the



comparison of the number of fatalities. In maritime transport the number is close to zero (fig. 2). Relation between the number of the fatalities and the number of units in traffic (fig. 3) signals the necessity of performing more detailed analysis of the risk in particular branches of transport, considering similar exposure ratio (vehicle kilometres travelled, time of operating in the system). At the moment there is a lack of such information for all the transport branches analysed.

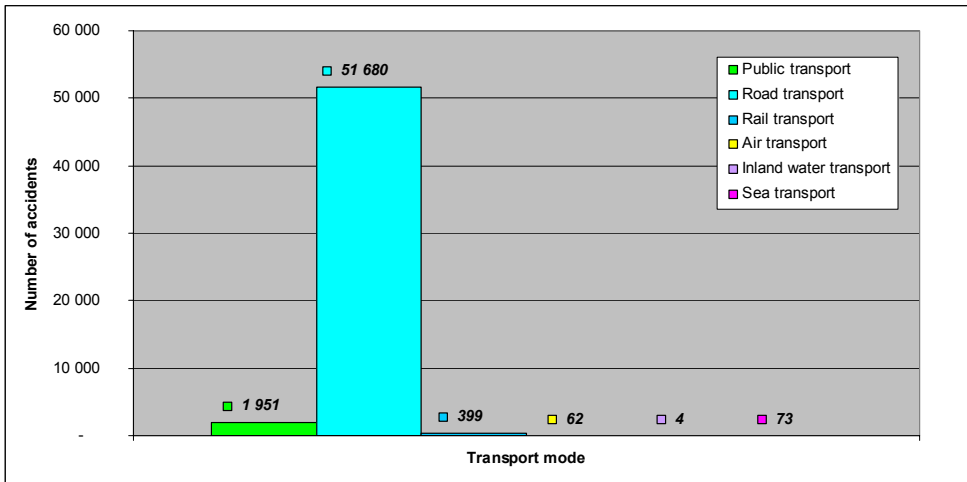


Figure 1 The average annual number of accidents in the branches of transport for the period 2001-2006 in Poland

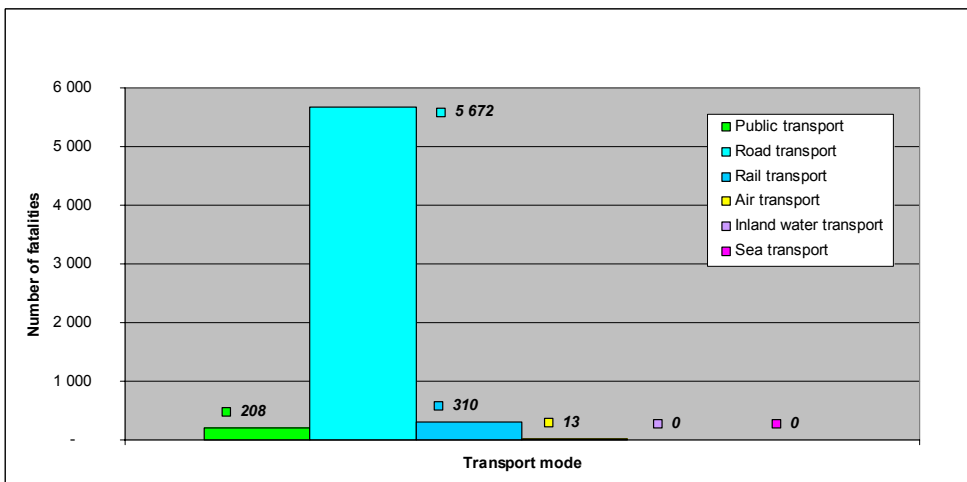


Figure 2 The average annual number of fatalities in the branches of transport for the period 2001-2006 in Poland.

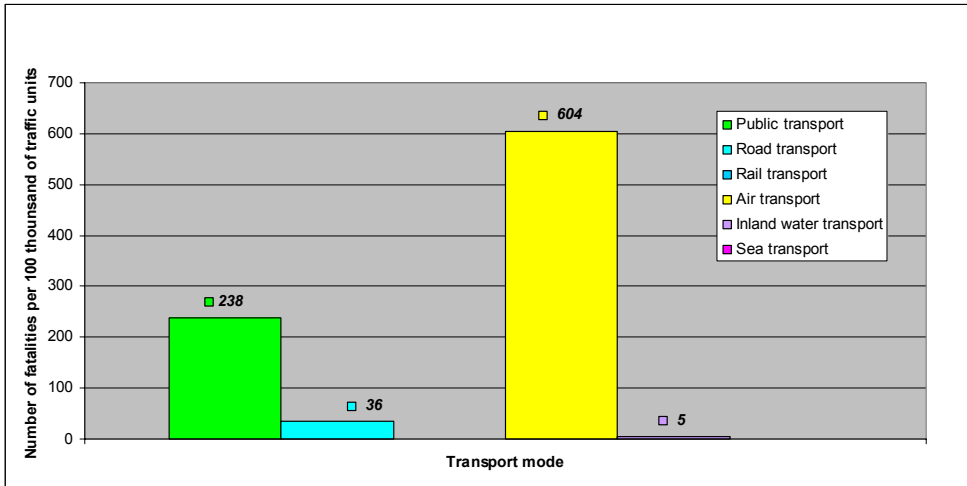


Figure 3 Average index of the fatalities per 100 thousand units in traffic in the branches of transport for the period 2001-2006 in Poland.

### 3. Selected aspects of the safety systems organization in transport in Poland.

In the comparative analyses of the functioning of branch transport safety systems it is possible to relate to many legal, organizational and financial aspects. From the point of view of the possibility of the integration of those systems it is necessary to identify the divergences and relations within the following aspects:

- institutional structures, their authority and relations,
- staff and its training system,
- safety monitoring system, quality of the data bases, data processing system and methods of the risk assessment,
- prevention system, methods of the running traffic management, introduced safety measures and control instruments used,
- rescue systems,
- scientific research of the safety,
- rules of planning of the safety improvements and funding of the systems' development.

Detailed analysis of these aspects, bearing in mind their further development is one of the basic tasks of the ZEUS Project [3]. ZEUS project's analyses performed to date indicate complete dissimilarity of the forms of transport management and division of the authority in the scope of safety in particular



branches of transport. At the current stage there are quite small possibilities of integrated action (table 3). Similar situation occurs when accidents databases are concerned. Databases occur in diversified form, they have various content and purpose, and in case of air and marine transport they are dissipated.

It should, however, be emphasized that the systems of the air, maritime, and railway safety are closely connected with international law and are supervised by international safety agencies. The above concerns operating procedures, rescue systems, passing the traffic tests by vehicles and vessels, operators' training and licensing, etc. In the motor transport the range of the connections and international supervision is relatively small, considering the influence of this means of transport on the overall transport safety.

Table 3. Basic institutions of the transport safety management in Poland

Mode of transport	Supervising institutions with authority on the safety	Specially designed institutions with authority on the safety only
Road transport	<ul style="list-style-type: none"> <li>- Ministry of Transport</li> <li>- Police Headquarters</li> <li>- National Headquarters</li> <li>- Chief Inspectorate of the Road Transport</li> <li>- Regional Road Traffic Center</li> <li>- Road authorities</li> <li>- Public transport authorities</li> </ul>	<ul style="list-style-type: none"> <li>- National Road Safety Council</li> </ul>
Rail transport	<ul style="list-style-type: none"> <li>- Ministry of Transport</li> <li>- Office for Rail Transport</li> <li>- Chief Inspector of the Rail Technical Supervision</li> </ul>	<ul style="list-style-type: none"> <li>- State Commission for Railway Accident Investigation</li> </ul>
Air transport	<ul style="list-style-type: none"> <li>- Ministry of Transport</li> <li>- Office for Civil Aviation</li> </ul>	<ul style="list-style-type: none"> <li>- State Commission for Air Accident Investigation</li> <li>- Commission for Accident Investigation of State Aviation</li> </ul>
Maritime transport	<ul style="list-style-type: none"> <li>- Ministry of Transport</li> <li>- Maritime Offices (with VTS systems and Headquarters and Control Centre of the Maritime Administration)</li> <li>- National Authority for the Inland Water Management</li> </ul>	<ul style="list-style-type: none"> <li>- Maritime Chamber</li> <li>- Maritime Service for Search and Rescue</li> </ul>



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#### 4. Conclusion

Analyses of the existing safety systems indicate their great diversity in particular branches of transport. Searching for the new impulses for the improvement of the efficiency of the transport safety management there are potentially big possibilities resulting from the integration activities and utilization of the proven experiences within the transport sector. It is justified to take up research tasks within priorities seen from the point of view of the systems integration areas such as:

- institutional and legal system for the integrated transport safety systems,
- methods of the risk assessment in the transport systems (definitions, models, description methods, risk prediction and identification of the basic problems),
- system reacting towards the danger (online monitoring, supervision, rescue and damage removal),
- post-accident activity system (commissions, their working procedures, methods for the identification of the accidents' causes, treatment of injured, formulation of the post-accident recommendations).

#### References:

1. Transport safety performance in the EU. A statistical overview. European Transport Safety Council 2003
2. Transport accident costs and the value of safety. European Transport Safety Council 1997
3. Zintegrowany System Bezpieczeństwa Transportu ZEUS. (Integrated Transport Safety System) Research project ordered by PBZ 2/2006 [www.projekt.e-zeus.eu](http://www.projekt.e-zeus.eu)

