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DIFFERENT ASPECTS IN THE SAFETY OF ROAD TRANSPORT

Research terminology regarding the security of civilians and transport security used in source literature refers to a number of conditions. In the course of an analysis, it was observed that the level of security of populations inhabiting a given country area depends on various negative factors, either generated by or resultant from conducted activities, including but not limited to dangers posed by road transport. The objective of the article is to frame a panorama of issues related to the negative influence of road transport-related threats. On the basis of collected empirical data and its interpretation in the light of adopted theoretical assumptions, the author will try to identify and explain the conditions (reasons), types, and directions of changes regarding road transport threat and also explain the state of road safety, road transport infrastructure, safety engineering in transport and psychology of driver of road vehicles. The objective of the article is also to frame a panorama of issues related to the negative influence of road transport-related threats on public safety. On the basis of collected empirical data and its interpretation in the light of adopted theoretical assumptions, the author will try to identify and explain the conditions (reasons), types, and directions of changes regarding road transport threats and present their negative impact on security of the population. It should also be noted that transport should be instrumental human needs, related to the implementation of specific tasks, its objectives and specific objectives. Transport needs are an integral part of the national economy. They also affect the organization and functioning of social life, in which every need to move, both people and goods has a certain meaning. Transport needs reflect the demand for these transport services and are addressed to different systems and forms of transport structures. Knowledge of transport needs plays a fundamental role.

Keywords: Road transport, road safety, road transport infrastructure, safety engineering in transport, psychology of driver of road vehicles.

1. INTRODUCTION

The current standard of present infrastructure maintenance and the low quality of collective transport stimulate individual car transport growth. The underlying problem of the Polish road network is the lack of motorways and express roads. It is a key factor decreasing transport accessibility of the whole Polish territory and its individual regions. The capacity of connections “between main agglomerations has already been exhausted, resulting in heavy traffic on main state roads”. Due to the importance of the road transport for interna-

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tional exchange and logistic supplies for industry and trade, such shortage of high-capacity roads is becoming one of the most notable risk factors for populations using road infrastructure. Literature review, own observations, pilot studies, and data provided by the Information Processing Institute (OPI) reveal that there are no research studies concerning the relationship between the security of civilians and societies and the negative impact of threats generated by road transport. Hence, there is a need for research in said area and for seeking solutions aimed at improving social and civilian security and reducing the number of dangers posed by road transport.

2. THE CURRENT STATE OF ROAD SAFETY

When referring to transport safety, we should first define the present-day road safety situation both in Poland and abroad. The following factors affect road safety: causes of traffic incidents, traffic incident rates, users as a determinant of the safety situation, amongst them drunk and intoxicated drivers, young drivers, pedestrians, children, and road attacks.

Other factors which have a direct effect on the safety situation are road environments and vehicles. The determinants of driver reaction and behaviour while on the road are factors affecting road characteristics. Speed also has an effect on the level of direct risk. Given the foregoing, a series of actions has been designed to improve safety in general communications and transport. These include government administration and competent government departments. In the context of the ways of shaping road safety, we need to take into account the relations between the following: vehicles, road users, and their environment. Most sensitive areas, including: pedestrian crossings, crossroads, cycling paths crossing a road, roads connecting different nodes, and traffic equipment.

Adequate speed management and physical means forcing drivers to reduce speed wherever needed are preconditioned by speed zones. When speaking of transport safety, we refer to special European Union legal rules and regulations. These regulations apply to the purpose of the evolution and effectiveness of road transport and to the superior systems representing car transport within the EU. What is more, they concern the transport of goods, including strategic and dual-use goods. Road transport in Poland has been integrated with the transport system within the European Union. Community programmes, and amongst them policies related to road safety improvement, are constantly reviewed and subject to impact assessments. Laws also determine the organization of the transport of dangerous goods. They include mainly the forms of transport of dangerous goods, their preparation for transportation, appropriate documentation and labelling. Roads are also used for special purposes, such as pedestrian movements, pilgrimages, or marches. Another example of a special road use involves military transport and actions.

Environmental policy making in the context of transport safety is governed by EU legal protection and a selection of UN documents. They include the following: air, water and soil protection against dangerous consequences of transport-related activities; but also: noise emission protection and waste management in communications and transport. Transport safety is overseen by transport and traffic engineering. It focuses mainly on traffic genesis, measurements, research and analysis, on the creation of traffic road control systems and means of transport by road².

² S. Filary, *Bezpieczeństwo w komunikacji powszechnej i transporcie. Materiał dydaktyczny*, Poznań 2010, p. 3–6.

In Poland, provisions guiding transport regulations derive from laws, regulations and documents of the Ministry of Transport, the National Transportation Safety Board (KRBRD), the Road and Road Transport Department (DDiTD), the General Directorate of National Roads and Motorways (GDDiA), the General Inspectorate Road Transport (GITD), etc.

From the point of view of the structure of the causes of road incidents in traffic engineering, we can distinguish the following three major groups: the vehicle, the road user, and the road environment. On the basis of data collected by the safety authorities, such as: the Police, the Fire Brigade, and the Emergency Ambulance Service, and information provided by transport and insurance companies, we can say that most of road incidents results from a human error. The effect of factors of road environments on road incidents is estimated to be relatively low. The importance of road vehicles defects is also low. According to present-day research, what greatly contributes to the rate of road accidents and collisions (as far as road environment is concerned) is adverse weather and bad roadway condition. The analysis of the results of research into incidents in which road users are involved demonstrates that major errors leading to incidents are:

- failure to yield right of way, ca. 41%;
- jaywalking, ca. 30%;
- incorrect traffic manoeuvre, ca. 31%;
- failure to maintain a safe distance between vehicles, ca. 25%.

However, the results of research conducted in many countries indicate that the actual involvement of road environment defects is much greater than the statistics show. The Road safety in Poland for the year 2017 report contains data regarding the length of new roads and motorways, the number of vehicles, and the consequences and quantity of road accidents.

The development of GAMBIT 2005 – the National Road Safety Action Programme – is an advance in the research concerning the number of accidents and their consequences across individual Polish provinces. It presents the number of accidents caused by drunk drivers, rate of fatalities and injuries in road accidents, rates of fatalities and injuries involving pedestrians, and the number of road attacks. The factors determining the way of driving are as follows: mental and physical characteristics, external factors, psychological features, a set of motivators, the way of driving, the driver's level of persuasion and metrics. Road safety is further predetermined by:

- features of the road environment having a direct effect on transport;
- characteristic features of urban road networks;
- weather conditions;
- road surface condition;
- the effect of speed on the degree of hazards;
- high speed vs consequences of chance events.

Actions aimed at transport safety improvement are conducted by: the Police, the Fire Brigade, and the Provincial Council. The use of roads, pedestrian crossings, nodes and speed zones form a part of the UE transport systems. In addition, we should also take into consideration the vehicle systems of active and passive safety³.

³ *Ibidem*, p. 9–11.

3. ROAD TRANSPORT INFRASTRUCTURE

Road transport infrastructure is also a stimulus for regional economic development. Transport plays a vital role in national economy. And it is not only transport infrastructure that matters. Indicators for measuring road network facilities have great significance, too. Investments in transport infrastructure in EU Member States become a kind of a tool for regional development. However, road facilities within the EU differ from region to region. This is a sign of disproportions in regional development. It is associated with the so-called saturation indicators regarding investments in EU transport infrastructure development. They are constantly analysed and assessed. Road transport network development in Poland is closely related to economic development of its individual regions. Thanks to proper factor identification and impact analysis we can find out about the rates and effects promoting transport infrastructure development. Transport, including local transport, greatly benefits from Polish road network development. Government projects and plans are based not only on analyses and demand, but also on forecasts. Changes in road network availability and traffic volume estimates add to investment projects carried out later across individual provinces⁴.

Transport infrastructure development, including road undertakings, activate regional development in Poland. On the other hand, there are many aspects which indicate that transport infrastructure growth and economic development is noted but at the national level. Statistical analyses demonstrate that the impact of road network development is non-uniform and scattered throughout the country. Transport assumes key functions with regard to economy. The task of road infrastructure is to integrate space, which stimulates economic and human relations. From the economic viewpoint, transport may be regarded as a sub-system necessary to satisfy economic needs. Transport facilitates trade in goods, supplies factors of production, and distributes goods. It is an autonomous section of economy, which allows development of an outlet for raw materials. One of the first studies in the economy of transport focused mainly on good choices regarding location.

The general meaning of infrastructure refers to the total of sub-systems, devices used to properly interpret economy operations. The most important physical features of transport infrastructure relate to the ability to re-locate. Investment characteristics, on the other hand, include a lengthy and costly process of implementation of a road undertaking. Facilities, especially roads and road surfaces, are expensive, which - in addition to time-consuming construction works - requires from users a long-term and goal-oriented planning stage. The selection of appropriate indicators of road monitoring illustrates the scale and quality of transport network facilities. The importance of transport affects choices regarding the location of business undertakings and relocation of industries. Improvements of the transport infrastructure are beneficial not only to business entities but also to households. The effect of transport infrastructure development may refer to industrial production, employment, and employment in a given region. One of the most significant forms in which transport gravely affects economy include the changes it produces with regards to the structure of inter-regional trade. They affect the factors of production, goods and intermediate products, which are located in various regions around the country. Products in the sales centres must account for the cost of transport co-factors, which shape relations between the various areas of

⁴ A. Domańska, *Wpływ infrastruktury transportu drogowego na rozwój regionalny*, Warszawa 2006, p. 7–9.

production. The effect of transport infrastructure depends on diverse factors and various time-frames of research and analyses⁵.

The primary form of transport is car transport by road. Hence its great role in interpersonal communication. We should also note the regional diversity with regard to both infrastructure and its facilities or technical quality. It is a clear sign of developmental disproportions and varying directions of development across the country. Investments in road infrastructure in Poland different in part from those found in other EU countries. They are affected by the symmetry and conditions of equal development of the transport infrastructure network. Modifications in transport infrastructure concern passenger road transport as well as goods road transport. Road transport network development in Poland has greatly contributed to economic development and integration with the EU transport system. Currently, the saturation of the country road network refers to both quantitative and qualitative aspects⁶.

4. SAFETY ENGINEERING IN TRANSPORT

A Safety engineering in transport refers to technical safety, road transport safety management and risk management in transport. In addition, it tackles issues concerning any breaches of or non-compliance with transport safety obligations on the part of government authorities and administration. Owing to the growing number of risks, risk prevention and risk effect on population and society, problems had to be solved through the application of road transport engineering solutions. Safety management is mainly used by transport operators with the intention to increase the quality of the services provided. Nevertheless, the duty to assess risk refers to all bodies related to transport, not only to road transport. The above actions are a result of transport processes⁷.

There are two basic approaches to risk management in various road transport relations: operational (process and professional) and strategic. The former approach involves management on the basis of pre-determined goals, whereas the latter represents a prognostic thinking, strategy building and future plan making. These activities provide for new conditions and enable sustainable development. Finally, methods of transport-related risk assessment include risk estimation and quantification.

5. PSYCHOLOGY OF DRIVERS OF ROAD VEHICLES

In literature regarding the subject, there are also references to theoretical problems of road vehicle driver psychology. When exposed to critical situations on the road, drivers' behaviour and psychology are typical. What is important here are determinants of drivers' operational skills. Distractions are situational determinants of drivers' abilities. Additionally, emotional stress affects drivers' abilities. There is also empirical research concerning the safety of drivers' working conditions. The research involves also the circumstances preceding road accidents and disasters. Additionally, scientific literature accounts for the psycho-metrical criteria of 'being a good driver'. Ergonomic approaches to driving safety and

⁵ *Ibidem*, p. 10–82.

⁶ *Ibidem*, p. 120–154.

⁷ K. Chrużik, *Inżynieria bezpieczeństwa w transporcie*, Gliwice 2016, p. 4–94.

psychological aspects of professional drivers and special forces training refer now to the application of road vehicle simulators⁸.

6. SUMMARY

Research terminology related to transport, which from the point of view of the economic definition “is a process of production that, in a world of limited resources, shifts or relocates people, goods and energy in space”. In view of the above, transport is a function which allows for a movement of resources from low-demand areas to high-demand places. Thus, “various needs and desires of men” can be satisfied at the same time⁹. Transport fulfils three basic functions¹⁰:

- the consumption function – which entails meeting the shipping needs by provided transport services;
- the production function – which means satisfying production needs by the provision of transport services, i.e. by creating conditions for business activities, stimulating their operation, and having an impact on market operations and the exchange of goods;
- the integration function – which allows for an integration of the state and the society via transport services.

The fundamental role of transport consist of its function as a provider of services to the remaining branches of national economy. In the case of goods, shipping activities conducted by transport increase their value and – as a part of value of produced and relocated goods – are included in national income¹¹.

Economy could never function without transport, for it serves the role of a “blood-stream”. Other equally crucial issues are state energy supply and, with the growth of the Internet and the emergence of the *new economy*, the increasing role of telecommunications. The three policies – energy, transport and telecommunications – are, therefore, of strategic importance and special interest for the state and under its protection¹². In addition, transport fulfils the following economic functions¹³:

- it is a necessary component of goods supply and distribution (logistic services);
- it increases the spatial reach of the purchasing and the selling markets;
- it is an indispensable element allowing broad-scale industrial cooperation, be it local, regional or global;
- its capabilities ensure mass production coverage;
- it is an essential element that integrates the national economy with the international market;

⁸ J.F. Trelak, *Psychologia kierowców pojazdów drogowych. Teoria i stan badań*, Warszawa 2015, p. 3–24.

⁹ J. Burniewicz, *Ekonomika transportu*, Gdańsk 1993, p. 11.

¹⁰ M. Stajniak, M. Hajduk, M. Foltyński, A. Krupa, *Transport i Spedycja*, Poznań 2008, p. 16.

¹¹ J. Neider, *Transport międzynarodowy*, Warszawa 2008, p. 31.

¹² M. Mindur, *Wzajemne związki i zależności między rozwojem gospodarki a transportem*, Warszawa 2004, p. 139.

¹³ J. Neider, *Transport...*, p. 32.

- the availability of transport services is one the primary factors examined when considering new locations of production plants;
- the present transport infrastructure, both linear and nodal, directly affects the development of other types of business activities, such as trade, tourism, services, repairs etc.

The faces of transport are contradictory. On the one hand, it constitutes an undesired element, since – from the point of view of the shipper – It increases transaction costs, generates risks, and requires a number of additional operations. For individual countries or country groups, transport is a source of multiple ecological, investment, social and other problems. On the other hand, one could not imagine global economy, especially in the period of globalization, without a dense network of transport routes and links, allowing various producers, exporters and importers trade contact freedom, irrespective of the location of goods and their prospective owner. World regions having no transport routes or interchanges may not participate in the international exchange of goods or industrial cooperation¹⁴.

Despite the transformations which have taken place in Poland over the last 15 years, Polish transport continues to be an undeveloped, largely under-invested branch, typically offering entrepreneurs and citizens low-quality services. The greatest challenges to the transport system in Poland include: low-level road traffic security, outdated transport infrastructure which increases the cost of goods shipment and decreases the quality of transport services while reducing citizen mobility and discouraging foreign investors, low efficiency of organizations in charge of investments, high degree of wear posing a serious danger to numerous companies registered in Poland. Low-standard maintenance of present infrastructure and low-quality collective transport do not constitute any alternative to individual car transport¹⁵.

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¹⁴ J. Naider, *Transport międzynarodowy*, wyd. II zm., Warszawa 2012, p. 11.

¹⁵ G. Szyszka, *Logistyka w Polsce. Raport 2006*, Poznań 2007, p. 81–83.

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RÓŻNE ASPEKTY W BEZPIECZEŃSTWIE TRANSPORTU DROGOWEGO

Terminologia badawcza dotycząca bezpieczeństwa ludności cywilnej i bezpieczeństwa transportu stosowana w literaturze źródłowej odnosi się do szeregu warunków. W toku analizy zaobserwowano, że poziom bezpieczeństwa populacji zamieszkujących dany obszar zależy od różnych negatywnych czynników, generowanych lub wynikających z prowadzonej działalności, w tym, ale nie wyłącznie, zagrożeń stwarzanych przez transport drogowy. Celem artykułu jest przedstawienie panoramy problemów związanych z negatywnym wpływem zagrożeń związanych z transportem drogowym. Na podstawie zebranych danych empirycznych i ich interpretacji w świetle przyjętych założeń teoretycznych autor postara się zidentyfikować i wyjaśnić warunki (przyczyny), rodzaje i kierunki zmian w zakresie zagrożenia transportu drogowego, a także wyjaśnić stan bezpieczeństwa drogowego, infrastruktura transportu drogowego, inżynieria bezpieczeństwa w transporcie i psychologia kierowcy pojazdów drogowych. Cel poniższego artykułu stanowi również nakreślenie panoramy zagadnień związanych z negatywnym wpływem zagrożeń, powodowanych przez transport drogowy, na bezpieczeństwo ludności i społeczeństwa. Autor korzystając z zebranych danych empirycznych i ich interpretacji w świetle przyjętych założeń teoretycznych, podejmie próbę wyjaśnienia i identyfikacji uwarunkowań (przyczyn) oraz rodzajów i kierunków zmian zagrożeń powodowanych przez transport drogowy, jak również wskazania negatywnych skutków oddziaływania na bezpieczeństwo ludności. Należy zwrócić również uwagę, że transport należy do instrumentalnych potrzeb człowieka, związanych z realizacją określonych zadań, swoich założeń i sprecyzowanych celów. Potrzeby transportowe stanowią integralną część gospodarki narodowej. Wpływają również na organizację i funkcjonowanie życia społecznego, w którym każda potrzeba przemieszczania się, zarówno osób jak i towarów posiada określone znaczenie. Potrzeby transportowe odzwierciedlają popyt na te usługi transportowe i są adresowane są do różnych systemów oraz form struktur transportowych. Podstawowe znaczenie odgrywa znajomość potrzeb transportowych.

Słowa kluczowe: transport drogowy, bezpieczeństwo drogowe, infrastruktura transportu drogowego, inżynieria bezpieczeństwa w transporcie, psychologia kierowcy pojazdów drogowych.

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