

THE ANALYSIS AND ASSESSMENT OF SECURITY THREATS IN THE MOTOR TRANSPORT

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Abstract

Transport is one of the major and economically most important branches of industry that provides employment opportunities and welfare for population. However, despite beneficial aspects that come together with transport development, it is often associated with potential threat to people's health and lives.

It is needless to say that road safety has a great influence on society mobility. Out of all branches of industry, road transport is considered to be the most dangerous. Such conclusions are drawn on the basis of statistics according to which the greatest numbers of people die in road accidents.

Analysing the data gathered in given period, it can be estimated that more 90 per cent of the whole number of fatalities died in road accidents.

Constantly increasing amount of incoming automotive vehicles as well as outdated road infrastructure in Poland contributes to the growth of various security threats connected with road transport.

Due to the facts mentioned above, it is necessary to introduce important changes that would help to modify present road infrastructure and arrangement so that they are adjusted to continuously expanding transportation demands and needs.

Therefore, the following changes shall be paid additional attention: quality of road infrastructure.

Therefore, particular attention should be paid to the changes that are to be introduced. Such steps of modification aim at road infrastructure quality enhancement, improvement of the highway code, stricter requirements of different means of transport technical condition and changes concerning country transportation policy approach. These ideas are expected to result in increased road safety.

Keywords: transport system, reliability, safety

1. Introduction

Although transport is one of the major sectors of economy providing employment and prosperity, it often involves potential threats. Road traffic safety (RTS) is a factor of great importance in people's mobility. Road transport is considered to be the most dangerous of all transport branches and is the one which involves the biggest number of casualties (deaths and injuries) of road accidents. It is estimated that fatalities of road accidents account for more than 90% of all fatalities in transport.

On the basis of literature it can be said that more than 1.64 million people have lost their lives since 1970 on the territory of the European Union. Each year, on the roads of the European Union countries there are reported 40000 deaths in result of road accidents, and 1.7 million people sustain injuries. Thanks to investments which aim at reducing the number of accidents and their victims in the EU, it is possible to obtain savings of means significantly exceeding outlays which are presently used for disability treatment, rehabilitation of victims and liquidation of accident damages [3, 4, 7-9].

In the sector of transport, in the European Union countries, there are employed more than 10 million people. This sector generates approximately 10% of the gross national product. It is estimated that overhead costs of road accidents in the European Union are 160 billion euro yearly which corresponds to approximately 2% of its gross national product.

It is estimated that yearly costs connected with road accidents in Poland are above 2.11% of its gross national product – that covers the means which in Poland are spent for compensating the social and economic losses of traffic accidents. Therefore, it is necessary to develop effective methods of prevention from occurrence of excessive losses and related costs.

It should be mentioned that the list of major road safety threats in Poland does not correspond to those in the European Union countries. It includes: excessive speed, failing to adjust speed to road conditions, driving under the influence of alcohol or other drugs, young age and poor experience of drivers, reckless driving, poor equipment of cars and others [3, 9].

Despite some improvement in road traffic safety, that has been noted during four recent years, still, the risk of being killed in a road crash is twice higher than in leading EU countries and probability of death of a person involved in an accident is four times higher, on the average. At the same time, financial means and human resources provided for the situation improvement are far from being sufficient.

Increasing number of vehicles as well as an increase in road traffic intensity contributes to a rise of accident risk. These risks have been defined as a possibility of occurrence of a collision between [1, 5, 8-10]:

- vehicles,
- vehicle and human,
- vehicle and a stationary obstacle.

The main causes of accident occurrence risk are:

- damage to a technical object (transport means),
- error of the transport means operator,
- errors of other road users,
- inappropriate road infrastructure and poor road surface,
- other causes.

Threats posed by operating a municipal bus transport means can roughly be divided into two kinds:

- threats of health or life loss by passengers, drivers and people present in the technical object environment,
- environmental threats posed by:
 - lubricants,
 - exhaust fumes,
 - noise,
 - vibrations.

The notion of road transport threat is often associated with some other concepts used in literature, such as: accident, collision, undesirable event, safety. A road collision takes place when there occurs a sudden traffic disruption in effect of a crash of at least two vehicles. Such a happening involves a series of events leading to a situation when traffic is held up and cannot be continued according to previous assumptions. It should also be mentioned that each traffic disruption is a collision, a traffic jam being an example of which, whereas, a road accident is defined as a road collision in result of which participants of the traffic have sustained injuries or lost their lives [8, 9].

Causes of collisions and accidents include all events which take place before their occurrence, e.g. the vehicle technical state, type and condition of the road surface, weather conditions, improper behaviour of drivers resulting from their incompetence or psycho-physical condition. All the events that occur after the collision, e.g. severity of people's injuries (drivers and passengers) vehicle damages and injuries of side walkers involved in the road event, intensity of the vehicle damage are considered to be effects of accidents. It is also important to establish time intervals when there happened events which are classified as causes and effects of accidents or road collisions.

These can be events which occurred directly before and after the collision and events which happened quite a long time before the road event occurrence.

Municipal transport networks whose main goal is to carry out regular passenger transports over a given distance, with the use of common transport means, play a special role in meeting the transport

demands.

Within the whole structure of a transportation system, it is road transport which deserves special attention, including both individual and the public one. It is so because of an increasing number of different transport means (especially in private transport).

Compared to individual road transport, the public one has numerous advantages, including the possibility of carrying a bigger number of people simultaneously, which contributes to reduction of traffic intensity, noise and exhaust fumes emission. A special case of a common transport is a municipal one covering also suburban areas which though lying outside the city borders perform functions analogue to those of the city itself. The great role of the municipal transport is reflected by the relation of its efficient and reliable operation with the quality of social and economic life in urban areas. It is needless to say that the most popular kind of public transport is bus transportation. Its main task is to meet the transport demands according to passengers' expectations. Municipal bus transport does not require rails or tracks as other transport means such as trams or electric buses. It is characterized by:

- the widest application range
- spacious character of work
- ability to adjust to the time of transport needs,
- high transport speed.

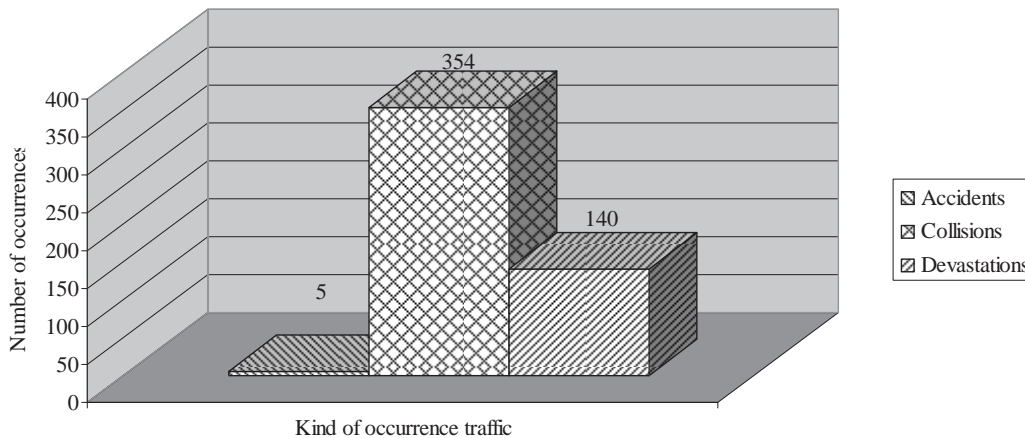


Fig. 1. Number of traffics occurred in 2008, depending on the event type

Despite many advantages of a municipal bus transport system it also poses different hazards to human health and life as well as the environment. Therefore, providing high level of the transport reliability, efficiency and safety is of great importance for its users.

This paper attempts to evaluate the dangers arisen in the process of using the vehicles, resulting from incorrect operation of the municipal transport bus subsystems. On the basis of the analysed relevant literature and our own investigations it has been found that the reasons of the dangers in the antropotechnic systems may be as follows:

- failures of the bus subsystems (components),
- operator's (driver's) faults,
- roadway co-users' faults,
- inappropriate infrastructure of the roadways and improper condition of the roadway surfaces,
- atmospheric conditions, etc.

The dangers caused by operation and maintenance of the buses in a transport system of municipal bus transportation may be divided into two types in general:

- to the people (related to the loss of the health or life of the passengers and drivers as well as of people which are within a vehicle surroundings),
- to the environment caused by emission of: operation and maintenance fluids, exhaust gases, noise, vibrations.

2. The research goal

The goal of this work is to make an analysis and assessment of threats occurring in road traffic, especially in motor transport.

3. The research object

The object of the research is a municipal transport system of an urban complex. The subject of the research is connections of the number of road events with forcing factors which contribute to road transport hazards.

4. The research methodology

Experimental tests covered road events with buses of different makes and types, used in the analyzed system of a municipal bus transport. The tests were carried out by a method of a passive experiment in natural conditions of transport means operating (city buses). Data concerning road events with involvement of the tested technical objects were processed from source documents such as: the damage report, the bus driver report, report from the event. The information covers time from 01.01.2008 to 31.12.2008. The data contained in the above mentioned forms concern: the road event place, its participants, weather conditions, effects as well as causes of the event occurrence. Within the analyzed time, 180 transport means were being operated.

5. The research results and analysis

In the period from the 1st of January to the 31st of December 500 traffic occurrences were reported, in result of which there occurred 354 collisions and, 140 devastations of vehicles and 5 accidents (Fig. 1).

On the basis of an analysis of the effects, it can be stated that most of the traffic were collisions whose results were damages to vehicles and the material losses were rather insignificant. The biggest number of collisions took place in autumn and Winter, that is, months when bad weather conditions affected adversely the process of driving (Fig. 2). A big problem for a transport company is also damages which involve excessive costs connected with providing the vehicle with proper technical state. Systems which are exposed to most frequent devastations due to the vehicle damage include such elements of its equipment as: seats, window panes, bodies, mirrors. The biggest number of such events was reported in autumn and winter. However, there were not many accidents reported in the analyzed period which could be due to: small speeds of vehicles within the built-up area and long job experience of bus drivers.

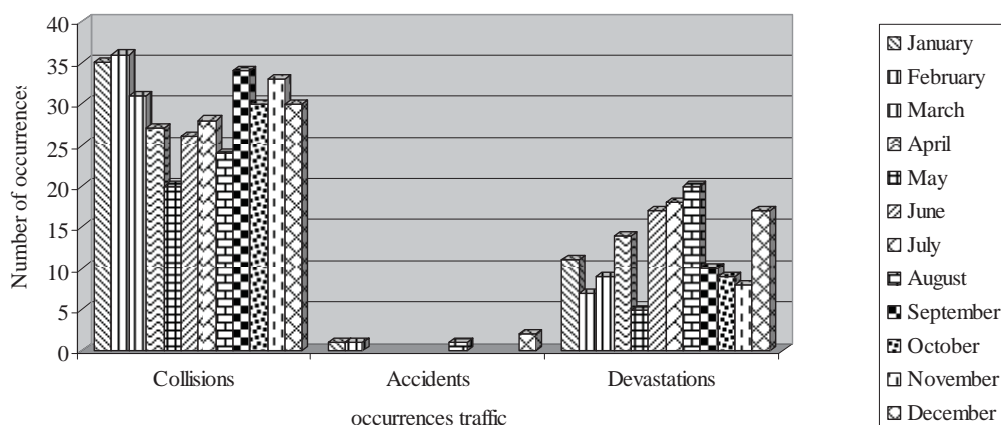


Fig. 2. Frequency of traffic occurrences divided into particular months, reported in 2008

Tendencies of occurrence traffic safety threats changes on particular weekdays have been presented in the chart below. On the basis of an analysis of the source data, it can be concluded that the increase in the number of road collisions occurs most frequently on Fridays, Saturdays and Mondays (Fig. 3). As far as Sundays are concerned being days of less intensive traffic, the smallest number of accidents was observed.

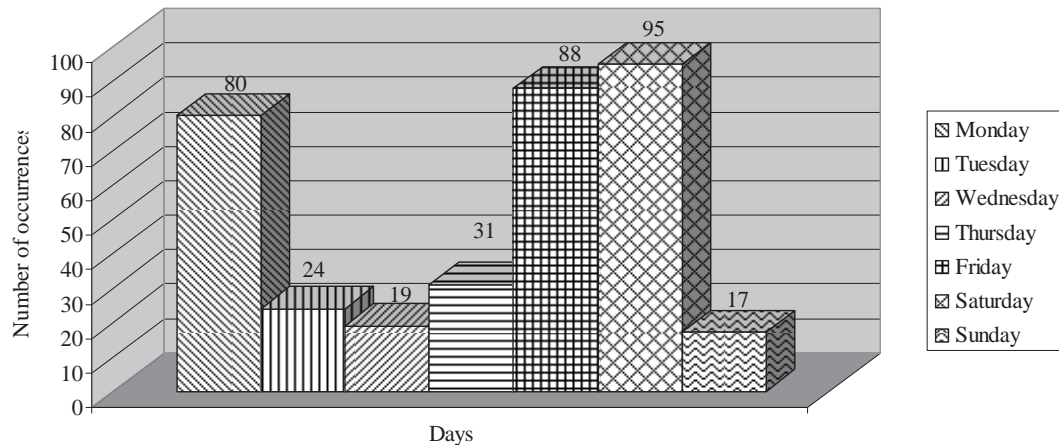


Fig. 3. Number of Road events classified according to weekdays of 2008

Bad weather conditions have also an influence on the number of road collisions especially that for the zone of moderate climate, they differ significantly in particular seasons of the year (Fig. 4). The effects of weather conditions include impaired concentration of the drivers and other traffic participants as well as failing to adjust the speed to the tread conditions.

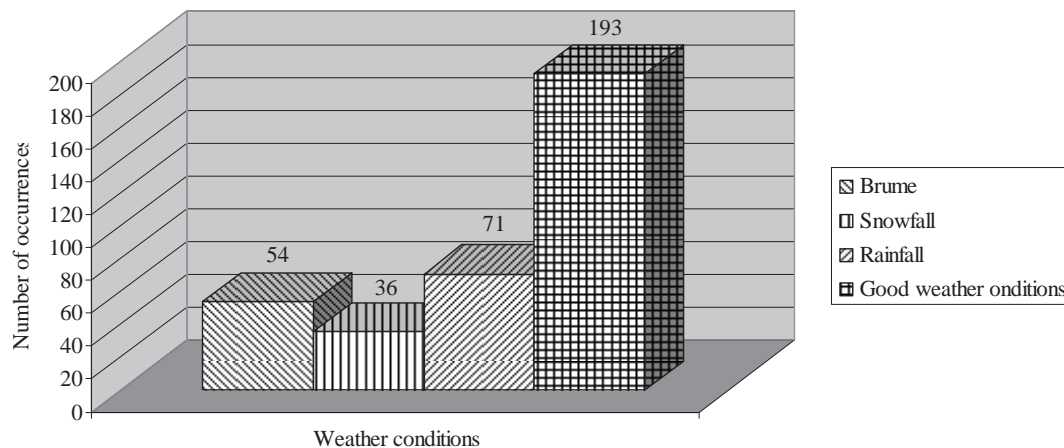


Fig. 4. Number of Road events with regard to weather conditions

As it results from the data presented in the below chart (Fig. 5) most of collisions take place on crossroads with a road with priority of way. In the analyzed time period, there happened 133 collisions in such places.

One of the road collision causes on crossroads of the main road with a subordinate one is excessive speed of vehicles (especially passenger vehicles). Other especially dangerous places are areas of crossroads including those with circular traffic where head-on, side and rear crashes often take place. Also, at bus stops there occur many collisions and accidents. During the carried out tests as many as 52 events of this type were reported. It is caused by bus drivers' errors that carelessly enter the lay by damaging mirrors of other vehicles going along the same traffic lane.

Other factors that contribute to road safety hazards are time of day and lighting of the road. Most of the collisions occurred with good weather conditions. The factor which plays an important

role here is reduction of concentration and attention of traffic participants and failing to pay enough attention during performing particular man oeuvres such as: overtaking, passing or changing the lane.

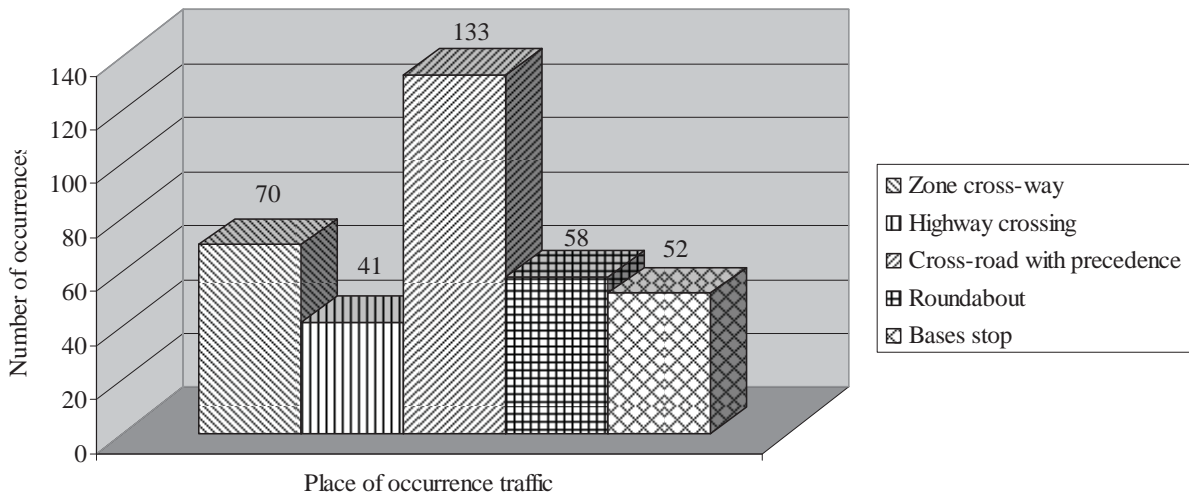


Fig. 5. Number of road events according to the place of their occurrence

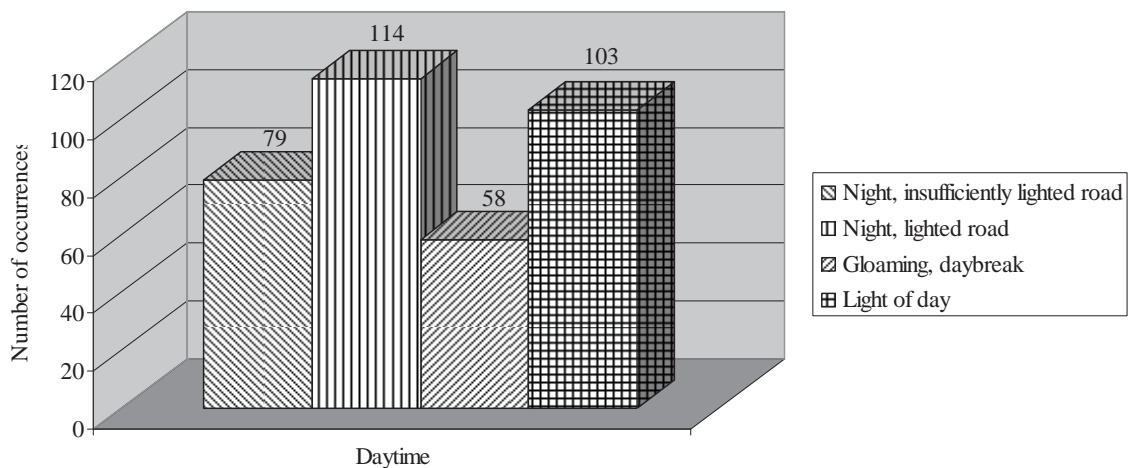


Fig. 6. Number of traffic occurrences classified according to the time of day

On the basis of an analysis of literature and results obtained from tests it is possible to say that such factors as, e.g. time of day, place of the occurrence, weather conditions, or day of week play an important role in road traffic threats. Exceeding the accepted level of at least one of these factors can have a negative influence on bus drivers which can result in their wrong reaction and eventually may lead to posing a threat to passengers' health or life as well as safety of other traffic participants.

On the basis of an analysis of results obtained from carried out experimental tests it is possible to formulate the following observations:

- from the chart presented in Fig. 2 it results that most of road accidents and collisions occur in autumn and winter months which is caused by different factors such as.
 - bad weather conditions (rain and snow falls, thick fog) which largely reduce bus drivers' visibility,
 - Shorter days and longer nights (longer periods of darkness).
- the majority of collisions occur on Saturdays, Fridays and Mondays, that is, days which begin or finish weekends, on these days road traffic is increased (Fig. 3),
- the most frequent places of collisions are crossroads, especially in case of crossroads with a road with priority of way and also on roundabouts (Fig. 5).

6. Conclusions

The major factors affecting the number of road threats and thereby the number of occurring accidents and collisions include errors on the part of drivers and other traffic participants. The most frequent being: driving under the influence of alcohol, not adjusting the speed to road conditions, reckless driving and breaking traffic rules (e.g. not giving way).

Factors connected with behaviours of traffic participants are of crucial for improvement in road traffic safety. Insufficient driving skills, bad manners, inappropriate way of driving as well as physical or psychical unfitness of drivers, all make it impossible for road users to feel safe. Poor social and legal awareness should also be mentioned here as well as disobedience of traffic rules.

It was found that poor road surfacing in Poland has a large influence on the number of road traffic threats. It is reflected by an increasing number of suspension elements damages. There is an urgent need to conduct further research on the quality of road surfacing which will result in its improvement leading to significant reduction of road safety threats.

Although in terms of the number of accidents, Poland is not at the first position compared to other European Union countries it is predominant in terms of the number of fatalities. This is of great concern as human life and health are the most precious assets that should be protected in the best possible way. In order to minimize the number of casualties of road accidents it is necessary to improve active and passive safety level through implementation of modern solutions to such systems as e.g. ABS, ESP, ASR, ACC.

There are many different factors that have a significant influence on safety of road participants, these include: time of day, place of accident, weather conditions or day of week. These factors, combined or alone, increase the number of road safety threats. .

It may seem surprising but it also happens that good weather conditions can be the cause of accidents and road collisions as such conditions make drivers feel too confident which, in turn, leads to lack of concentration and carelessness.

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