Analysis of the causes that generate traffic accidents

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Abstract: The article describes the causes of serious road accidents, as well as the analysis of the influence of the environment on the safety in circulation. In addition, the road network schemes are subject to analysis, ie to what extent they influence the safety of the road. The geometric elements of the road, the layout, the curves in profile. The route of a road has to provide good guidance through its geometry in space and through the elements in the environment and the longitudinal profile, transversal profile, intersections, visibility analysis during the driving process of a vehicle. Influence of road function on traffic safety. For developed countries, the road network is defined on the basis of the road classification in terms of the function it performs, with a focus on the ability to collect or transit traffic. Influence of road equipment on traffic safety. Influence of running surface characteristics on traffic safety. The ruggedness, flatness and waterproofness of the road surface are absolutely indispensable, ensuring the comfort and safety of the traffic. The influence of the human factor on the safety in circulation. Traffic participant is the first link in the road safety chain. Whatever the technical measures adopted, the effectiveness of road safety policy ultimately depends on the behavior of the traffic participants. Violation of pedestrian traffic rules. The circulation of the means of transport is accompanied by energy waste, in the form of noise and vibration, which also has an influence. The forecasts for the development of the transport network show that the sudden increase in the number of transport units increases the risk of an increase in the number of accidents. The vehicle, its influence on the safety in circulation. According to the data on the distribution of accidents by types of vehicles, we can see that the group with the highest number of accidents is that of cars. Conclusions and recommendations are outlined.

KEYWORDS: ACCIDENT RUTIER, PIETON, REȚIEUA STRADALĂ, INTENSITATEA TRAFICULUI, DRUMURI

1. Introduction

Road transport is an integral part of our lives. Whether we are driving a car, a motorcycle or a bicycle, are in a public transport or just pedestrians, we are all participants in traffic. Every day, we spend considerable time moving from one place to another. Crowding, traffic jams, blocked intersections, aggression, young rebels behind the wheel, careless pedestrians, noise pollution, illegally parked cars, all define contemporary traffic where no one seems to follow the rules. Unfortunately, all these problems translate in the very large number of road accidents. Of all transportation accidents, road accidents cause the most casualties each year.

2. The causes that generate road accidents

The influence of the road environment on traffic safety. The totality of streets and spaces reserved for the pedestrian and vehicular traffic of a city constitutes the traffic network or the street network; the elements consist of bars (streets) and nodes (intersections, squares, centroid, etc.), to which are added the extended parking arrangements (parking lots, garages).

A very important index in establishing traffic networks is the percentage of land use of the total area of the traffic network in the entire area of the city. Statistically, such occupancy rates vary between 10% and over 40% of the city. Experience has shown that the ground occupancy of traffic networks of values close to 20% is reflected with satisfactory results in traffic, but this indicator also depends on the size of the city and some local conditions.

The different plan configurations of the traffic networks, in particular of the main road network, distinguish several types with common characteristics. Differentiations between types occur depending on the multitude of conditions that have influenced the structure of existing cities since the origins of their formation. Thus, sets of different types of street networks can be found in the same city, developed in different eras.

Regardless of the causes that generated them, there are two main categories of network types: geometric more or less rigid, and free.

From the point of view of traffic, each of these networks has positive and negative characteristics, so the inclusion in one of these types must result from comparative analyzes.

In general, for the development of modern traffic, the aim is to achieve clear networks of interzonal and external connections, as direct as possible and without embarrassing interference. Of course, the elements of the traffic network cannot and should not be identified with the traffic vectors of the zonal distribution, but they must satisfy them in the best conditions, in this sense, the configuration of the network, as a type, is not necessarily an essential condition, but it must still be taken into account which of the types would be most appropriate for local conditions and coordination with the provisions of the systematization of land use and traffic distribution, in the current and future traffic conditions.

The geometric elements characteristic of roads represent the totality of the component elements of a road in situation plan, longitudinal profile and transversal profile.

Studies conducted over time on road accidents by Kang J. [1] highlighted a number of connections between the risk of their occurrence and the geometric elements of roads, drawing the following conclusions: the proportion of accidents is 1.5 to 4 times higher in curves than in alignment.

A number of authors have identified some of the risk factors in their studies. For example, they studied the perception of the credibility of the speed limit imposed in relation to certain characteristics of the road according to which the objective risk varies:

- curve: yes / no;
- road width: average / wider than average;
- viewing distance: less than average / average / higher than average;
- opening the scene (presence of objects that block the view);
- left / right vision;
- the presence of the bicycle lane;
- presence of traffic lights;
- trees left / right;
- vegetation on the left / right;
- traffic in the same direction / in the opposite direction [2].

The arrangement of many intersections is the apparent result of evolution over time.

By arranging the intersections, the aim is to allow the crossing of flows and changes of direction and direction, which are necessary to travel a route, minimizing the dangers of accidents and ensuring the best possible flow of traffic, with average speeds and flows, as close as possible to the design speeds and traffic capacities of the component streets of the route.

During the process of driving a vehicle, approximately 95% of the information that reaches the driver is perceived visually. The visual detection process is the only one in tracking the road, as well as the detection of obstacles and the interpretation of road
signs, light signals, markings or other signaling modes. Drivers do not have the ability to observe the road continuously. They blink, notice objects on the other side of the road, look in the rearview mirrors, read the car's appliances, and talk to passengers in addition to other tasks. The process is therefore one of sampling [3].

In the case of developed countries, the road network is largely defined on the basis of the classification of roads in terms of the function they perform, with an emphasis on the ability to collect or transit traffic.

Traffic planning and infrastructure design have a particular impact on road safety, reflected for example both in the appearance of streets in residential areas for accidents involving pedestrians and in the case of an urban traffic network with a large number of intersections, which poses a danger, high accident due to the lack of separation of traffic of all categories of road users.

The correct location of traffic signs makes a considerable contribution to improving the safety and efficiency of the transmission network. They must be designed to convey clear and unambiguous messages to road users so that they can be understood quickly and easily. In developed economies, road signs comply with the regulations and standards in force to ensure their consistency across the country.

The quality of the road surface essentially influences the traffic conditions. The safe operation of the road is influenced by the way the road tire contact is made. The lack of permanent contact of the tires with the road reduces the possibilities of maneuvering and braking and can generate undesirable road events.

The roughness, flatness and impermeability of the road surface are absolutely indispensable, ensuring the comfort and safety of traffic.

Pits, veils, sills, sanded surfaces, damaged edges and poor sidewalks are just some of the factors involved in losing control of the vehicle and skidding.

There are no statistics on accidents caused by potholes, but it is believed to be the major cause of accidents that occur at high speeds, especially for two-wheeled vehicles. The pits are risky, on the one hand on impact, on the other hand when trying to avoid them.

Roughness. Roughness is the property of the road surface to show roughness. This ensures the stability of the vehicles in motion, by achieving the best possible grip between the tire and the track.

Flatness. Flatness is a characteristic of the track and represents its uniformity. Its quality can be affected by different types of cracks, deformations or disintegration problems.

Defects related to the flatness of the road surface directly influence the comfort level of the occupants of vehicle, the cost of operating the road and can also have adverse effects on road safety.

Impermeability. Waterproofing is a qualitative parameter of the running surface and has a special importance on the behavior of the road structure in operation.

If the wear layer of the roadway does not ensure the impermeability of the road, water from rain or melting snow enters by infiltration into the layers of the road structure. In this situation, there are a number of deficiencies in each road layer, which is influenced by the presence of water in its material structure.

The traffic participant is the first link in the road safety chain. Whatever technical measures are taken, the effectiveness of road safety policy ultimately depends on the behavior of the traffic participant.

Worldwide, the human factor is responsible for 80-90% of road accidents. Starting from the premise that people are prone to commit various types of errors and that the human factor has a very important role in accidents, since the '80s, more and more efforts have been made to research and understand these factors.

Below is a list of the most common causes of fatal road accidents:

1. Inattention and daydreaming at the wheel - 62%
2. Use of mobile phone -12%
3. Interest in an event, object, person from outside - 7%
4. Conversations with other occupants in traffic - 5%
5. Using or searching for an object in the car - 2%
6. Eating and drinking - 2%
7. Setting the volume and air conditioning - 2%
8. Use of other systems adjacent to the machine: adjustment of side mirrors or seats - 1%
9. The movement of a pet or an insect in the habitat -1%
10. Smoking -1% [4].

All these are the basis for the formulation of the most common causes of road accidents: excessive speed, failure to give priority, violation of pedestrian traffic rules, driving drunk vehicles.

In the hierarchy of causes of accidents with serious consequences, the second place in terms of frequency is not given priority. It has been observed that these accidents are mainly grouped in the area of intersections, as a result of:

- the inattention of the drivers when crossing the space for reading the regulatory indicators;
- failure to take into account the influence of meteorological factors on visibility and the optimal stopping distance;
- incorrect assessment of the speed and distance of vehicles on the priority road;
- incorrect assessment of the distance from the vehicle, which comes from the opposite direction caused by the rear uninsurance.

Research has shown that noise influences aggression, because it amplifies the intensity of the state that has already been caused:

- to some extent this can be seen as a result of the direct influence of noise on frustration. The connection between the noise level and the degree of aggression seems to be given by the level of control that the subject has over the noise. If the individual has no control over the duration or volume of an irritating noise, the level of aggression increases;
- noise also tends to cause stress and makes concentration much more difficult. The horn is so overused in traffic that it becomes almost more important than the brake or steering wheel of a car.

The car crowds pedestrians on sidewalks that are permanently reduced in area, reducing the possibility of socialization and perception of the urban environment. Thus, in modern cities, the car that was conceived as a fast means of movement violates the freedom and possibility of safe movement of pedestrians, especially in city centers.

According to the data on the distribution of accidents by vehicle type, we can see that the group with the highest number of accidents is that of cars. In conclusion, road safety measures to reduce accidents will apply mainly to, but not limited to, this category.

3. Studies conducted on Stefan cel Mare Street in the city of Chisinau Republic

The traffic intensity was analyzed on Stefan cel Mare Street in Chisinau, Republic of Moldova, depending on the time of day. We build a graph of the difference in traffic intensity during the day.

Fig.1 Variation of traffic intensity during the day.
Analyzing road accidents according to the time of day, we build another graph. [5]

Fig. 2 The difference of road accidents during the day.

We make an analysis of these two graphs, we see that the intensity of traffic increases between 08:00-09:00 and 16:00-18:00, and the frequency of road accidents also increases between 08:00-09:00 and 16:00-18:00 which proves that it is a dependence of the frequency of road accidents on the intensity of traffic. The influence of noise pollution on Ștefan cel Mare și Sfânt Boulevard on the frequency of road accidents was established.

The measurements were performed with the sound level meter DT8852 on Ștefan cel Mare și Sfânt Boulevard on 13.04.2016, starting with 12:43 on Libertății Square and until 14:25 on Dimitrie Cantemir Square. The sound level meter DT8852 has been set to determine the level of continuous sound pressure weighted A on the edge of the roadway at a height of 1.2 m. From the curb upwards, setting the maximum sound level \( L_{\text{max}} \) on the streets:

1. Ciuflea \( (L_{\text{max}}) = 89.5 \text{ dB} \)
2. Ismail \( (L_{\text{max}}) = 91.0 \text{ dB} \)
3. Tighina \( (L_{\text{max}}) = 87.2 \text{ dB} \)
4. Armenească \( (L_{\text{max}}) = 88.9 \text{ dB} \)
5. V.Alecsandri \( (L_{\text{max}}) = 87.4 \text{ dB} \)
6. A. Pushkin \( (L_{\text{max}}) = 87.0 \text{ dB} \)
7. Bănulescu Bodoni \( (L_{\text{max}}) = 94.0 \text{ dB} \), it is raining
8. D. Cantemir Square \( (L_{\text{max}}) = 91.2 \text{ dB} \), it is raining

In the measurement process, the maximum sound level was \( L_{\text{max}} = 99.0 \text{ dB} \), when the alarm was on. The values of the noise indicators \( L_{\text{max}} \), presented above can be represented graphically for each point where the measurements were made.

Why is there a difference in sound level at different intersections? A study was made of the traffic intensity on all the intersections on Ștefan cel Mare și Sfânt Boulevard. Difference in traffic intensity at intersections. We compare these values and see that the noise intensity is higher at intersections where the traffic intensity is higher. So the size of the noise depends on the traffic. It was noticed that the biggest noise is the old trolleybuses and old buses.

From the graph shown in Figs. 3 results that on Ștefan cel Mare și Sfânt Boulevard, the admissible limits of the sound level during the day are: exceeded by 26dB, reason for which measures must be taken to reduce noise pollution.

4. Conclusions

Considering the increase, in recent years, of the degree of self-motorization, changes in the structure of public transport, increase of intercity commuting, it becomes clear that the existing road network (with insufficient technical parameters and traffic capacities) can no longer meet modern requirements. The situation is also complicated by the lack of alternative possibilities regarding the orientation of road connections, which causes the appearance in the central area of intra-urban transit flows in a volume of 50%. At the same time, the city center acts as a node in the structure of public transport, being the most important point of arrival and departure of passengers. It can be concluded that the main streets of the central area, destined for the connection with other urban territories, do not honor their tasks and need reconstruction with the conformity of the technical parameters to the normative ones.

In order to reduce noise pollution and to streamline road traffic on the traffic artery where the measurements were made, provision should be made for:
- introduction of new means of public transport;
- parallel use of green barriers and those built of special materials, noise screens;
- a less noisy road.

Through the consequences for the individual and the society, the analysis of the causes generating road accidents and especially the identification of the directions of action for the prevention of road accidents requires fundamental and experimental researches, to the development of which this work contributes. The situation of road accidents in Moldova, presented in this paper, emphasizes that research is needed to identify measures to improve road safety.

Bibliography