# THE FACTORS OF TRAFFIC ACCIDENTS

**Associate Lecturer Andrei IONESCU**
Doctoral student School of Law, IOSUD „Titu Maiorescu" University, Bucharest
Faculty of Law and Economic Sciences in Târgu Jiu
"Titu Maiorescu" University, Romania
*ionescu.andrei1202@yahoo.com*

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**Abstract:**
*Road accidents are not simple random events, but the result of a combination of interdependent factors: human, technical, road-environment related, and others. The human factor is identified as the main element, determining the situations that lead to accidents and, at the same time, bearing their consequences. However, besides the human factor—whether we speak of drivers, cyclists, motorcyclists, or pedestrians—there are also other factors, referred to as secondary in the production of road accidents, such as: (the means of transport and inadequate road/access ways); favorable factors (weather conditions, level of luminosity, speed, state of health etc.).*
*Road crime has long been a major global issue, with devastating effects on people's health and lives, as well as on the economy, estimated at 2% of the EU's GDP.*
**Keywords:** *road accident, factors, road infrastructure, driver, road safety.*

## 1. PRELIMINARIES

The generating causes of road accidents have always been a topic of constant interest due to the possibility of preventing and combating them. Some authors argue that no dominant circumstance present in all situations could be identified; as a rule, several causes leading to the road incident were found, considering that "these accidents are not completely accidental".[1]

Thus, according to Professor Emilian Stancu, accidents occurring on public roads result from the "independent or combined action of three factors: human, technical, and road-related". [2] Other authors consider that the factors involved in the genesis of road trauma consist of: the main factor—the human being; secondary factors (the means of transport and inadequate road/access ways) and favorable factors (weather conditions, level of luminosity, speed, state of health etc.). [3] We believe that there are several factors, but the human being is the most important causal factor in the occurrence of road accidents (whether driver, cyclist, or pedestrian), because they create the situation that

makes the accident inevitable; yet they also bear its negative consequences. [4] Specialists in the field have identified 36 causes of serious road accidents [5], most of them rooted in human behavior-particularly that of drivers-namely: speed inappropriate for road conditions; failure to yield to pedestrians; failure to yield to vehicles; distractions; unlawful overtaking; failure to keep safe distance; driving under the influence of alcohol; failure to ensure when changing direction; other violations committed by drivers; driving against traffic; driving without a license; falling asleep at the wheel; improper reversing; unlawful speed; improper lane change; failure to comply with railway-crossing rules; ignoring traffic lights; driving under the influence of drugs; failure to comply with mandatory or regulatory signs; disabilities or medical conditions; unsecured load; illegal stopping or parking. The human being remains the most important causal factor in road accident occurrence because they create the situation that renders the accident inevitable and they also suffer its consequences. [6] In what follows, we will not address this factor, but the others, called secondary (the means of transport and inadequate roads/access ways) and favorable factors (weather conditions, luminosity, speed, state of health etc.) [7].

## II. ROAD ACCIDENTS - A SOCIAL SCOURGE

The living conditions of postmodern society [8] are profoundly influenced by the digital technology revolution and, especially, by artificial intelligence (AI). These have become a way of life not only at the individual level but have penetrated all spheres of activity.

As a result of this process, simultaneously and consequently, we see, on the one hand, massive population concentration in cities [9] and, on the other, an unprecedented intensification of economic (including online) and cultural exchanges. Thus arises the need for constant movement of people and material goods; the exchange of information and ideas is amplified. Under these conditions, the importance of transportation increases considerably, as do the means of transport of all types, which directly contribute to meeting the demands arising from socio-economic development.

An essential role is played by road transport, which, in addition to its undeniable economic utility, also has broader social utility, ensuring—or, more precisely, facilitating—

the immediate individual and collective needs for rapid travel, entertainment, or recreation. This explains why the automobile—which has fascinated humankind ever since its invention—has become today more fascinating and more necessary than ever. Its use brings multiple and significant benefits for the individual as well as for society, securing it a well-deserved central place in the landscape of postmodern life.

Today, more than 1.2 billion automobiles circulate on Earth's roads, of which fewer than 45 million are electric cars. These figures, however, do not say everything, because despite the energy and raw material crisis felt in almost every country, the number of automobiles continues to grow, with specialists estimating that by 2035 more than 2 billion cars will be on the road worldwide. [10]

This constant increase inevitably leads to considerably denser traffic and, at the same time, to a rise in accident risks and the number of road accidents. Thus, the use of automobiles proves not only advantageous for individuals and society but also dangerous. [11] Beyond the great and undeniable advantages and benefits that the automobile brings to humankind, its use-especially when carried out outside legal and technical requirementscan be accompanied by unwanted effects with the gravest consequences. The number of automobile victims, as well as the cost of material damage caused by road accidents, remains alarming.

Road-related criminality has taken on worrying proportions worldwide. According to estimates by the World Health Organization, globally, road accidents will lead to 13 million deaths and 500 million injuries over the next decade.

In 2023, approximately 20,418 people lost their lives in Europe, while in Romania, 1,545 people died, 3,537 were seriously injured, and 2,172 were slightly injured. According to statistics, in Romania, the number of fatalities in serious road accidents in 2023 was 88 fewer than in 2022 (corresponding to a decrease of about 5%) [12], placing the country among the 18 states where the fatality rate fell in 2023. The reduction recorded in Romania is more pronounced than the European average (a decrease of 5.4% compared with only 1.3% in the EU). At the same time, mortality decreased from 86 deaths per 1 million inhabitants in 2022 to 81 deaths per 1 million inhabitants in 2023. Despite this positive evolution, Romania ranks second in the EU, after Bulgaria, in terms

of road accident mortality. The safest European countries are Norway (20 deaths per million inhabitants) and Sweden (22 deaths per million inhabitants) [13].

In a ranking of persons who died in serious road accidents by age group, the highest frequency of mortality is found among individuals aged 66-75 (279 deaths), representing the age group most commonly encountered among pedestrians and cyclists killed. Additionally, as in previous years, the data show that people over 60 represent more than one-third of all road-traffic fatalities (37.2%). Conversely, 1 in 5 drivers-motorized or not-who died in road accidents in 2023 were aged 18–30. Moreover, 58.7% of road users aged 18-35 who died were vehicle drivers. Not to be overlooked is the number of deaths among those aged 0-17 (79 deaths), most of whom were passengers (43 deaths), pedestrians (23 deaths), or cyclists (9 deaths) [14].

In 2023, an average of four accidents per day involved pedestrians, resulting in at least one pedestrian death and the serious injury of approximately four pedestrians. Most accidents involving pedestrians (1,401) resulted in the injury of a single pedestrian and caused 442 pedestrian deaths and 948 serious injuries. In 2023, 78 serious accidents involved multiple pedestrian victims: 64 incidents with two pedestrians injured (19 deaths, 62 seriously injured), 11 accidents involving three pedestrians (9 deaths, 8 serious injuries), one accident causing one serious injury and three minor injuries, and two accidents involving five pedestrians (2 deaths, 2 serious injuries). [15]

Pedestrians represented 28.9% of serious road accident victims, ranking second after vehicle drivers. They are one of the most vulnerable categories due to their lack of protection in the event of a collision. In road accidents, pedestrians suffer the most severe consequences in the impact with other road users, while injuries inflicted on others are rare. [16] Motorcyclists are likewise extremely vulnerable, with alarming numbers of deaths and serious injuries in Romania and across Europe. In Europe, more than 3,500 motorcyclists died in accidents in 2020, and Romania remains consistently among the countries with the most motorcycle victims, with over 100 deaths in the same year and more than 1,300 in the first 11 months of 2024.

Cyclists also represent a highly vulnerable category [17]. In recent years, Romania has recorded the highest number of cyclist deaths in road accidents in the European Union, with 191 victims (10% of all road deaths) and 10 deaths per million inhabitants.

[18] Of all persons seriously injured in road accidents in Romania in 2023, most were vehicle drivers (1,623 persons), representing 46% of total serious injuries.

Statistical data show that, compared to the distribution of fatalities, individuals over 65 have a lower share among the seriously injured, which may be explained by their higher physical vulnerability-when involved in a serious accident, their risk of death is higher compared with other age categories. Among the seriously injured, the age group with the highest share is 18–25 (14.8%), followed by 46–55 (14.4%). [19] Passengers represented one-quarter of all persons who suffered serious injuries in road accidents (883 persons).

Road-related criminality-beyond the impressive number of deaths and injuries-naturally entails economic consequences. Almost without exception, road accidents cause material damage of varying degrees. Most compensations are paid directly by civil liability insurers. Regarding mandatory civil liability insurance (RCA) [20], according to the Financial Supervisory Authority, at the end of 2023 there were 7,053,399 valid RCA policies, of which 5,514,050 were held by individuals and 1,534,349 by legal entities.

The total value of damages (paid compensations plus reserve changes) for RCA insurance in 2023 amounted to 5,538,066,650 lei. [21] According to the National Union of Insurance and Reinsurance Companies (UNSAR), the largest compensation paid in 2023 exceeded 5.6 million lei; the value of the top 10 compensations paid under mandatory RCA insurance in 2023 totaled 34.7 million lei, each covering both bodily injury and material damage. The average RCA claim increased significantly in 2023, by over 8% [22].

At the beginning of the 2020s, the average social costs and total costs for a deceased person, for a seriously injured person, and for accidents resulting in fatalities or serious injuries were as follows:

- average social cost per seriously injured person: 684,827.41 lei (€152,495.64);
- average social cost per deceased person: 4,302,673.62 lei (€958,108.49);
- average social cost per serious accident: 760,158.42 lei (€169,270.16);
- average social cost per fatal accident: 4,883,603.01 lei (€1,087,468.38);
- total cost of seriously injured persons: 5,675,164,707.62 lei (€1,263,731,341.32);

- total cost of deceased persons: 8,231,014,632.30 lei (€1,832,861,564.34)- total cost of serious accidents: 6,604,256,351.83 lei (€1,470,619,121.72);

- total cost of fatal accidents: 8,370,495,558.42 lei (€1,863,920,806.63).

## III. THE ROAD FACTOR

The road factor, as a condition in the occurrence of traffic accidents, concerns land travel routes, namely roads, and specifically their condition—whether or not they are paved, the quality of the asphalt layer, the presence of road signs, and the proximity of obstacles to the roadway.

Experts, based on statistical data, have confirmed some correlation between road width and accident frequency. Thus, for a road width of 5 m, the number of accidents per million vehicle-kilometers is 0.95; at 7 m width, the number of accidents decreases to 0.5, and on roads 7–13 m wide, it falls to 0.35 [23].

Infrastructure deficits are reflected in reduced mobility, insufficient connectivity in certain regions, poor interconnection of major economic and urban centers, high transit traffic through towns that lack bypasses, long travel times, and traffic congestion. An increase in traffic volume, coupled with slow infrastructure development, can negatively influence the evolution of road accidents and may serve as a predictive indicator in road safety.

Romanian authorities (Pro Infrastructura Association[24]) estimate that investments of hundreds of millions of euros are needed to build city bypasses, which are necessary to handle heavy traffic, reduce congestion, and lower the risk of accidents. In addition, road signs and markings must be installed and maintained, along with proper lighting.

Similarly, the high proportion of road fatalities in Romania compared to the EU can also be explained by the lack of highways, given that the European Commission has shown that only a small part of deaths occur as a result of accidents on highways, where very few frontal collisions—the most dangerous type—take place. The absence of highways in Romania redirects traffic to roads where lanes are not physically separated, allowing for severe head-on collisions.

Consequently, reducing the impact of the road factor in triggering accidents can be achieved through the development of a road network adapted to current transport needs, considering the large and increasing number of vehicles operating on Romanian roads. As noted earlier, at the beginning of 2025, Romania's public road network, which as of 31 December 2023 totaled 86,388 km, consisted of 17,677 km (20.4%) national roads, 35,046 km (40.6%) county roads, and 33,665 km (39.0%) communal roads. [25] The density of the public road network per 100 km² was 36.2%. The highest density values were recorded in the Bucharest-Ilfov region (50.8 km), North-East (40.7 km), and South-West Oltenia (39.1 km).

The mobility index (million vehicle-kilometers traveled) in 2023 was 179,517. Adding the number of driving license holders-8,856,128 [26]-gives a clearer picture of this phenomenon.

Regarding this factor, many traffic accidents are caused by pedestrian inattention or indiscipline. However, more frequently, pedestrians-through no fault of their own-become victims of such accidents. More than half of serious accidents involving pedestrians occurred in urban areas (826 incidents, 55.6% of the total). In rural areas, 526 accidents occurred (35.6%), and outside localities, 130 (8.8%).

Statistics from 2023 in Romania show that in rural areas, more than half of pedestrian fatalities (50.7%) resulted from accidents on national roads, and about one-third (34.7%) on county roads passing through rural communities. Additionally, 71.8% of seriously injured pedestrians were involved in accidents on national or county roads.

In urban areas, the main cause of serious pedestrian accidents is failure to yield to pedestrians (responsible for 40.5% of pedestrian accidents), followed by illegal road crossing (the primary cause in 34.8% of serious pedestrian accidents). [27] This distribution again highlights the consequences that inadequate infrastructure has on road user safety.

Although there is a decrease in the number of serious urban accidents, the overall number of traffic accidents in cities remains high. This is due to both subjective/behavioral causes and objective factors. Among the latter are the disappearance-or at best narrowing-of sidewalks to make room for parking, ongoing (often seemingly chaotic) road and pedestrian infrastructure repair works (so-called modernization investments in gas,

electricity, TV cables, etc.), which make walking in cities an adventure, whether large or small.

Adding the lack of pedestrian education, driver arrogance (which is directly proportional to the horsepower of the vehicles they drive), silent engines, unlit roads, walking often becomes a dangerous or even tragic adventure.

Finally, among the most frequent causes of accidents related to the road factor are: incomplete or insufficient [28] road signage; deteriorated or under-construction roads [29]; other road-related causes [30]; unmarked obstacles on the roadway [31]; and animals or other objects [32].

## IV. THE TECHNICAL FACTOR

Another circumstance that can contribute to the occurrence of a traffic incident is the technical factor, related to whether the vehicle operating on a public road is functioning optimally.

Road accidents can be caused by various vehicle malfunctions affecting the braking system, steering, etc., which may occur suddenly during movement or may have preexisted.

The average age of vehicles presented for technical inspection (ITP) in 2023 (first presentation) was 15.43 years (increasing compared to the previous year, when it was 15.21 years). Of the 86,705 vehicles technically inspected in traffic in 2023, 34.3% were non-compliant from a road safety perspective. 6.82% of the vehicles inspected in traffic and 15.75% of all non-compliant vehicles presented an imminent accident risk. [33] In Romania, there were 7.3 new vehicle registrations per 1,000 inhabitants. Romanian legislation requires vehicle owners to perform periodic technical inspections once every two years for the first 10 years, after which inspections become annual.

In 2014, considering the importance of this cause in road accidents, a set of European legislative measures, the “Vehicle Technical Inspection Package” [34], was adopted, composed of three directives: Directive 2014/45/EU on periodic technical inspections, Directive 2014/47/EU on roadworthiness checks of commercial vehicles in traffic, and Directive 2014/46/EU on vehicle registration documents.

Although vehicle technical failures can occur unexpectedly, they are most frequently the result of failing to perform periodic inspections, during which technical problems can be identified and corrected.

Globally, approximately 165,000 automobiles are produced daily, which contributes to an increase in both the number of cars on the roads and road accidents. The main problem is not the number of cars, but the age and quality of the vehicle fleet. It is considered advisable to limit the importation of vehicles older than 10 years and to apply an additional pollution tax.

In serious road accidents on Romanian roads in 2023, 11,458 vehicles of various categories were involved, of which 6,825 were passenger cars (59.6%).

Technical failures of vehicles caused 12 serious road accidents in Romania in 2023, resulting in the deaths of 4 people and serious injuries to 10 others, yielding a mortality rate of 33.3%.

## V. ENVIRONMENTAL FACTORS

As highlighted in the specialized literature [35], the natural environment is one of the factors shaping road safety. Therefore, in the following, given that meteorological factors are not explicitly reflected in the number of serious road accidents, we will attempt to determine under what conditions they can influence the occurrence of traffic accidents.

Contrary to some claims, meteorological conditions are not the primary factor in the etiology of the incidents considered here: 91.7% of serious road accidents in 2023 occurred under normal weather conditions.

Exceptional weather conditions are usually accompanied by repeated warnings from authorities, which encourages more cautious behavior among road users. Conversely, in the absence of exceptional weather conditions, high traffic volumes can coincide with lower levels of caution and attention. Among various adverse weather circumstances, rain is the condition in which most serious road accidents occurred (5.89% of serious accidents happened in rainy conditions).

In 2023, higher mortality was observed in accidents occurring during blizzards, strong winds, and rain. The majority of serious accidents (3,777-83.4% of all events in

2023) occurred on dry roads [36]. It should be noted that 13.7% of incidents occurred on wet roads, and only 2.8% occurred on roads covered with snow, ice, or slush.

Most accidents caused by cyclists occurred on dry roads (91% of such incidents), placing cyclist-related incidents as the leading cause of accidents on dry roads (500 serious events, 45 more than the next cause-speed not adapted to road conditions). This is consistent with the more frequent presence of cyclists in good weather compared to rain or snow, which leads to more cautious behavior.

A large number of accidents were caused by speed not adapted to road conditions on wet or icy/snow-covered roads, compared to other causes in these conditions. In fact, speed not adapted to road conditions is the second leading cause of serious road accidents on dry roads, followed closely by illegal pedestrian crossing.

Finally, less than one-tenth of serious pedestrian accidents occurred in the absence of adequate street lighting (nonexistent, nonfunctional, or turned off). The majority of serious pedestrian accidents (81.3%), most fatalities (72.9%), and the highest number of seriously injured pedestrians (84.5%) occurred under adequate lighting conditions.

## V. CONCLUSIONS

Road accidents represent one of the most serious issues faced by contemporary society, with deep social, medical, economic, and psychological consequences. Their occurrence is rarely the result of a single cause; rather, they stem from the complex interaction of multiple factors-human, technical, environmental, and infrastructural.

Among these, the human factor remains the most important, since it creates the situation that makes the accident inevitable and, at the same time, is the one that suffers its consequences. However, the increasing number of vehicles, the modernization of infrastructure, and the complexity of traffic have led to the emergence and amplification of secondary and favourable factors, which may trigger, facilitate, or worsen the effects of accidents.

The road factor plays a decisive role in ensuring safe traffic. A road that is inadequately designed, poorly maintained, or insufficiently signaled significantly increases accident risk. Therefore, modern infrastructure must be built and managed

according to principles that ,,forgive" human error and reduce the severity of its consequences. Similarly, favourable factors such as weather conditions, visibility, speed, the physical condition of the driver, or the technical state of the vehicle can amplify vulnerabilities in traffic. These elements contribute to creating dangerous contexts, especially when drivers do not adapt their behaviour accordingly.

Preventing and combating road accidents requires a holistic approach, involving:

- continuous improvement of road infrastructure;
- strict compliance with legal norms;
- responsible behaviour from all traffic participants;
- modern technology and intelligent traffic management systems;
- effective oversight and intervention by authorities;
- education and awareness campaigns;
- regular technical inspection of vehicles;
- reducing environmental and visibility risks;
- promoting safe mobility and vulnerable road user protection.

Road safety is a shared responsibility. Only through coordinated action among authorities, specialists, drivers, pedestrians, and society as a whole can we significantly reduce the number of accidents and their dramatic consequences.

Road accidents, although often described as ,,random", are in fact largely predictable and, to a considerable extent, preventable. Understanding and addressing their causes is the first essential step toward safer roads and a healthier society.

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