

Reasons and Strategy for Road Accident Prevention in Constantine State

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Abstract

Through this article, we will try to discover and analyze the reasons that lead to the occurrence of traffic accidents in the city of Constantine. For this reason, the descriptive analytical method was used, through which we concluded that the most important reasons that contributed to the exacerbation of the phenomenon are the human factor. To mitigate traffic accidents, a comprehensive strategy in which all actors contribute to curbing this phenomenon was adopted.

Key words: traffic accidents - causes - strategy - state of Constantine

INTRODUCTION

Many economic processes, from commuting to work, to the supply of raw resources and energy, to the distribution of goods to consumers, are directly linked to transport. Transport also plays an indispensable role in the social sphere, as it allows people to communicate, get to know each other, and exchange ideas. Transport has always represented a certain place in the social hierarchy.

When we talk about transport, we use words like “mobility”, “congestion”, “flow” or “artery”, and these terms are convenient for describing flows in networks. We conclude that transport is a vital function of human society, just as blood is essential to human life.

Traffic accidents are among the most important and serious contemporary problems that hinder social and economic development, as they target more and more residents, who lose their lives, become permanently disabled, or become unable to provide services for some time, resulting in human and economic losses. In this regard, the World Health Organization (WHO) ranks traffic accidents among the ten most common causes of death in the world (WHO, 2013, p.2).

Algeria is among the countries that are experiencing a significant escalation of the problem of traffic accidents, especially in recent times, due to the increase in the size of the parking lot and therefore the increase in traffic, the roads can no longer accommodate the huge number of cars and therefore the possibility of traffic accidents has become more important. For example, the number of traffic accidents in Algeria recorded in 2019, according to the National Commission on Road Safety, was estimated at about 13,310 accidents, and this is a significant number that should be studied seriously to mitigate its impact.

Among the cities witnessing major traffic accidents, we find Constantine, which has experienced a peak, especially in recent times, pushing local authorities to study this phenomenon, to analyze and understand it in order to find solutions to reduce it. From the above, we can ask the following problem: What are the causes of the occurrence of traffic accidents in the city of Constantine? What is the strategy used to reduce these accidents?

This research aims, in addition to clarifying the extent and evolution of traffic accidents in the city of Constantine, to shed light on the causes of traffic accidents recorded in the city of Constantine and to propose a clear strategy to reduce them.

Regarding the approach adopted during the research, we relied on the descriptive analytical approach, where data were collected from various safety agencies related to traffic accidents, so that they were organized and analyzed in a way to understand and know the extent of their severity in order to take effective preventive measures, and our study also focused on knowing the most important reasons involved in the exacerbation of this phenomenon in order to achieve a preventive strategy to reduce the negative consequences of traffic accidents.

Concepts Related to Traffic Accidents and their Causes

Definition of Traffic Accidents

These are accidents that occur on the roads when a car collides with another car, person, or animal, or collides with a facility or other things. These accidents result in property loss, human injury, and death (Zanati&Benini, 2019, p .460).

It is also known that all the collisions that occur on the roads of all kinds, and these accidents may result in one or more victims, killed or injured, or material losses that are represented in personal or public property owned by the state (Boudarifa, 1991, page 13).

They can also be defined as that imbalance that occurs in the traffic pattern that includes people, vehicles, and the environment. Any defect in these three elements will inevitably lead to a traffic accident because traffic accidents are divided into physical and material accidents (Ladi, 2014, p. 8).

Causes of Traffic Accidents

A - Reasons Related to the Driver

They are represented by the errors of road users (drivers and pedestrians), as human causes are the main cause of many accidents, due to poor management of the road or the vehicle by the driver. Among the most important reasons are the following:

- Driving under the influence of alcohol and other psychoactive substances
- Inattentive driving
- Extreme fatigue and lack of rest on long trips.
- Pedestrian-related reasons include:
 - Failure to respect designated pedestrian crossing locations, or not using them according to the rules.
 - Not appreciating the risks of not obeying traffic rules and running traffic lights.
 - Walking on the road despite the presence of sidewalks.

B - Indirect Causes (road - vehicle)

➤ Unsafe road infrastructure

The design of roads can have a significant impact on their safety. It is preferable that roads be designed with safety in mind for all road users. This means ensuring that there are adequate facilities for pedestrians, cyclists, and motorcyclists. Measures such as pedestrian and bicycle lanes, safe crossing points, and other traffic calming measures can be essential to reducing the risk of injury among these road users (WHO, 2021).

➤ Vehicles

Safe vehicles play an essential role in preventing accidents and reducing the likelihood of serious injury. There are several United Nations regulations on vehicle safety, and compliance with national manufacturing and production standards, which will save many lives. These include requiring car manufacturers to comply with front and side impact regulations, including electronic stability control (to prevent skidding), and ensuring that all vehicles are equipped with airbags and seat belts. Failure to meet these basic standards significantly increases the risk of injury from traffic crashes for people Inside and outside the vehicle. (WHO, 2021).

Presentation of the Study Area in Constantine

Constantine is located in the northeast of Algeria, where it is considered the capital of the East, 245 km from the Algerian-Tunisian eastern border, about 431 km from Algiers, and 235 km from Biskra and 89 km from Skikda (Rahamniya, 2016). Its population is approximately 1.013 million in 2019. Constantine occupies an area of 2288 km².

It is located at 36.23 north latitude and 7.35 east longitude of the Greenwich line, composed of six districts and 12 municipalities. This is shown on Fig.1.:

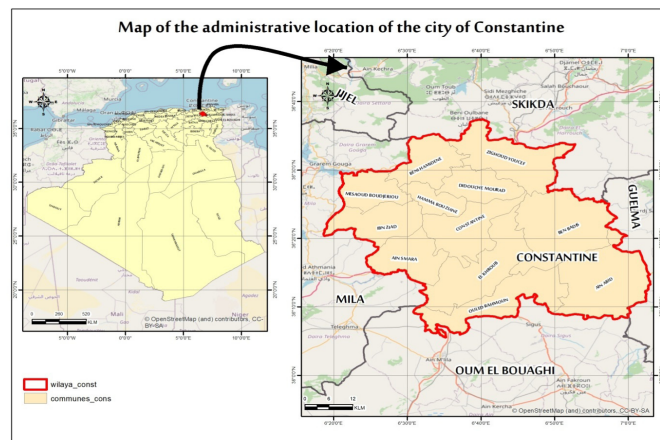


Figure 1. Map of the administrative location of the city of Constantine. Source: Author output based on ArcGIS 10.8

RESULTS AND DISCUSSION

Evolution of Traffic Accidents in Constantine

➤ Statistics of Traffic Accidents in Constantine

Constantine is one of the cities where traffic accidents occur daily, causing many deaths, and for several reasons, the most important of which are the indifference of drivers, and the lack of knowledge of traffic culture, in addition to the common errors in the technical design of the road, we will discuss below the development of traffic accidents, in addition to the number of deaths and injuries resulting from them during the period from 2012 to 2019, which are presented in the following table (1):

Table 1. Statistics of traffic accidents for the city of Constantine during the period 2012-2019

Change in accidents number	accident number	years
/	1834	2012
297+	2131	2013
425+	2556	2014
285-	2271	2015
52-	2219	2016
97-	2122	2017
219-	1903	2018
234+	2137	2019
-	23773	Total

Source: made by the authors with the interpretation of the results obtained from the Civil Protection of Constantine of 2020.

When we analyze Table No. 01, we find that the number of traffic accidents can be divided into periods indicated as follows:

- The period between 2012 and 2014: This period has seen many accidents, about 1834 accidents were recorded in 2012, and the number of accidents continues to increase, reaching 2556 accidents during the year 2014, an increase of 772 accidents, this increase explains the indifference and non-compliance of drivers with the law, in addition to the wear and tear of the roads and the poor planning or design of road engineering.
- The period between 2015 and 2018: This period was characterized by a relative decrease in the number of traffic accidents, with about 2,271 accidents since 2015, gradually decreasing to 1903 accidents, a decrease of 368 accidents, this decrease is due to the intensive awareness campaigns conducted by security services represented by the National Security, Civil Protection and the National Gendarmerie, in addition to the Association of Road Safety, in 2015, Constantine was chosen as the capital of Arab culture, which has had a positive impact on the improvement of road conditions in the city.

- Phase 2019: This year has seen an increase in the number of traffic accidents compared to previous years, where 2,137 accidents were recorded, due to excessive speed and non-compliance with the law, in addition to the deterioration and lack of maintenance from the potholes on the roads and the absence of directional signs and traffic lights.

➤ Death Statistics

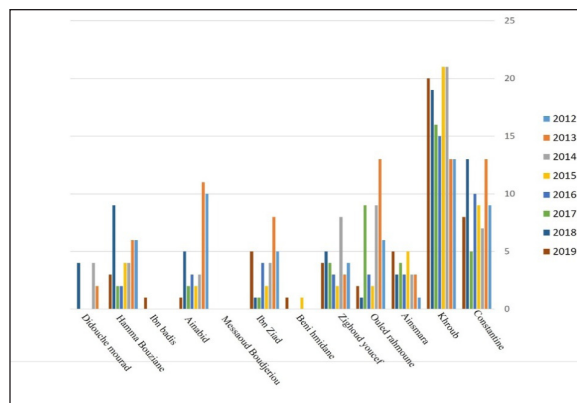


Figure 2. Statistics of deaths in the city of Constantine during the period 2012-2019. **Source:** made by the authors with the interpretation of the results obtained from the civil protection of Constantine of 2020

Figure (2) represents the distribution of deaths according to the communes of the city of Constantine during the period from 2012 to 2019, where the commune of El Khroub recorded a total of 138 deaths or 32%, and this explains that serious accidents occur at the level of this commune, this is due to the presence of curves or bends on some roads, as the national road No. 101 near the bridge entrance to the town of El Khroub, followed by the town of Constantine with 74 deaths, or 17%, because it is targeted by neighboring municipalities, which leads to traffic jams, including the roads linking the town of Constantine to the town of El Khroub, which affects the number of accidents. This traffic jam affects the psychology of the driver in addition to the narrowness of its streets, followed by the municipality of Ouled Rahmoun with 10%, then the municipality of AinAbid and the municipality of Hama Bouziane with 9% and 8% respectively, then the rest of the communes come with a small percentage, while there are no deaths recorded in the communes of Messaoud Boudjeriou, IbnBadis, and BeniHmeidane.

Comparing the deaths during this period in the city of Constantine as a whole, we see that the statistics have fluctuated, since in 2013 they increased to 72 deaths to continue to decrease over the years to reach in 2017 to 43 deaths before increasing again in 2018 to 60 deaths, in 2019 the number of deaths fell to 50.

➤ Injuries Statistics

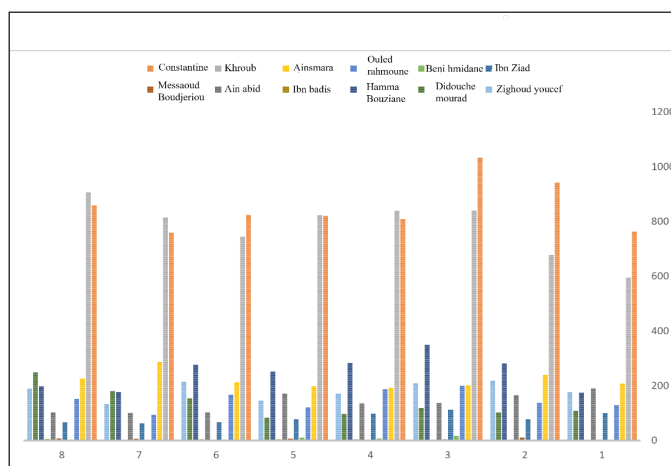


Figure 3. Statistics of injuries in Constantine during the period 2012-2019. **Source:**made by the authors with the interpretation of the results obtained from the civil protection of Constantine of 2020

Figure (3) represents the distribution of injuries according to the communes of the city of Constantine during the period between 2012 to 2019, where the commune of Constantine recorded a total of 6809 injured or 30%, and this explains

that serious accidents occur at the level of this commune, this is due to the failure to comply with legal standards for the technical design of roads, as the national road No. 03 near the airport Mohamed Boudiaf, followed by the commune of El Khroub with 6,241 injured, or 28% because the commune is targeted by the neighboring communes, which causes traffic jams, especially the roads linking the commune of Constantine to the commune of El Khroub. This traffic jam affects the psychology of the driver in addition to its narrow streets, followed by the municipality of Hama Bouziane with 9%, then the municipality of AinSmara and the municipality of Zighoud Youssef with 8% and 7% respectively, then the rest of the communes come with a small percentage.

Material Losses

Table 2.Material losses per traffic accident for the city of Constantine during the period 2012-2019.

Municipality	Material losses					other
	car	truck	bus	Motorcycle	heavy machinery	
Constantine	5936	469	227	477	29	29
el khroub	5396	558	128	173	34	34
Ouledrahmoune	1019	104	6	10	3	3
Ainsmara	1528	220	31	54	2	2
Zighoudyoussef	801	185	23	95	19	19
bénihmeidan	30	2	0	0	0	0
ibnzziyad	422	156	18	20	3	3
Messaoudboudjeriou	20	2	0	4	2	2
ainabid	996	123	13	32	7	7
ibnbadis	36	6	0	0	0	0
hammabouziane	1461	251	41	84	9	9
didouchemourad	845	146	30	45	4	4
total	18490	2244	517	994	115	115

Source: made by the authors with the interpretation of the results obtained from the civil protection of Constantine of 2020

Through table No. (2), which represents the material losses of the city of Constantine during the period 2012 to 2019, where we note that the number of losses in cars constituted the highest percentage of the total losses of about 18490 cars, or 82.45%, which is a very high percentage, and this is because it represents the highest percentage also in the National Park of Cars, where the municipalities of Constantine and El Khroub represented the highest rates in the municipalities with respectively 32, 10% and 29.18% of the total number of car accidents AinSmara, Hama Bouziane and ouledRahmoun with rates of 8.26%, 7.90% and, 5.51% respectively This is due to the fact that these municipalities have fewer accidents compared to the previous municipalities, in addition to having fewer cars compared to the previous municipalities as well, and at the end came the rest of the municipalities that are characterized by less mobility And the least number of cars compared to the other municipalities.

- As for trucks, they came second in the total losses with about 2,244 loads, or 10%, indicating that trucks are among the main causes of accidents. The communes of Hama Bouziane, AinSmara, the commune of Zighoud Youssef, IbnZiyad, Didouche Mourad, AinAbid, and the commune of OuledRahmoun, came with rates ranging between 11.18% and 4.63%, while the losses were almost non-existent in the town of IbnBadis, the towns of Messaoud Boudjeriou and Beni Hmaidan showed rates of 0.2%, and 0.08%, respectively.

- The motorcycles are ranked third in total losses, about 994 bikes, or 4.43%.

- The percentage of buses ranked fourth in total losses, with 517 buses, or 2.3%.

- As for the percentage of tractors and machinery and other vehicles, their percentage was very low, about 115 and 64, or 0.5% and 0.2%, respectively.

Main Causes of Traffic Accidents in Constantine

A- General Reasons

Human errors are generally the main cause of traffic accidents, whether these errors are related to the human factor, the technical design of the road, or the vehicle. The proportion of the human factor in traffic accidents in Constantine is 96.65%, while the vehicle factor constitutes 2.34%. The remaining factors represented concern the road environment, and constitute a small percentage of 1%, it is, therefore, necessary to intensify the search for solutions to reduce traffic accidents, especially at the level of the human factor, by treating it in all its aspects, from training in driving schools to driving itself, in addition to intensifying the traffic awareness campaigns with the participation of all actors.

Table 3. Causes of traffic accidents in Constantine during the period 2010-2019

Causes	Number	Percentage
Human Factor	4330	96.65%
The vehicle	105	2.34%
The road and environment	45	1%
Total	4480	100%

Source: made by the authors with the interpretation of the results obtained from the national sécurité directorate of Constantine of 2020

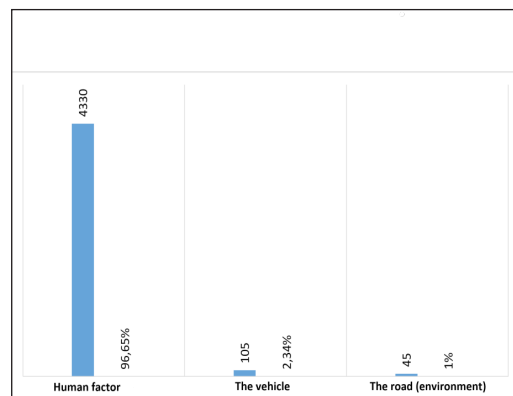


Figure 4. Causes of traffic accidents in Constantine during the period 2010-2019. **Source:**made by the authors with the interpretation of the results obtained from the national sécurité directorate of Constantine of 2020

Through figure No. (3) on the direct causes of traffic accidents in Constantine, we see that the human factor is the main cause of accidents, since it constitutes the largest percentage or 96.65% of the total causes of accidents, while the causes related to the condition of the vehicle come in second place with 2.34%, while the factor related to the road environment comes last with 1%.

B- The Causes of the Human Element During the Years 2010-2019

Table 4. Reasons related to the human factor during the years 2010-2019:

Nature of the violation	Number	Percentage %
Driving while intoxicated or under the influence	67	1.54
Driving without a valid license	296	6.83
Failure to obey the speed limit	1127	26.02
Running a stop sign	73	1.68
Reversing	45	1.03
Failure to obey traffic lights	9	0.20
Serious overtaking	131	3.02
Dangerous maneuvers	69	1.59

Using a cell phone or listening to the radio	2	0.04
Not using foot paths	91	2.10
Denial of right of way	131	3.02
Failure to maintain a safe distance	74	1.7
Unsafe parking or stopping	18	0.41
Failure to obey traffic signs	16	0.36
Loss of control	225	5.19
Walking on the left	14	0.32
Passing a solid line	4	0.09
Changing direction without signal	20	0.46
Driver inattention when leaving a stop	65	1.50
Driver inattention	873	20.16
Closing the bus door on the victim's fingers	1	0.02
Driver inattention while attempting to reverse	94	2.17
Driver's lack of caution when passing a bicycle or motorcycle	7	0.16
Lack of attention by the victim or lack of caution by pedestrians When crossing the road	339	7.82
Playing in the middle of the road	60	1.38
Walking on the side of the road	47	1.08
Other cases	432	9.97
Total	4330	100

Source: made by the authors with the interpretation of the results obtained from the national sécurité directorate of Constantine of 2020

It appears in Table No. (4) that the traffic accidents resulting from speeding are equal to 26%, which was the highest percentage, followed by the percentage of driver inattention in urban areas of 20%, while the rest of the reasons came in small percentages ranging from 0.02% to 6%.

C- Vehicle-Related Reasons During the Years 2010-2019

Table 5. Vehicle-related reasons during the years 2010-2019.

Nature of the violation	Number	Percentage %
No position lights	1	0.95
No turn signals	/	/
Brake failure or ineffective brakes	76	72.38
Flat tires and tire blowouts	14	13.33
Illegal lighting	/	/
Unsecured payload	2	1.90
Oversizedload	/	/
Router malfunction	/	/
Other factors Mechanical imbalances	12	11.42
Total	105	100

Source: made by the authors with the interpretation of the results obtained from the national sécurité directorate of Constantine of 2020

From table No. (5), traffic accidents due to defective or ineffective brakes resulted in the occurrence of 76 accidents, which is 72.38%, which is the highest percentage, followed by the percentage of tire punctures and explosions of 13.33%, while the rest of the reasons came in small percentages. It varied from 0.95% to 11.42%.

D- Environment-Related Causes During the Years 2010-2019**Table 6.** Environment-related causes during the years 2010-2019.

Nature of the violation	Number	Percentage %
Absence of highbeam	5	11.11
Absence of traffic lights	/	/
Road distortions and potholes in the road, roadblocks (invalid road)	14	31.11
Inadequate road layout	2	4.44
Crossing of animals	4	8.88
Dense fog	2	4.44
Rain, snow, ice	9	20
Sandstorms	/	/
Sun glare	/	/
Slippery road	8	17.77
Falling of the public lamp post on the road	1	2.22
Total	45	100

Source: made by the authors with the interpretation of the results obtained from the national sécurité directorate of Constantine of 2020

From Table No. (6), traffic accidents that occurred as a result of deformations on the road and potholes in the road (invalid road) resulted in the occurrence of 14 accidents or 31.11%, which is the highest percentage, followed by the percentage of accidents that occurred due to slippery road of 17.77%, while the rest of the causes came in small percentages ranging from 4.44% to 11.11%.

Traffic Accident Prevention Strategy**A- Traffic Awareness**

Traffic awareness is defined as the dissemination of traffic culture among all members of society, correcting their misconceptions through persuasion by providing solid information and facts, which help to form a correct opinion and create the ability to prepare for voluntary adherence to traffic rules and regulations in order to ensure the safety and security of road use (Ali Saud Al-Sahli, 2008, p. 5).

B- The Role of Media in Raising Traffic Awareness: (Atwi and Mekideche, 2018, p. 376)

The media is considered one of the most influential and present means for the public, especially to address issues and correct deficiencies, which impacts large segments of society.

C- Techniques Used to Control Traffic Violations

Among the techniques used to control traffic violations and thus reduce traffic accidents, we mention the following:

- Radar: in order to measure the speed of vehicles on the road.
- Surveillance camera: their role lies in the control of violations of speed cameras or traffic lights.
- Laser beams: called (LIDAR) or light detection and ranging panel, which sends a beam of highly focused invisible light that determines the speed of the car by noting the amount of change in time needed to see the light pulses. In 2006, a system was developed, easy to use and cheap, and in 2007, new units were introduced to the European market that cannot be altered or blocked (Ben Dbayan 2014. p 17-18).
- Spatial determination of accident locations, in order to know where traffic accidents occur in abundance, in order to create maps that contribute to understanding the phenomenon and finding future solutions.
- Electronic traffic control systems for signals:

The ability to control different intersections is facilitated by the use of coordinate matching, a traffic management system used to link multiple traffic signal controllers and reduce travel times and fuel consumption. Considered the most advanced and widely used system, SCATS® is the most adaptive urban traffic control (UTC) system in the world today (Traffic Technologies, 2022).

CONCLUSION

Traffic accidents are among the most important problems facing the city of Constantine, a strategy has been proposed to reduce accidents, through the following:

- Traffic awareness.
- The role of the media in traffic awareness.
- Techniques used to control traffic violations.
- Spatial determination of traffic accident locations.
- Traffic control systems for traffic signals.

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