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THE ROLE OF SPEED AND ITS IMPACT ON TRAFFIC ACCIDENTS. A FIELD STUDY IN BATNA PROVINCE

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ABSTRACT

Traffic accidents are among the most prominent contemporary issues that hinder the path of development and progress in societies, due to the significant human and economic losses they cause. This problem is particularly evident in developing countries. This scientific paper aims to study the various factors and dimensions leading to traffic accidents, in addition to analyzing their psychological, social, and economic impacts. It will also address the causes of excessive speeding while driving, based on the results of a field study conducted in the province of Batna during September 2024. Finally, the necessary measures to ensure drivers' compliance with legal speed limits will be discussed.

KEYWORDS

Traffic Accidents, Excessive Speed, Batna Province

CITATION

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Introduction.

Traffic accidents are among the most prominent contemporary issues hindering development and progress in societies due to the significant human and economic losses they cause. This problem is particularly acute and evident in developing countries.

Road accidents kill approximately 1.3 million people annually and result in injuries or disabilities for more than 20 million people worldwide. By 2030, it is expected that the death toll from traffic accidents will increase by about 80% in developing countries. The cost of injuries caused by road accidents in developing countries is estimated at around $65 billion annually. Surprisingly, this amount exceeds the developmental aid these countries receive. Despite this, most of these nations either ignore or fail to give adequate attention to the causes and consequences of road accidents. In contrast, developed countries with advanced road safety measures have shown significant concern for the issue of traffic accidents[1].

Speed is considered the primary factor in accidents across various countries worldwide, contributing to at least 50% of all physical accidents. According to available statistics, Algeria is among the countries most affected by traffic accidents, ranking 13th globally. Speed remains one of the main causes of these accidents, accounting for 47% of the total accident-related statistics for 2023, as reported by the Regional Group of the National Gendarmerie in Batna Province[2].

[1] Zakaria Aqari, An Analytical Study of Traffic Accidents in Algeria from 1970 to 2010 (Master's thesis, University of Batna 1, 2011), 1.
[2] Ali Thabet, Rabab Aqti, and Adel Baghza, "A Socio-Statistical Reading of Traffic Accidents in Batna Province for the Year 2023," Journal of Researcher in Humanities and Social Sciences 16, no. 3 (2024): 31–38.

1. General Concepts of Speed

Speed poses a significant danger to drivers and other road users, often leading to negative and potentially catastrophic outcomes. As speed increases, the mental and physical capacities of the driver decrease, affecting their ability to react quickly and make correct decisions in critical situations. High speeds also complicate driving conditions, making vehicle control more difficult and significantly increasing the risk of accidents.

1.1. Definitions

There are several definitions of speed, including[1]:

- Regulatory Speed (Permitted Speed): The speed allowed by law, associated with posted speed limits on roads.
- Applied Speed: The speed at which a driver operates their vehicle, whether it aligns with the regulatory speed or not.
- Perceived Speed: The speed determined by experts and specialists, used as a reference for road design standards, taking into account the balance between movement and safety.
- Safe Speed: The speed limit chosen by the driver, where the focus is more on safety than on the smoothness of movement on the road.

When discussing speed as a problem, the focus is on excessive speed, defined as extreme behavior in speed distribution. It refers to significantly exceeding the legally set speed limit, where the difference between the actual speed and the regulatory speed is substantial. This increases the risk of accidents and negatively impacts the safety of drivers and other road users.

From a physical perspective, speed is defined as the ratio of distance to time traveled, measured in units of km/h or m/s. When discussing the relationship between humans and machines while driving, it is essential to consider the physical laws governing speed, alongside human capabilities and vehicle performance. As vehicle speed increases, the stopping distance grows, and the centrifugal force acting on the vehicle in curves rises, reducing the driver's field of vision. Despite these variables, the one constant is the limited ability of the human body to withstand impacts, making excessive speed a real danger to road safety.

2. Physical Factors of Motion

2.1. Kinetic Energy

Considering vehicles as moving objects, they accumulate kinetic energy (***KE***), which is directly proportional to the square of speed, according to the following relationship:

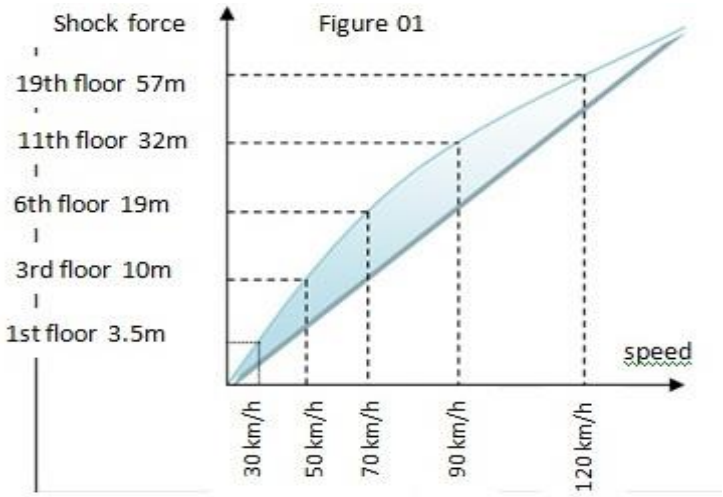
$$KE=mv^2/2$$

Where: m is the mass of the vehicle.

Speed is the primary determinant of the amount of energy released during a vehicle's collision with an obstacle. Consequently, the severity of the danger and the likelihood of injuries are directly related to speed. In addition to the energy dissipated by the obstacle, there is also energy absorbed by the body until it comes to a stop (e.g., steering wheel, wall, ground, or seatbelt). The amount of energy dissipated during a collision at 30 km/h is approximately 20 times the mass of the driver's body[2].

The following figure illustrates the equivalence of impact forces at certain speeds with the forces experienced during free falls from specific heights.

[1] Omar Majoul, Speed and Its Impact on Traffic Accidents (Final study memo for the certification of Chief Inspector of Land Transport, National School of Applied Techniques for Land Transport, Batna, 2006), 5.
[2] Omar Majoul, op. cit., 6.



As for pedestrians, they have a 90% chance of survival after an accident if the collision speed is 30 km/h or less. However, this chance drops to less than 50% if the speed is 45 km/h or higher. The survival rate is 20% at a speed of 64 km/h or more, and a pedestrian hit at 80 km/h has no chance of survival[1].

2.2. Stopping Distance

Stopping distance consists of the distance traveled during the driver's reaction time, plus the vehicle's braking distance. It is estimated that a driver with full capabilities (fully alert, well-rested, not under the influence of alcohol or drugs, and not distracted by in-vehicle devices like phones) takes one second to initiate braking, or between one and two seconds depending on traffic conditions.

If a vehicle is traveling at 60 km/h and the driver's reaction time is the same as another driver traveling at 50 km/h, the second driver will come to a complete stop at a certain point, while the first driver's speed at that point will still be around 43 km/h. This highlights the significant impact of increased speed on stopping distance and safety levels.

2.2.1. Reaction Path

This is the distance traveled during the time interval before braking begins. For example, with a reaction time of 1.5 seconds and a speed of 50 km/h, the distance covered is 21 meters (1.5 seconds × 14 m/s) before braking takes effect.

2.2.2. Braking Distance

This is the distance traveled from the start of braking until the vehicle comes to a complete stop. It depends primarily on two main factors: speed and road conditions. On wet roads, the braking distance is approximately twice as long as on dry roads. On snowy roads, the friction coefficient decreases, leading to an eightfold increase in braking distance. Other factors affecting braking distance include tire pressure, tire friction, the condition of the braking system, and the vehicle's mass[2].

Table 1.

Speed (km/h)	Reaction Path (m/s)	braking distance		Stopping Distance	
		Dry Road	wet Road	Dry Road	wet Road
30 **(km/h)**	08	05m	07m	13 m	15m
50 **(km/h)**	14	12 m	20m	26m	34m
80 **(km/h)**	22	31m	50m	53m	72m
100 **(km/h)**	28	48m	80m	76m	108m
120 **(km/h)**	33	70m	111 m	103m	144m

[1] Lamia Wanas, Black Spots of Traffic Accidents in Batna Province (Master's thesis, University of Batna 1, 2011), 36.
[2] Omar Majoul, op. cit., 9.

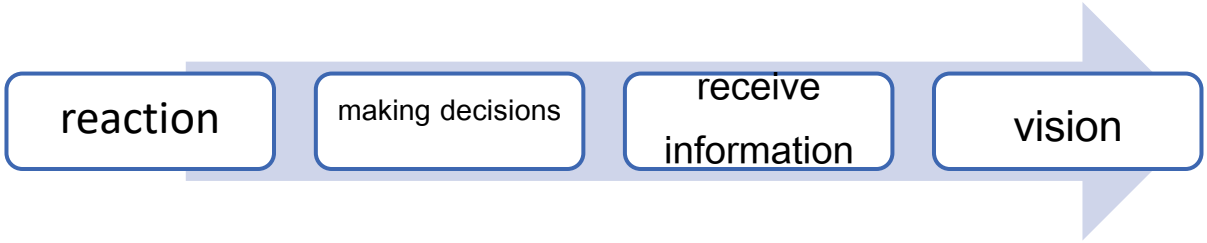
The previous table provides an example of stopping distances relative to speed. However, it is important to note that the values listed are lower than those determined during road design. Safety factors also take into account unfavorable (or favorable) conditions (such as road conditions, vehicle tire conditions, and driver reaction time[1]).

2.2.3. Centrifugal Force

Centrifugal force is a physical effect experienced by all vehicles when navigating curves. Its intensity increases with higher speeds and wider curve radii. When this force exceeds the available adhesion between the tires and the road, the vehicle deviates from its path. However, other factors also influence vehicle stability and maneuverability, such as friction levels, tire pressure and balance, curve inclination, and the quality of tire-road adhesion. These factors can either improve performance or worsen it.

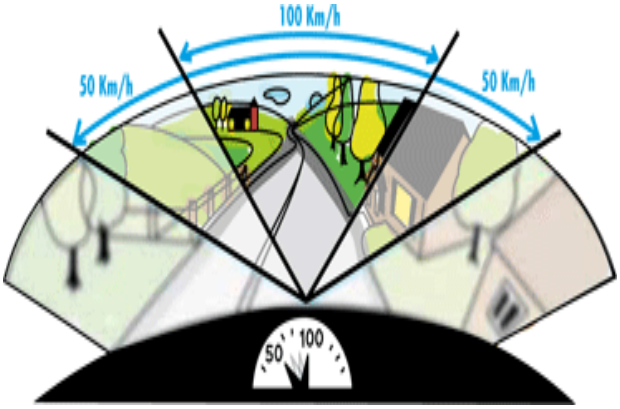
2.2.4. Reduced Visual Capabilities

Driving a vehicle is a task that requires simultaneous information processing, as it involves numerous skills and abilities that must be coordinated at the same time. The process can be summarized into four basic stages:



This highlights the human brain's ability to process a large amount of information while driving, as 90% of a driver's decisions rely on visual information. As vehicle speed increases, the brain is forced to filter out some information due to its inability to fully absorb and process it. This impairs part of the driver's visual capabilities, negatively affecting their range and field of vision, and consequently, their ability to make appropriate decisions in a timely manner.

When stationary or walking, the natural human field of vision is approximately 180°. However, as vehicle speed increases, this field gradually narrows, reaching 45° at a speed of 100 km/h. As a result, any obstacle outside this limited range becomes invisible and is not taken into account by the driver. In fact, the higher the speed, the more the vision focuses on a single point straight ahead, reducing the driver's ability to perceive the surrounding environment and make quick and effective decisions.



In addition to the narrowing of the field of vision, the driver also finds it difficult to accurately estimate distances. According to physical principles, speed significantly impacts some of the driver's essential abilities, which can be critical in emergency situations. Consequently, the driver's efficiency in dealing with road surprises decreases, leading to a decline in road safety levels and an increased risk of accidents[2].

[1] . Mamoun Al-Tayeb, Traffic Accidents and the Role of Speed in Their Increase (Center for Gulf and Arabian Peninsula Studies, Kuwait University, 2011), 31.
[2] Global Status Report on Road Safety 2015 (World Health Organization, 2015), 10.

2.3 Factors Affecting Speed

Speed plays a pivotal role in the likelihood of fatalities or serious injuries, a phenomenon that can be explained through the principles of physics, particularly the impact of kinetic energy released during a collision. The speed chosen by drivers is influenced by several factors, including the driver's personal characteristics, the vehicle's capabilities, and road conditions. Collectively, these elements significantly affect the level of safety while driving.

2.3.1. The Driver:

The driver's motivations, shaped by their personality and perception of speed, can be summarized as follows[1]:

- Speed as a Time-Saving Factor: Some drivers believe that increasing speed is an effective way to save time while driving. However, the time difference achieved is often negligible compared to the potential risks. For instance, when driving a vehicle non-stop for 100 km at 150 km/h instead of 130 km/h, the time saved is only about 6 minutes. Consequently, the belief that speed significantly contributes to saving time is a misconception, especially when weighed against the severe risks associated with excessive speed, both for the driver and other road users.

- Speed as a Source of Pleasure: Psychological studies and research indicate that for some drivers, exceeding speed limits is not driven by an actual need to reach a destination quickly but rather by psychological factors tied to fulfilling personal desires, such as seeking excitement or a sense of challenge. This behavior often occurs without sufficient awareness of the risks associated with excessive speed, thereby increasing the likelihood of accidents and endangering the lives of both the driver and other road users.

- The Desire to Imitate Others: The speed adopted by some drivers is not necessarily a reflection of their personal nature but may result from the influence of others and a desire to imitate. In many cases, the behavior of surrounding drivers can unconsciously push an individual to exceed legal speed limits without fully recognizing the associated dangers. This tendency can lead to excessive speeding, thereby increasing the probability of accidents and negatively impacting overall road safety.

- Exceeding Speed as an Involuntary (Automatic) Action: Some drivers become accustomed to driving at high speeds, turning it into an automatic behavior that they practice without full awareness. Over time, high speed becomes ingrained in their driving habits, reducing their perception of its risks and making them less attentive to the possibility of accidents. This habituation can lead to unintentional recklessness, particularly in situations that require caution and adaptation to road conditions.

- When the Driver is emotionally distressed: Due to issues at home or work, can significantly influence a driver's behavior.

- When the driver is running late: The pressure to reach a destination on time can push drivers to exceed speed limits. This sense of urgency often overrides their judgment, leading to risky driving behaviors that compromise safety.

- Due to the long distance to be covered: The length of the journey can also influence a driver's tendency to speed.

2.3.2. The Vehicle:

Although speed is no longer a primary factor in the promotion and sale of vehicles due to various considerations, particularly legal ones, owning a car with high power and performance remains a competitive advantage for every brand and model. This, in itself, can serve as a strong incentive for some drivers to drive at excessive speeds, increasing the risks on the road, especially in the absence of sufficient awareness of the consequences of speeding.

- Vehicle Type and Excessive Speed:

A study conducted in Switzerland demonstrated a correlation between vehicle type and excessive speeding. Radar was used in this study to record instances of speeding exceeding 17 km/h above the limit, i.e., beyond 137 km/h. The recorded violations were categorized into two groups:

- Minor Excessive Speeding: Between 18 km/h and 29 km/h above the limit.
- Major Excessive Speeding: More than 30 km/h above the limit[2].

[1] Zakaria Aqari, op. cit., 44.
[2] Omar Majoul, op. cit., 13.

Table 2.

Vehicle Type	Minor Speeding (135-150 km/h)	Major Speeding (>150 km/h)
Small / Subcompact	%60,6	%39,4
Compact	%53,1	%46,9
Sedan	%44,7	%55,3
Station Wagon	%54,8	%45,2
MPV	%50,5	%49,5
SUV (Sport Utility Vehicle)	%38,8	%61,3
Minivan	%62,5	%37,5
Sports Car	%56,3	%43,8

The previous table indicates that small cars are less prone to major excessive speeding, while SUVs (Tout-terrain) record the highest rate of violations. This phenomenon can be explained by the fact that small cars generally have less powerful engines compared to other vehicles, limiting their ability to reach high speeds easily. Additionally, the vibration of small cars during driving enhances the driver's sense of instability, making them less inclined to increase speed. In contrast, larger vehicles provide greater stability, which may encourage drivers to drive at higher speeds.

It is also worth noting that enthusiasts of high speeds typically do not prefer small cars. This category of vehicles is often owned by drivers who are less interested in excessive speeding. As a result, the phenomenon of speeding is less common among small car drivers compared to drivers of high-performance vehicles with powerful engines, which attract those seeking high performance and greater speeds.

On the other hand, SUV (Tout-terrain) drivers often feel a heightened sense of safety due to the features of these vehicles, such as their large size, quiet cabin, lack of noise, comfort, and absence of vibrations. These factors may reduce the driver's awareness of the vehicle's speed, increasing the likelihood of driving excessively fast without realizing it. Furthermore, the elevated driving position above road level diminishes the driver's perception of actual speed, potentially leading to exceeding legal speed limits without a sense of danger.

- Vehicle Brand:

A study conducted in Switzerland revealed a correlation between the brand of the vehicle and the level of excessive speeding. The following table illustrates the composition of the Swiss vehicle fleet, along with the percentage of involvement of certain brands in exceeding legal speed limits. The results indicate that some brands are associated with higher rates of excessive speeding, reflecting the influence of technical and psychological factors related to these vehicles on driver behavior.

This finding underscores how specific vehicle brands, often due to their design, performance capabilities, or perceived status, can encourage drivers to engage in speeding. The study highlights the interplay between vehicle characteristics and driver psychology, suggesting that certain brands may inherently promote riskier driving behaviors.

Table 3.

vehicle brands	vehicle brands and the level of excessive speeding	Vehicle brands and its percentage of presence in the parking
Audi/BMW/Mercedes	30%	14,4%
European brands	54,5%	56,8%
Japanese and Korean brands	13,5%	24,4%
Other brands	2%	4,4%

The previous table indicates that German brands (Audi, BMW, Mercedes) rank second in terms of speeding rates, while other European brands take the top spot. In contrast, Japanese and Korean brands record significantly lower rates of exceeding legal speed limits.

These results can be explained by the fact that German manufacturers often focus on producing high-performance vehicles, with a relative absence of smaller cars in their lineup, making them more prone to being

driven at high speeds. On the other hand, other brands offer a diverse range of vehicles with varying levels of power, reducing their association with speeding[1].

2.3.3. The Road:

The design and infrastructure of roads play a significant role in encouraging drivers to increase their speed. Drivers tend to feel more confident driving at higher speeds on wide or well-paved roads. Additionally, roads with low gradients, a lack of traffic signals, monitoring equipment, or proper road markings may prompt drivers to exceed legal speed limits. Furthermore, traffic density and vehicle flow significantly influence the speeds drivers adopt. In congested roads, drivers are forced to reduce their speed, while on empty roads; they may unintentionally increase their speed without realizing the potential risks.

2.3.4. Effects of Speed

In terms of both positive and negative impacts, speed is a key factor in all measures taken in the field of road safety. Speed management policies can be framed within several objectives, but they are of utmost importance when it comes to improving road safety and reducing the number of accidents and casualties. Therefore, controlling speed and strictly enforcing laws are among the most important means of achieving a safer driving environment and minimizing risks for drivers and other road users.

2.3.5. Advantages of Speed

In the business world, speed is a major competitive advantage, playing a crucial role in executing various activities in the shortest possible time, such as production and trade. In the transportation sector, speed is often seen as a positive factor due to its tangible benefits, including[2]:

- Technological advancements that have increased reliance on cars as a primary means of transportation.
- The use of high-speed trains (TGV), which reduce travel time between major cities.
- Dependence on airplanes as the fastest available mode of transport, contributing to reduced travel time for individuals and goods.

Speed is also an effective means of improving the quality of travel for both individuals and businesses. For individuals, it allows:

- More frequent visits to friends and relatives.
- Easier and faster travel to distant tourist destinations.
- Residing in areas far from work to benefit from lower housing costs or a more comfortable environment.

For businesses, it enables:

- Expansion into new markets and increased productivity and profitability.
- Faster delivery processes to meet customer demands in the shortest possible time.

In many fields, increased speed is essential to reduce response times, especially in emergency services such as:

- Ambulances, which must arrive quickly to save patients and the injured.
- Fire trucks, which need high speeds to reach fire sites.
- Public transport vehicles like buses, where speed is a key factor in improving service.

In addition to its practical benefits, some people find that driving at high speeds provides a sense of freedom and excitement, making it an enjoyable experience for some. Moreover, speed in land transport helps reduce travel time on long journeys between Provinces, while its impact is less pronounced within cities due to congestion and frequent intersections that limit the ability to drive at high speeds.

2.4. The Drawbacks of Speeding

Driving at excessive speeds on roads has severe consequences, leading to an increase in traffic accidents and the resulting human losses and material damages. Additionally, it negatively impacts the environment through increased noise levels and higher emissions of polluting gases into the atmosphere.

2.4.1. The Impact of Speed on Road Safety

According to available statistics in Algeria for the year 2023, excessive speed remains one of the main causes of traffic accidents, accounting for 47% of the total accident rates for 2023, as reported by the Regional

[1] Omar Majoul, op. cit., 15.
[2] . Mamoun Al-Tayeb, op. cit., 52.

Group of the National Gendarmerie in Batna Province. However, excessive speed is a major road safety issue in many countries due to its dangers, as it is responsible for one-third of fatal accidents.

According to statistics available in Algeria for 2023, excessive speed remains one of the leading causes of traffic accidents, representing 65% of the total accidents recorded during the year, according to data from the National Road Safety Delegation. It is worth noting that excessive speed poses a significant challenge to road safety in many countries due to its severity, as it accounts for one-third of fatal accidents.

In general, the number and severity of accidents increase with higher speeds, attributed to several factors, including[1]:

- Excessive speed reduces the time available for the driver to make appropriate decisions, leading them to rely on their first instinct without sufficient thought. As a result, the reaction distance required increases with speed, potentially reducing the driver's ability to effectively avoid hazards.

- Braking distance is directly proportional to the square of speed (V^2), meaning that when speed doubles, the stopping distance increases fourfold. Studies on perception time and stopping distance confirm this relationship, as perception time under normal conditions ranges from 1.5 to 3 seconds. With increased speed, the stopping distance grows significantly, raising the risk of accidents and making them harder to avoid.

- The higher the speed, the lower the chance of avoiding a collision. For example, if a driver is traveling at 80 km/h on a dry road and a child suddenly appears crossing the road, the driver will need 22 meters to comprehend the situation and an additional 35 meters to stop the vehicle completely, resulting in a total stopping distance of 57 meters. If the child is only 36 meters away, the risk of being hit and killed is high at this speed. If the car is traveling at 70 km/h, the child may suffer fatal injuries, while reducing the speed to 50 km/h can lessen the severity of the injury.

Stopping distance depends on road conditions, as braking distance doubles on wet roads compared to dry ones and increases sixfold on snowy roads due to reduced friction. Other factors also affect braking distance, such as tire pressure, tire traction, brake system efficiency, and vehicle weight. Therefore, adjusting speed according to road conditions is essential to ensure safe driving[2].

- As speed increases, the chance of avoiding a collision decreases. For example, if a driver is traveling at 80 km/h on a dry road and a child suddenly appears crossing the road, the driver will need 22 meters to comprehend the situation and an additional 35 meters to stop the vehicle completely, resulting in a total stopping distance of 57 meters (perception time + braking distance). If the child is only 36 meters away from the vehicle, the risk of a fatal accident is high at a speed of 70 km/h. While reducing the speed to 50 km/h may lessen the severity of the injury, it does not guarantee completely avoiding the collision.

- Stopping distance is also influenced by road conditions. On wet roads, the braking distance is nearly twice as long as on dry roads. On snowy roads, reduced friction increases the braking distance by six times. Other factors affecting braking distance include tire pressure, tire traction, brake system condition, and vehicle mass.

- A driver's ability to see decreases as speed increases. When stationary or walking, the natural field of vision is approximately 180°, but it gradually narrows as speed increases, reaching 45° when driving at 100 km/h. This means visual focus becomes directed toward a single point straight ahead, reducing the driver's ability to perceive the surrounding environment and increasing the risk of accidents.

2.4.2. The Impact of Speed on Accident Rates

Statistics indicate that approximately 60% of fatal accidents occur in rural areas, where excessive speed is the primary cause of most accidents, whether due to collisions or veering off the road. In urban areas, most victims are road users such as pedestrians and cyclists, with the main cause being excessive speed and vehicle size[3].

In general, the Finch et al. (1994) model Shows that reducing the average speed by 5 km/h can lead to a 2-3% decrease in physical accidents[4].

Road conditions and characteristics also play a major role in the relationship between speed and the likelihood of accidents. Factors such as the number and types of intersections, the presence of pedestrians, cyclists, and agricultural machinery all contribute. In environments with complex traffic conditions, the risk of accidents increases, and driving at excessive speeds makes them even more dangerous. For this reason,

[1] Omar Majoul, op. cit., 20.
[2] Website, accessed November 9, 2024, http://aljazairalyoum.com/tag/%D8%AD%D8%A7%D8%AF%D8%AB-%D9%85%D8%B1%D9%88%D8%B1/.
[3] Omar Majoul, op. cit., 18.
[4] . Website, accessed November 8, 2024, http://www.thecartech.com/SafetyAndEnvironment/safety/accident_analysis/car_accidents_speed.aspx

highways record relatively low accident rates due to simpler traffic flow, unlike urban areas characterized by more complex driving conditions.

2.4.3. The Impact of Speed on the Environment[1]:

- CO_2 Emissions: According to a 2015 British study, carbon dioxide (CO_2) emissions reach their lowest levels when a vehicle's speed is between 20 and 40 km/h, while they peak at low speeds below 15 km/h, especially when the engine is running.
- Fuel Consumption: The higher the speed, the more fuel the engine requires to meet the increased demand. For example, increasing speed from 20 km/h to 110 km/h raises fuel consumption by 23%. Driving style also significantly impacts fuel consumption, as irregular driving (e.g., aggressive driving) noticeably increases consumption.
- Noise Pollution: Vehicle noise primarily comes from the engine and tire friction with the road, both of which are related to vehicle speed. As speed increases, noise levels rise, potentially doubling by approximately 12 decibels (dB), especially in older vehicles.

2.4.4. The Impact of Speed on Quality of Life:

Excessive speed negatively affects quality of life, leading to social costs that are difficult to quantify, particularly for individuals outside the vehicle. While the impact of noise and injuries caused by speed can be measured, other effects are harder to assess, such as pedestrians' fear of speeding vehicles, which discourages them from using bicycles or limits their mobility. Excessive speed also affects pedestrians' ability and comfort when crossing roads, especially for children and the elderly, increasing their sense of insecurity while traveling[2].

3. Field Study in Batna Province

A field study was conducted on the phenomenon of speeding in vehicle driving and the resulting accidents. The city of Batna was chosen as the study sample due to several considerations, most notably its ranking as the highest nationally in terms of traffic accidents.

The study was conducted in two phases:

1. First Phase: Included a statistical analysis of traffic accidents in Batna Province, where data was collected and analyzed, focusing on the characteristics of these accidents and their associated causes.
2. Second Phase: Involved the analysis of a questionnaire prepared and distributed to drivers to gauge their opinions on the risks of speeding in causing traffic accidents, as well as their suggestions for mitigating this phenomenon. This section will present the key findings from the study.

3.1. Statistical Analysis of Traffic Accidents in Batna Province

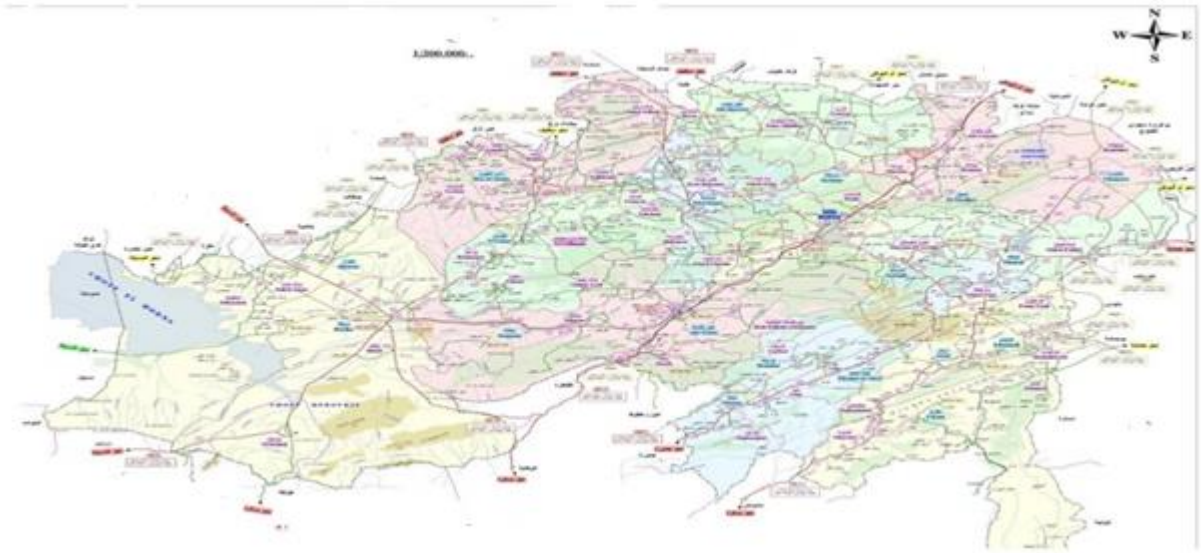
3.1.1. Overview of Batna Province

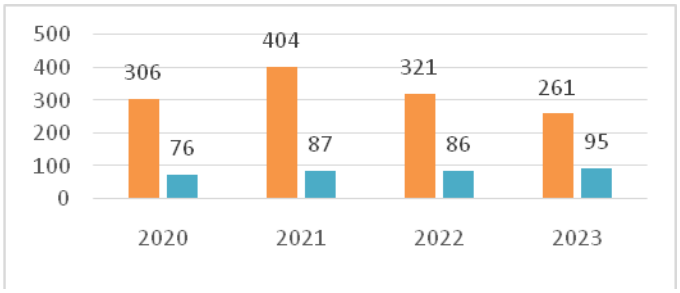
Batna Province is located in the heart of the Aurès region. It is bordered to the north by Mila Province, to the south by Biskra and M'Sila Provinces, to the east by Oum El Bouaghi and Khenchela Provinces, and to the west by Sétif and M'Sila Provinces. The province is characterized by rugged terrain and is located 524 km southeast of Algiers, the capital, with an elevation of approximately 1,200 meters above sea level. Batna Province covers an area of 16,899 km².

The road network in the province includes several types of roads, such as national, provincial, and municipal roads, as shown in the following figure:

- National Roads: 10 roads with a total length of 804.3 km (16.34% of the total network).
- Provincial Roads: 36 roads with a total length of 650.4 km (13.21% of the total network).
- Municipal Roads: A total length of 3,205.89 km (54.59% of the total network).
- Rural Tracks: A total length of 1,212.22 km (20.64% of the total network).

[1] Website, accessed November 8, 2024, http://www.thecartech.com/SafetyAndEnvironment/safety/accident_analysis/car_accidents_velocity.aspx.
[2] Website, accessed November 9, 2024, https://ar.wikipedia.org/wiki/%D9%88%D9%84%D8%A7%D9%8A%D8%A9_%D8%A8%D8%A7%D8%AA%D9%86%D8%A9.





3.1.2. Statistics on Traffic Accidents in Batna Province

Analyzing the situation of traffic accidents plays a fundamental role in providing an accurate database that helps decision-makers adopt effective measures to reduce this phenomenon. By studying the factors influencing accidents, appropriate measures can be taken to improve road safety and reduce the number of accidents and their resulting losses.

In 2023, 168 bodily injury traffic accidents were recorded in Batna Province, resulting in 95 fatalities and 261 injuries. Figure 05 illustrates the evolution of the number of victims (injured and killed) from 2020 to 2023. A decline in the number of injured individuals from 306 to 261 can be observed, which may reflect improvements in medical and emergency services or the implementation of more effective preventive measures. On the other hand, the number of fatalities increased from 76 to 95, equivalent to one death every four days in Batna Province. This indicates an increase in the severity of traffic accidents and a rise in the mortality rate, highlighting the need to strengthen road safety measures to address this issue[1].

3.1.3. Statistics on Traffic Accidents in Batna Province by General Causes

An analysis of Figure 06 reveals that the majority of traffic accidents, 91.07%, are attributed to driver-related factors, with 153 accidents caused by drivers.

[1] Ali Thabet, Rabab Aqti, and Adel Baghza, op. cit., 33.

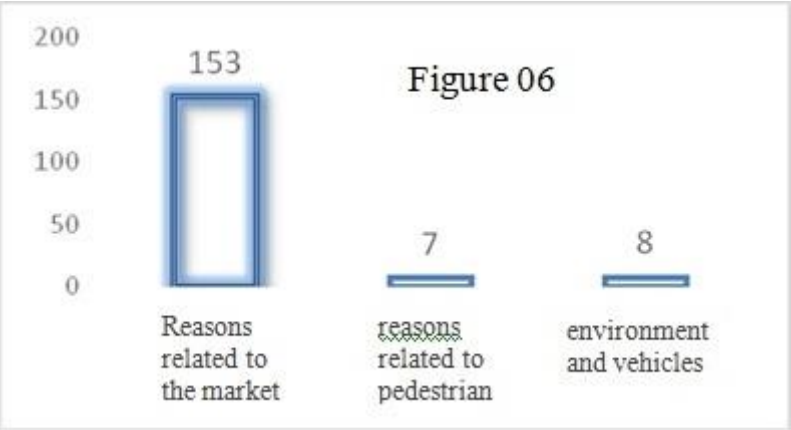
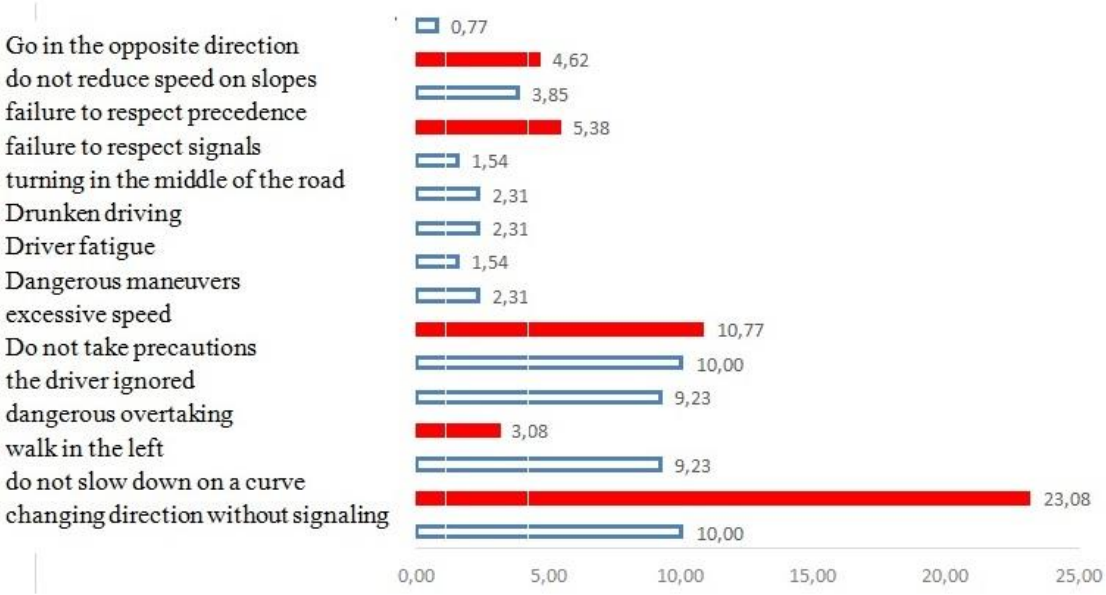


Figure 06

Additionally, the percentages of accidents caused by pedestrians (4.17%) and those related to environmental and vehicle factors (4.76%) are equal. The human element remains the primary factor in traffic accidents due to its central role in the traffic process and the significant impact of driver behavior on road safety.



Among the driver errors that led to traffic accidents, as illustrated in Figure 07, the following breakdown is observed:

- Excessive speed and failure to reduce speed in various situations is the leading cause of accidents in the province, as clearly reflected in the available data.
- Speed-related factors account for 47% of accidents, with the following distribution:
- Failure to reduce speed on curves: 23.08%
- Excessive speed and recklessness: 10.77%
- Failure to maintain a safe distance: 5.38%
- Failure to reduce speed on slopes: 4.62%
- Dangerous overtaking: 3.08%

These behaviors reflect a lack of traffic culture and a weak sense of responsibility among some drivers, highlighting the need for increased awareness and stricter enforcement of traffic laws[1].

[1] Ibid..p 33

3.2. Analysis of the Questionnaire

We relied on a questionnaire as a tool for data collection, following these steps:

- **Questionnaire Design**: It was designed to target drivers from various categories.
- **Questionnaire Distribution**: Distributed to a sample of 60 drivers at the parking lot of Batna-1 University during September 2024. Participants were selected randomly.
- **Follow-up on Questionnaire Completion**: To ensure understanding of the questions and clarify any inquiries participants might have.

The questionnaire was divided into two sections to facilitate data analysis:

1**. Section One**: Focused on the personal data of the study participants.

2. Section Two: Addressed drivers' opinions on the impact of speed on traffic accidents.

3.2.1. Analysis of Section One:

This section covered a set of demographic factors for the participants, including age, gender, occupation, and years of driving experience.

- Sample by Age Factor:

Age	Repetition	Ratio
18-28	37	61.7
29-39	14	23.3
≥40	13	21.7
The total	100	60

Table 4. Shows that 61.7% of the drivers included in the study are between 18 and 28 years old. Considering the current education, training, and qualification system in Algeria, this age group is the most vulnerable to traffic accidents compared to other groups. This is due to their lack of driving experience and behavioral factors associated with youth, such as recklessness and underestimating road risks.

- Sample by Occupation Factor:

Age	Repetition	Ratio
Student	44	73.3
Agent	12	20
Not working	4	6.7
The total	60	100

Table 5. reveals that 73.3% of the surveyed sample are students, which is attributed to the choice of the university parking lot as the location for distributing the questionnaire.

In contrast, 20% of the sample represents workers, reflecting relative diversity among participants but highlighting the dominance of the student category due to the study's location.

- Sample by Years of Driving Experience:

Age	Repetition	Ratio
Less Than 2 Tears	38	63.3
2-10	16	26.7
≤10	6	010
The Total	60	100

Table 6. Shows that 63.3% of the surveyed sample obtained their driver's license less than two years ago, while 26.7% have driving experience ranging between 2 and 10 years.

This distribution indicates that the majority of participants are new drivers, reflecting their limited experience in dealing with various road conditions. Although experience increases over time, the presence of a large number of inexperienced drivers may pose a risk to all road users due to their lack of familiarity with safe driving rules and quick responses to emergencies.

Table 6. also reveals that 63.3% of the surveyed sample obtained their driver's license less than two years ago, while 26.7% have driving experience ranging from 2 to 10 years.

This suggests that most drivers in the study have limited driving experience, which may increase the risk of accidents, especially due to their lack of knowledge about defensive driving techniques and handling emergency situations. Despite the fact that experience grows over time, the high number of new drivers poses a danger to all road users, highlighting the need to enhance awareness and training programs on road safety.

3.2.2. Analysis of Section Two:

This section addressed several key points, including:

- Ranking Human Errors by Accident Severity:

Raking For Causes Of Accidents	Repetition	Ratio
Driving fast	34	56.7
Drunk driving	9	15
Failure to respect security distances	2	3.3
Dangerous overtaking	12	20
Fatigue and exhaustion	3	5
The total	60	100

Table 7. Shows that the majority of the surveyed sample attribute the severity of traffic accidents to excessive speed (56.7%), followed by dangerous overtaking (20%).

This conclusion aligns with the analysis conducted by the National Road Safety Delegation, which classifies excessive speed as one of the main causes of traffic accidents in Algeria. This underscores the need to intensify awareness and monitoring efforts to reduce these phenomena by promoting drivers' compliance with traffic laws and implementing stricter measures to curb accidents caused by speeding and dangerous overtaking.

- Definition of Speed:

Categories	Repetition	Ratio
Time gain factor	28	46.7
A way to prove oneself	16	26.7
A mean of Entertainment	7	11.7
Danger for life	9	15
The total	60	100

Table 8. reveals that only 15 % of the surveyed sample understand the real danger posed by speed to life, while 46.7% consider it a means to save time. Additionally, responses from some young drivers indicate that they view speed as a way to prove themselves and for entertainment, reflecting a dangerous trend among this group.

Based on these findings, it is clear that young drivers need intensive awareness about the dangers of speeding. This necessitates focusing traffic prevention programs on them, whether through targeted media campaigns or interactive training programs, to correct misconceptions and promote a culture of safe driving.

- Traffic Violations Committed by the Sample in the Past:

Categories	Repetition	Ratio
Speed violations	18	30
Not wearing a seatbelt	4	6.7
Failure to respect traffic signals	22	36.7
Wrong parking	2	3.3
More than one violation	9	15
Not committing a violation	5	8.3
The total	60	100

Table 9. Shows that the majority of respondents have committed traffic violations, with only five exceptions. It also reveals that 36.7% of the sample violated traffic laws by failing to respect traffic signals, while 30% committed violations related to exceeding the legal speed limit.

These figures reflect the need to enhance traffic awareness and intensify road monitoring, particularly regarding speed and adherence to traffic signals. They also highlight the importance of implementing stricter training programs during driver education, alongside more deterrent penalties to reduce violations that pose a risk to public safety.

- Question: What Do You Do When Feeling Tired While Driving?

Categories	Repetition	Ratio
Stop walking	5	8.3
Increase the car's speed	19	31.7
reduce the car's speed	13	21.7
Do not change the speed of the car	23	38.3
The total	100	60

Table 10. Shows that 31.7% of the surveyed drivers increase their speed when feeling tired to reach their destination faster, which raises the likelihood of a traffic accident. In contrast, 38.3% of the sample do not change their speed. This behavior indicates that rushing to reach a destination is one of the main factors behind speeding and can become a dangerous behavioral habit, especially when the driver is running late for an appointment.

To address this issue, it is essential to raise awareness among drivers about the dangers of driving while fatigued and encourage them to take breaks during long trips. Additionally, promoting a culture of road safety among young people, who are often more prone to such risky behaviors, is crucial.

- Solutions to Reduce Excessive Speeding:

Categories	Repetition	Ratio
Be firm in dealing with speeders	24	40
License with drawl	13	31.7
Intensify n advertising campaigns	5	21.7
Double the fine	18	38.3
The total	60	100

Table 11. Shows that the respondents agreed on several proposals to reduce traffic speed. 40% of them believe it is necessary to strictly deal with violators, eliminate favoritism, and impose fines rigorously on all drivers without exception. Meanwhile, 30% support doubling the financial fines for those who commit these violations, given the serious risks they pose to drivers and road users.

The sample group was also asked to provide suggestions or opinions that could contribute to reducing traffic speed. Many of them offered a range of recommendations, including:

- Raising community awareness about the dangers of speeding through media, lectures, and educational sessions.
- Intensifying advertising campaigns on streets and roads.
- Increasing the presence of security and traffic patrols on roads.
- Installing surveillance cameras on highways to monitor violators.
- Updating and modernizing traffic signs and signals, especially those related to speed limits.
- Imposing fines on drivers who drive excessively slowly, as they may pose a danger.
- Raising the minimum age for obtaining a driver's license to 20 years to reduce accidents among inexperienced young drivers.
- Rehabilitating road shoulders according to international standards to ensure their effectiveness.

These suggestions emphasize the importance of preventive and legislative measures to reduce excessive speed, with a focus on continuous awareness and strict enforcement of laws to ensure road safety.

Conclusions.

We can assert that excessive speeding in the Province of Batna poses a significant risk to drivers and other road users. The primary reasons for this include a lack of awareness and education about the dangers of speeding, as well as certain societal habits and mindsets that view speeding as a cultural norm. Additionally, there are challenges that hinder effective monitoring, such as a shortage of necessary equipment and resources, as well as an insufficient number of qualified personnel to carry out traffic control duties.

Therefore, it is essential to develop a comprehensive strategy aimed at reducing excessive speeding, through:

- **Enhancing traffic monitoring measures** by utilizing modern technologies and increasing the number of surveillance teams.

- **Intensifying awareness campaigns** to shift negative attitudes toward speeding, particularly among young people.
- **Strictly enforcing penalties** on violators without any exceptions.
- **Conducting further studies and research** on road safety to develop effective, scientifically grounded policies.

Reducing traffic accidents requires collaborative efforts between official authorities, civil society, and the media to ensure a safer road environment in the Province of Batna.

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