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***Research paper***

# Analysis and management of traffic accident in Baghdad city

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**Abstract**

Currently, the city of Baghdad in Iraq suffers from an increase in irrigated traffic accidents for several reasons; so, it is necessary to study the main factors and causes of traffic accidents in Baghdad and focus on the methods to mitigate them. A questionnaire was formulated based on the literature review to collect information on the perceived causes of traffic accidents in Baghdad. The questionnaire was distributed to the targeted professionals across Baghdad. After analyzing the collected data using the SPSS program, the results showed that the major cause of traffic accidents in the city was the driver as this factor accounted for most of the traffic accidents. The attitude of the passengers was observed as the least cause of traffic accident in the city while the vehicle factor is the most important among the main factors. Based on the research findings, a system has been proposed for controlling the most important causes of traffic accidents in Baghdad. The system was proposed to reduce traffic accidents through safety guidelines and the education of the drivers of the presence of danger to life. The use of industrial bumps that allow one-way traffic, as well as the use of speed indicators and cameras on highways to identify traffic offenders was also proposed. Finally, the imposition of sanctions and fines on those that violate traffic laws as well as the tests for alcohol and drug are equally suggested.

***Keywords***: *Accident; Analysis; Car; Collision; Controlling; Driver ;Management; Pedestrian; Traffic; Vehicle*.

## 1. Introduction

Traffic collision (also referred to as traffic accident) can be in the form of motor/vehicle or pedestrian collision. Traffic accidents are an unexpected collision of two objects (moving or static) or between objects and human on the road. Traffic accidents are usually associated with damage to properties and sometimes results in either permanent disability or death [1]. Several factors are responsible for traffic accidents, such as vehicle speed, vehicle design, road design and environment, drivers' experience and behavior. Globally, traffic accidents account for death and several forms of disability in addition to financial costs to the individual directly involved and the society at large. Several human lives and properties are lost to traffic accidents globally. Death and injury due to traffic accidents have been acknowledged as a global phenomenon and has attracted the attention of the related authorities globally especially on the continued increase in the number of deaths or serious injuries due to traffic accidents.

Iraq is experiencing a high number of accident related deaths just like other countries and it is taking toll on the Iraqi society. Hence, there is a need to put up an effective plan that will ensure the protection of the country from too much social, economic, and health losses due to road traffic accidents. This research was conducted with the aim of analysing the accident prone areas in the streets of Baghdad and to establish the major causes of accidents in these routes. This research includes investigations on the analysis of pedestrian accidents. Some of the efforts towards the reduction of high traffic accident rates include the building of models for the improvement of highway safety, programs which consist of identifying the dangerous pedestrian accident routes, analysis of the rate of occurrence of accident in these routes and identifying major causes of such accidents in those locations. Then, a management strategy which focused on the determination and evaluation of the appropriate solutions to minimize the number of identified dangerous pedestrian accident locations in the system was suggested. The establishment of traffic safety improvement programs was also proposed in this study.

## 2. Related works on traffic accidents

This section presents a review of the previous works on the management and analysis of traffic accidents. Massie et al. (1995) combined passenger-vehicle travel data from Nationwide Personal Transportation Survey, General Estimates System, and Fatal Accident Reporting System for 1990 to study the rate of traffic accident per vehicle per mile of travel. The rate of accident was high for drivers in the age range of 16–19 years and those above 75 years old. Those above 75 years old (the oldest drivers) experienced the highest rate of traffic accident while those between 16 to 19 years (young drivers) had the highest rate in all police-reported traffic accidents. According to gender, men recorded a higher rate of accident risk compared to women, but the women recorded higher accident rates in all the police-reported crashes [2].

Chin (2003) examined the occurrence of traffic accident at signalized intersections using the random effect negative binomial model. The rate of traffic accident at the intersections for several years was analyzed using Poisson and negative binomial (NB) models. However, these models have some limitations; for the Poisson model, the variance-to-mean ratio of the obtained accident data must be approximately 1. For both NB and Poisson models, there must be no correlation between the collected data and time. being that accident data are characterized by heterogeneity and serial correlation, it may be inappropriate to use both Poisson and NB models. In this situation, the random effect negative binomial (RENB) model is a more suitable alternative. In the RENB, the

data is treated in a time-series cross-section panel, making it possible to handle the spatial and temporal effects in accident data.

In this paper, the use of RENB model for the identification of the factors affecting intersection safety was described. To verify a models' suitability, several goodness-of-fit criteria are employed. In this study, the model was evaluated for suitability and applied to the investigation of the relationship between the rate of traffic accidents and the geometric and traffic control characteristics of signalized intersections in Baghdad. From the results, 11 factors were found to have a significant influence on the safety at the junctions. The highly significant factors were the volumes of the total approach, the numbers of phases in each cycle, the presence of a surveillance camera, and the uncontrolled left-turn lane [3].

Jrew et al. (2007) developed a model for the prediction of accident in Arbil urban areas. The study aimed to develop an appropriate statistical predictive model for different locations and use the models to identify the dangerous routes in Arbil urban area. The study reported an increase in accidents with traffic volumes but not in a regular pattern [4].

Nazmi (2007) analyzed the rate of pedestrian accidents in AL-Zarqa City, Jordan with the aim of identifying the relationship between geometric design elements and pedestrian accidents. The study also aimed to find the causes, nature, type, and fatality of pedestrian accidents in the city. From the results of the analysis on the features and distribution of pedestrian accidents in the city, most of the pedestrian accidents in the city were found to be slight but with severe injuries compared to the number of fatal accidents. Majority of the slight to fatal accidents occur among those of about 24 years old or less. Similarly, most of the accidents took place far from the intersections [5].

Wen-hui et al. (2010) discussed the analysis of the safety factors for traffic accident in order to protect traffic police and improve the safety level. The study categorized the safety factors into 4 comprising of human, road, vehicle, and environment). With the application of system dynamics, the flowchart and the causality graph of the system dynamic were established. Furthermore, the relationship between changing each parameter and the changes in the safety degree in accident scenes were determined via simulation studies. From the results, the human factors were found to contribute more traffic accidents compared to the other factors [6].

Nathan et al. (2010) studied the use of system dynamics analysis for a better understanding of the major causes of traffic accidents. The study established the use of this approach to achieve a better understanding and prediction of non-combat-related traffic accidents in Iraq. It also showed the use of the method to explain the dynamics and mechanism of each type of accident. Finally, the study provided suggestions on the use of modeling information achieved in combating vehicle accidents in the U.S. Army to model, simulate, and analyze various areas of vehicle safety in the US populace [7].

Zeng et al. (2012) used fuzzy clustering to study the characteristics of traffic accidents in order to reduce losses and prevent the occurrence of accidents. In this study, the square method was used for the calculation of the transitive closure and the results showed that the probability of traffic accident in automobile was the highest in terms of the traffic accident index of 5 types of traffic modes (automobile, motorcycle, tractor, non-motorized vehicle, and pedestrian). Furthermore, the probability of traffic accident for tractor, pedestrian, and non-motorized vehicles was also found to be similar, but motorcycles showed the least traffic accident probability [8].

## 3. Methodology and data collection

To achieve the main objectives of this study which are: to investigate and identify the root cusses of traffic accidents in Baghdad, and to suggest a management system to control traffic accidents in Baghdad, a collection of common causes of traffic accidents was done. A questionnaire was designed and distributed to various people from different educational backgrounds (Engineer, Ph.D., Master of Road Engineering, Consulting officer, traffic policemen, and drivers) to find out the main reasons for traffic accidents. About 100 questionnaires were distributed but only 60 of them responded, representing 60% of the total questionnaires distributed. The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0.

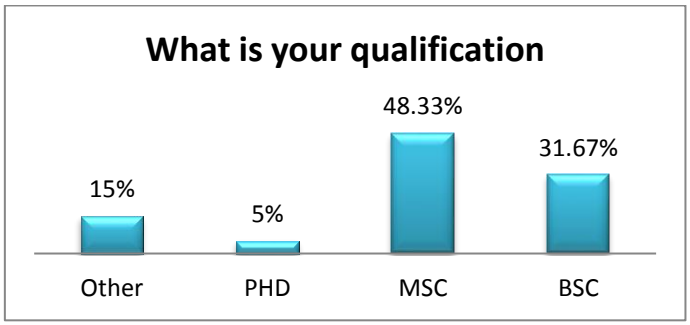


**Fig. 1:** Educational Qualification of the Respondents.

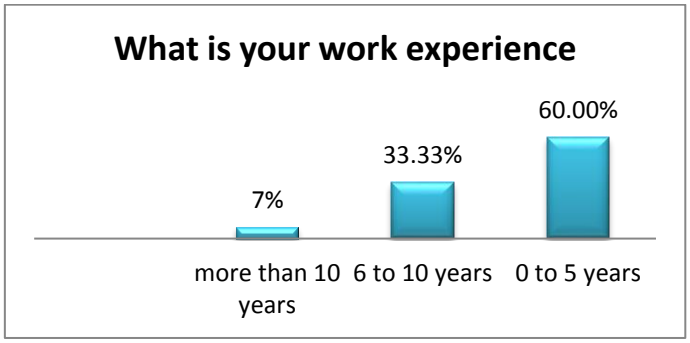


**Fig. 2:** Years of Experience of the Respondents.

## 4. Results of statistical analysis

### 4.1. Human

The results in Table 1 showed that 'Driving on the opposite sides' and 'Driving under the influence of alcohol, drugs, and other intoxicating substances' ranked the highest. 'Smoking while driving' and 'Other factors' ranked the least.

**Table 1:** The Human Factors (A - Drivers)

| Rank | Std. Deviation | Mean | 1. The human: A-Drivers |
|---|---|---|---|
| 1 | 0.53652 | 4.6833 | Driving on the opposite sides |
| 4 | 0.97192 | 4.2667 | Wrong overtaking. |
| 3 | 0.93277 | 4.3333 | Exceeded the speed limit |
| 10 | 0.78041 | 3.9667 | The wrong lane |
| 9 | 1.00788 | 4.0333 | Take the wrong turn |
| 7 | 0.65008 | 4.1333 | Wrong rotation |
| 12 | 0.88474 | 3.8833 | Following very closely |
| 11 | 1.02290 | 3.9333 | High weight |
| 12 | 1.22255 | 3.8833 | Wrong stop |
| 5 | 0.62073 | 4.2333 | Non-compliance with traffic light |
| 14 | 0.78312 | 3.7833 | Violation of the mandatory signs |
| 15 | .93640 | 3.7333 | Not giving preference to cars |
| 17 | 1.04840 | 3.4500 | Not giving priority for pedestrians |
| 13 | 1.01667 | 3.8167 | Annual inspection of vehicle |
| 18 | 0.82064 | 3.2667 | Failing to secure car stability while standing |
| 6 | 0.84706 | 4.1667 | Suddenly turning |
| 2 | 0.69115 | 4.6167 | Driving under the influence of alcohol and intoxicating substances |
| 8 | 0.74314 | 4.0833 | Using the phone while driving |
| 19 | 1.59262 | 2.8500 | Smoking while driving |
| 12 | 0.95831 | 3.8833 | Work long hours in the day |
| 16 | 1.10916 | 3.5833 | Inefficiency of a large percentage of drivers and the low eligibility and culture of traffic because of a lack of training |
| 20 | 1.34826 | 2.2500 | Others |

The results in Table 2 showed that 'Lack of commitment to places designated for pedestrian crossing' and 'Weak traffic awareness for pedestrians' ranked the highest, while 'Child's play on the roads' and 'Others for pedestrians' ranked the least.

**Table 2:** The Human Factors (B- Pedestrians)

| Rank | Std. Deviation | Mean | B-Pedestrians |
|---|---|---|---|
| 1 | 0.81146 | 4.05 | Lack of commitment to places designated for pedestrian crossing |
| 3 | 0.88474 | 3.8833 | Walking on the road path |
| 5 | 1.06232 | 3.5833 | Violation of Passenger Traffic Rules. |
| 4 | 0.93277 | 3.6667 | Child's play on the roads |
| 2 | 0.82937 | 3.9167 | Weak traffic awareness for pedestrians and especially children. |
| 6 | 1.1717 | 2.5 | Others |

The results in Table 3 showed that 'Non-compliance with the use of safety measures' ranked the highest

**Table 3:** The Human Factors (C-Passengers)

| Rank | Std. Deviation | Mean | C-Passenger |
|---|---|---|---|
| 1 | 0.84973 | 3.3000 | Non-compliance with the use of public safety measures such as the use of the seat belt and children seating in specified areas. |
| 2 | 1.16190 | 2.3500 | Other for passenger |

### 4.2. Road

The results in Table 4 showed that 'Working on the road without warning signs', 'Engineering defects in the design and implementation of the road', Presence of pits and bumps' and 'Delay in treatment and poor infrastructure and urban planning' ranked the highest while 'Advance planning sites bridges, tunnels, walkways and indiscriminate expansion in construction before finding a suitable service structure' and 'Others for road' ranked the least.

**Table 4:** The Road Factors

| Rank | Std. Deviation | Mean | 2-Road |
|---|---|---|---|
| 2 | 0.79972 | 3.9333 | Engineering defects in the design and implementation of the road, the presence of pits and bumps, and the delay in treatment and poor infrastructure and urban planning |
| 1 | 0.82270 | 3.9667 | Working on the road without warning signs |
| 8 | 0.92425 | 3.4000 | Advance planning sites bridges, tunnels, walkways and indiscriminate expansion in construction before finding a suitable service structure |
| 3 | 0.51640 | 3.7333 | The presences of bumps asphalt to reduce accidents and distributed randomly. |
| 6 | 1.03115 | 3.5667 | Lack of infrastructure (water and electricity) for expansion of urban roads and streets that requires re-digging the streets without paying attention to the control of contractors to suitability for use according to the specifications |
| 5 | 0.94046 | 3.6167 | Insufficient lighting on both sides of the road |
| 4 | 0.84973 | 3.7000 | Narrow sidewalks for pedestrians |
| 7 | 0.89237 | 3.4833 | Neglect the places of pedestrian at intersections |
| 6 | 0.92730 | 3.5667 | Unavailability of enough parks and playgrounds which forces children to play on the streets |
| 9 | 1.14426 | 2.7500 | Others |

### 4.3. Vehicle

The results in Table 5 showed that 'Not making sure that the vehicle is roadworthy' ranked the highest while 'Density of traffic on the roads resulting from the annual increase in the number of vehicles' ranked the least.

**Table 5:** The Vehicle Factors

| Rank | Std. Deviation | Mean | 3. Vehicle |
|---|---|---|---|
| 1 | 0.85354 | 4.1833 | Not making sure that the vehicle roadworthy, especially with regard to the technical vehicles with equipment such as lighting, brakes, steering, tires, and others |
| 2 | 0.83209 | 3.9500 | Surrounding environmental factors are a group of natural factors of the formation of frost and fog, high winds and rain and the occurrence of landslides and flash floods in the winter and high temperature and its impact on human activity and the degree |
| 3 | 0.71525 | 3.3833 | The density of traffic on the roads resulting from the annual increase in the number of vehicles |

From the results analysis shown in Table 6, it was found that the most effective reason for accidents is the vehicle factor.

**Table 6:** The Basic Factors

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Human Factor | 60 | 3.4270 | .82060 |
| Vehicle Factor | 60 | 4.1833 | .85354 |
| Road Factor | 60 | 3.5379 | .76249 |

Table 7 showed that the highest contributor to accidents is 'Driver' (one of the human factors).

**Table 7:** The Human Factors

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Driver Factor | 60 | 3.8561 | .81566 |
| Pedestrians Factor | 60 | 3.6000 | .85105 |
| Passenger Factor | 60 | 2.8250 | .92894 |

Table 8 the highest percentage of the causes for the whole factors (human, vehicle, and road) and most of them are human causes.

**Table 8:** The Most Important Contributors

| Rank | Factors | Mean | Causes |
|---|---|---|---|
| 1 | Human | 4.6833 | Driving in the opposite side |
| 2 | Human | 4.6167 | Driving under the influence of alcohol and intoxicating substances |
| 3 | Human | 4.3333 | Exceeded the speed limit |
| 4 | Human | 4.2667 | Wrong overtaking. |
| 5 | Human | 4.2333 | Non-compliance to traffic light |
| 6 | Vehicle | 4.1833 | Not making sure that the vehicle is roadworthy, especially with regard to the technical vehicles with equipment such as lighting, brakes, steering, tires and other |

## 5. Management of traffic accident in Baghdad

Based on the most important causes, a system was developed for this purpose to reduce them:

### 5.1. Driving in the wrong direction, exceeding the speed limit, wrong overtaking, and non-compliance to traffic light

The development of industrial bumps that allow one-way traffic; the use of speed indicators in highways; the use of cameras to identify traffic violations; the imposition of sanctions and fines on those who violate traffic laws.

### 5.2. Driving under the influence of alcohol and intoxicating substances

Reduce driving under the influence of alcohol, intoxicating substances, and drug; mandatory prison term upon test completion of alcohol and drug abuse; automatic license revocation appears to be the single most effective measure to reduce drunk driving.

### 5.3. The driver does not ensure the validity of the vehicle and especially with regard to technical equipment components such as lighting, brakes, steering, tires and other

Through safety guidelines and educate the driver of the presence of danger to his life and the lives of people in the case of walking in the road and there are mechanical damages to the vehicle, the brakes, and tiers.

### 5.4. Lack of commitment to places allocated for pedestrian crossing

To limit the movement of pedestrians through the expansion of the pier and the construction of small public parks on the sides of the road.

### 5.6. Lack of traffic awareness for pedestrians and especially children

Through the instructions and guidance of parents to prevent their children from playing in the streets, as well as by increasing recreational parks for children.

### 5.7. Non-compliance with rules of using the means of public safety such as using the seat belt and children seating in specified places

Everyone in the vehicle should put on seat belts, not only those in the front seat. There should be fines for not putting on seat belts and such fines should be reasonably high and effective. Laws criminalizing non-compliance to the use of seat belts should be enacted and enforced with visible police presence. The public should be sensitized and educated to ensure compliance to seat belt laws. Children should be banned from occupying front seats (backed with laws and fines).

### 5.8. Working on the road without warning signs

Fines and penal laws should be imposed also cameras in the streets and bridges to enable the monitoring of offenders.

### 5.9. Engineering flaws to follow the highway specification in design and construction

Through the attention of the General Authority for Roads by sending a committee that detects the cause of this incidents.and resolve them.

## 6. Conclusions and future studies

### 6.1. Conclusion

Traffic accident represents a worldwide socio-economic problem and it is not possible or realistic to expect that all traffic accident can be avoided. So, an understanding of the main factors identified in this study is necessary. The vehicle should be road-worthy, and the driver must neither drive on the wrong way nor under the influence of agent. An early analysis of the main causes will hopefully assist by reducing their occurrence by:

- Using industrial bumps that allow one-way traffic; the use of speed indicators in highways; and the use of cameras to identify traffic violations. Sanctions and fines should be imposed on the violators and those found to be driving under the influence of agent (upon test completion) should be penalized.
- Through safety guidelines and educating the drivers on the presence of danger to his life and the lives of people especially when walking on the road and there are mechanical damages to the vehicle, the brakes, and the tiers.

### 6.2. Future studies

The following are suggested titles for future studies in this regard:

1) Analysis of gender differences in the perception of traffic accidents risks in Iraq.
2) Study on the impact of increased traffic accidents on the Iraqi society in the future.
3) Analysis of traffic accidents by driver's age and gender.
4) The effects of road traffic accidents on the Iraqi society.

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