A Sustainable Framework to Reduce Traffic Accidents in Baghdad City

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Abstract. Traffic accidents are the most critical problems related to safety and security in the city, and they have negative effects on human life and psychological, health, and economic impacts on people, society, and the city. After 2003, the number of cars increased in Iraqi cities and traffic accidents increased, as the number of traffic accidents in Iraqi cities reached between 8-11 thousand accidents annually during the period 2012-2018. The percentage of accidents in Baghdad Governorate 12.1 % of all incidents in Iraq, 66% of accidents in Baghdad Governorate are inside the Baghdad city (the capital), divided by 70 % in Rusafa and 30% in Karkh in 2017 and 2018. By preparing a questionnaire on the causes of accidents in Iraqi cities, it showed that the most important reasons are the lack of adherence to traffic laws and the weak knowledge of them and old laws and their non-conformity with technological developments and communications in the transport sector. The research proposes to develop an integrated framework that adopts sustainable transport along its social, institutional, and economic aspects to solve the problem of accidents in Baghdad city.

Keywords: Framework, Traffic Accidents, Baghdad City, Social Aspect, Government level.

1. Introduction
Traffic accidents are one of the most important causes of the problems of cities that lead to an increase in the number of deaths in cities and cause various economic, environmental, and social damages that have different health and psychological effects on society and individuals. 750–880,000 people died prematurely in road traffic crashes in 1999. Some 85% of these occurred in developing countries, and urban road networks contributed to a significant proportion of countries’ national road traffic crash problems. Between 35- 70 % of all crashes occur in urban areas [1].

In 2010, the states presented in the World Health Report (WHR) documented road traffic injuries as the ninth most common reason for the disability of people. According to the World Health Organization (WHO) [2], about 1.24 million casualties and 50 million injuries were reported globally. Automobile accidents are rated as the eighth cause of injuries and death toll worldwide [3].

These road traffic accidents cause an increased death toll or injury and result in communal and financial damage to the state [4]. The deaths or disabilities of youngsters caused by accidents have a solemn effect on families and more widely on society [5]. The loss or disability of an earner causes financial suffering for family members and changes the domestic dynamics [3].

After 2003, the number of cars in Iraq increased, and traffic accidents increased, causing an increase in the number of dead and injured, requiring a framework to reduce these accidents. Traffic regulation by the concerned authorities is very weak. Therefore there is an overlap in the movement of vehicles in a confusing way for the drivers. This may increase the possibility of traffic accidents [6].

2. Statistics of Traffic Accidents in Iraq
Statistics of traffic accidents in Iraq shows the research statistics of accidents at three levels:

2.1. National level
Government reports of traffic accident statistics in Iraq during the period 2012-2018 showed that there is a discrepancy in the number of traffic accidents in Iraq during this period, and amount to accidents account for 1% of the total number of cars in Iraq, and the results of traffic accidents are 22% the death rate and 78% of injured (Table 1).

Table 1: Number of accidents, deaths, and injuries at the national level.

| Year | Number of accidents | Number of deaths | Number of injured |
|------|---------------------|------------------|------------------|
| 2012 | 10709               | 3132             | 11009            |
| 2013 | 9725                | 2951             | 10694            |
| 2014 | 8814                | 2769             | 9210             |
| 2015 | 8836                | 2514             | 9429             |
| 2016 | 8763                | 2531             | 9016             |
| 2017 | 8824                | 2621             | 9388             |
| 2018 | 9852                | 2767             | 10439            |
| Total| 65523               | 19285            | 69185            |

Percentage: 1 %, 22 %, 78 %

[7], [8], [9], [10], [11] and [12].

Figure 1 shows that the highest incidents were in 2012, began to decline and stabilize during 2013-2017, and then began to increase in 2018.

Figure 1: Number of Traffic Accidents at National Level

2.2. Province level (Baghdad province)

Reports indicated the total number of cars in Iraq reached (6439332), and the number of cars in Baghdad province reached (2291149), i.e., 36% of the total cars in Iraq. Government reports of traffic accident statistics in Baghdad governorate during the period 2015-2018 indicated a slight decrease in the number of traffic accidents and that the percentage of accidents in Baghdad province represents 12.1% of all traffic accidents in Iraq. Traffic accidents are 27% of the deaths and 73% of the number of injured (Table 2).
Table 2: Number of accidents, deaths, and injuries at the level of Baghdad province.

| Year | Number of accidents | Number of deaths | Number of injured |
|------|---------------------|------------------|-------------------|
| 2015 | 1248                | 304              | 944               |
| 2016 | 1111                | 315              | 796               |
| 2017 | 1015                | 306              | 709               |
| 2018 | 1023                | 277              | 746               |
| Total| 4397                | 1202             | 3195              |
| Percentage | 12.1% | 27% | 73% |

[7], [8], [9], [10], [11] and [12].

Figure 2 shows that the highest number of incidents reached in 2015 and began to decline and stabilize in 2017 and 2018.

2.3. City level (Baghdad City) (capital)
The Baghdad city is divided into two parts (Al-Karkh and Al-Rusafa), and government reports of traffic accident statistics in Baghdad during the period 2017-2018 indicated that 66% of the incidents were in the Baghdad city of the total accidents in Baghdad province. 30% of the incidents occurred in al-Karkh area, and 70% occurred in al-Rusafa. Traffic accidents are 26% of the deaths and 74% of the number of injured (Table 3).

Figure 3 shows that the number of incidents in the karkh area decreased in 2018, while the Rusafa area rose in 2018.

Table 3. Number of accidents, deaths and injuries at the level of Baghdad province.

| Area   | Year | Number of accidents | Percentage | Number of deaths | Number of injured |
|--------|------|---------------------|------------|------------------|-------------------|
| karkh  | 2017 | 218                 | 30 %       | 56               | 134               |
|        | 2018 | 186                 |            | 41               | 138               |
| Rusafa | 2017 | 463                 | 70 %       | 113              | 284               |
|        | 2018 | 472                 |            | 96               | 332               |
| Total  |      | 1339                |            | 306              | 888               |
| Percentage | 66% | 26% | 74% |

[7], [8], [9], [10], [11] and [12].
3. Causes of Traffic Accidents in Iraqi Cities

The research to find out the causes of traffic accidents in Iraqi cities was based on a questionnaire for transport specialists from academics and traffic men, the Secretariat of Baghdad, Ministry of Municipalities and Public Works, and the Ministry of Planning, with 150 samples to show the most essential reasons affecting the increase in the number of accidents, through analysis Results using (SPSS), Likert scale 1-3 (3 strong effect, 2 medium effect, 1 weak effect) and as follows (table 4):

![Figure 3: Number of Traffic Accidents at City Level](image)

| X | N   | Minimum | Maximum | Mean  | Std. Deviation |
|---|-----|---------|---------|-------|----------------|
| X1| 150 | 2.00    | 3.00    | 2.653 | .47750         |
| X2| 150 | 2.00    | 3.00    | 2.553 | .49881         |
| X3| 150 | 1.00    | 3.00    | 1.973 | .69463         |
| X4| 150 | 1.00    | 3.00    | 2.573 | .53529         |
| X5| 150 | 1.00    | 3.00    | 2.200 | .57928         |
| X6| 150 | 1.00    | 3.00    | 1.766 | .46942         |
| X7| 150 | 2.00    | 3.00    | 2.566 | .49720         |
| X8| 150 | 1.00    | 3.00    | 2.620 | .50060         |
| X9| 150 | 1.00    | 3.00    | 2.386 | .67343         |
| X10| 150 | 1.00    | 3.00    | 2.606 | .71322         |

Authors by SPSS

A. (X1) Weak application of traffic laws by an executive and government authorities: the results showed that they are the highest impact on the increase in the number of accidents in Iraq by an average of 2.65, especially after 2003, where the application of most traffic laws has weakened, as well as the failure of the laws to keep pace with technological developments Modern communications and informatics.
B. (X2) Excessive speed: One of the main causes of traffic accidents in Iraq due to the failure of drivers to commit to the specified speed: with a strong impact of 2.55, due to the lack of modern methods to determine traffic speed on primary and secondary roads in Iraq.

C. (X3) Increasing the number of private cars in Iraq, which increases traffic volumes and traffic accidents: with an average impact of 1.97, the number of cars increased significantly after 2003.

D. (X4) The network level deterioration of roads and main streets in most Iraqi cities, causing an increase in the number of accidents: with a strong impact amount to 2.57. Most roads in Iraq suffer from deterioration and decrease in the level of service as a result of their lack of maintenance continuously and quality, causing them to disappear and the appearance of drilling and breaking the road. The expansion of bridges and tunnels and the collapse of protective fences increase the number of traffic accidents in Iraq.

E. (X5) Deterioration and lack of infrastructure for signs and warning traffic signs on most major and secondary roads: with an average effect of 2.2, as most roads lack effective traffic signs and traffic signs to help drivers know the road and its instructions.

F. (X6) The non-compliance of tri-frame transport (tuk-tuk and similar) of any traffic laws and instructions and their interaction with cars, causing many traffic accidents: with an average effect of 1.77, as most of these media do not comply with traffic laws but are few and limited in certain areas.

G. (X7) Lack of community awareness of the need to abide by traffic laws and regulations aimed at protecting the lives of citizens: with a strong impact of 2.57, as most traffic laws lack understanding and absorption by citizens as a result of lack of awareness and education on them.

H. (X8) Ignoring the citizens’ disregard for the guidelines and instructions that reduce traffic accidents: the second highest strong effect was 2.62. Most Iraqi citizens ignore traffic guidelines and do not realize their importance in regulating life and increasing safety and public safety.

Lack of community awareness is unintentional, while ignorance is intentional.

I. (X9) The presence of interference in pedestrian traffic with cars due to the lack of a citizen's commitment to cross or from pedestrian bridges: with an average effect of 2.39, as the interference between pedestrians and cars results from pedestrians crossing in unallocated places and different places.

J. (X10) Lack of adequate and proper pedestrian transit spaces in places with high traffic density: with a strong impact of 2.6, as it is the main reason for the overlap of pedestrians and cars, as well as the lack of climate-appropriate needs for these places to provide a comfortable atmosphere for pedestrians.

The interference of pedestrian and vehicle traffic has to do with community awareness. While the lack of places for pedestrian crossings related to the infrastructure.

K. The results of the questionnaire show many problems that increase accidents in Iraqi cities, including those related to the administrative, organizational, and governance aspect, which the government and regulatory bodies represent in terms of the lack and weakness of laws, legislation and infrastructure, and another aspect related to the social dimensions represented by the lack of societal awareness of the transport and traffic sector. Consequently, there is a weakness in the complementary relationship between the different levels represented by government, society, and the individual.

4. Proposed Sustainable Framework to Reduce Traffic Accidents in Iraqi Cities

The Iraqi state depends and focuses on the development of laws in various sectors, including laws on roads and traffic, but mainly on the economic and material aspect only to control traffic on the roads, without focusing on the social and environmental aspects, which also contribute to reducing the Traffic accidents in greater proportions than the economic aspect. That is, the decision-making process is one-way, not participatory and complementary.
The research proposes a sustainable framework that adopts a two-way decision-making process to integrate different levels of government, society, and the individual as follows (see Figure 4).

4.1. **Government level**

Its represented by the economic and regulatory aspects through:

- Increase and impose fines on violators of laws and traffic regulations, which cause an increase in traffic accidents on roads and main and secondary streets.
- Preparing modern traffic laws in line with technological and information development in the transport and traffic sector.
- Develop laws and regulations to increase and encourage the use of non-automated transport in the city, due to the lack of Iraqi traffic laws to legislation on these means (bicycles and walking).
- Allocating a large financial budget for street maintenance and organization and providing traffic signs and signs.
- The establishment of a body specialized in collecting, analyzing and making decisions in the field of roads and traffic includes the Directorate of Traffic civil society organizations and the ministries of municipalities and communications are essential in introducing technologies and technologies modern in the field of traffic, especially smart systems that reduce traffic accidents.
- Encouraging the implementers of traffic laws, especially the traffic police, the importance of applying laws that reduce and reduce traffic accidents because of their importance in improving the safety and safety of the community.
- Prepare a special law regulating the movement of three-wheeled transport (tictks, etc.) and complying with traffic laws to reduce accidents.
- An introduction of development and educational courses by the executive authorities of traffic laws to raise awareness and deal with citizens and drivers.
- Provide high-level public transport routes to encourage citizens to use public transport and reduce private cars.
- Encourage investment in constructing road infrastructure.

![Figure 4: Proposed Sustainable Framework to Reduce Traffic](image-url)
4.2. Community level

It is represented by the social and environmental aspect, which works to increase traffic awareness in the whole group through:

- The establishment of civil society organizations specializing in the awareness aspect in the transport and traffic sector working to spread awareness of the traffic culture and compliance with laws and instructions that maintain traffic safety and increase safety.
- Encouraging the community to use non-automated transport through awareness campaigns in government institutions, schools, universities, and all facilities.
- Establishing pressure groups on legal and government agencies to participate in decision-making Related to the traffic and environmental safety of the community and the preparation of plans in local councils.
- Introducing curricula for students in primary, high school to maintain safety from traffic accidents and attention to traffic security in a theoretical and practical way.

4.3. Individual level

It is represented by the social aspect, which focuses on the behavioral dimensions of the individual and his or her actions in Various areas, particularly the transport and traffic sector, through:

- The family head focuses on teaching family members the laws and instructions of passage and adherence to maintain Personal safety.
- Increasing the cultural awareness of family members in traffic safety and environmental conservation using means non-automated transport because of its health and environmental benefits to the individual.
- Participating in delivering problems and needs related to the security and safety aspect to the authorities executive and government through media and regulatory.

5. Conclusions

The report and questionnaire statistics showed:

A. Analysis of reports indicates an increase in the number of traffic accidents at the national level due to the increasing in the number of cars and the weak application of traffic laws.

B. The number of cars is 36% concentrated in Baghdad province, and the accident rate was 12.1%, which means that users adhere to traffic laws more than other provinces, as a result of the large urbanization of Baghdad province as the largest city with a population and the availability of various activities. Different, as well as a high level of education and culture compared to other provinces.

C. The percentage of accidents inside Baghdad city was 66% compared to Baghdad governorate, i.e., outside the basic design limits of Baghdad city, as a result of the momentum and traffic intensity within the Baghdad city, which caused an increase in the proportion of accidents.

D. The percentage of accidents in the side of Al-Rusafa was 70%. While on the side of al-Karkh 30%, this is due to the age and small traffic network on the side of Al-Rusafa and its inability to accommodate large traffic volumes. As well as the stationing of most of the central commercial activities next to Rusafa, compared to the side of al-Karkh, where its traffic network is characterized by its traffic network modernity and its occupation of large areas.

E. The causes of traffic accidents are compounded by the executive authorities of traffic laws, drivers, and citizens, as they are all involved in increasing the number of accidents in Iraq as a result of the lack of law enforcement and lack of community awareness, which caused many accidents, an increase in economic, environmental damage and social for society because of old laws and not keep up with the times.
6. Recommendations
A. Reliance on the sustainable framework proposed in the research as a basis for developing policies to implement them according to governmental, community, and individual levels.
B. Complementarity between the levels proposed in the research requires the formation of an elected body for coordination and integration between levels.
C. The necessity of legal, informational, cultural, and societal support for the proposed body for the success of its executive tasks.

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