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ANALYSIS OF ROAD TRAFFIC ACCIDENTS AMONG IRAQI GOVERNORATES

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Abstract

Road accidents have been identified as one of the main causes of death and have a significant effect on public health challenges, economic growth and development. The Iraqi transport infrastructure has suffered from the effects of war, carelessness, and lack of investment. As a result, road traffic accidents have increased, and the current efforts to address road safety are minimal in comparison to the growing level of citizen suffering. The objective of this study was to provincially analyze traffic accidents in Iraq using data from 2010 to 2020 to shed light on the current situation. Three key conclusions were made from the results: first, people aged 35 years and under was the age group recorded in the most traffic accidents; second, Al-Najaf province recorded the highest rate of traffic accidents; and third, COVID-19 lockdown in Iraq caused a 28.5 % decline in traffic accidents while fatality and injury rates fell by 28 % and 18.4 % respectively, when comparing with the data of the same period in 2019.

Keywords:

Traffic accident;
Road safety;
Fatality rate;
Covid-19;
Lockdown.

1 Introduction

The transport network, especially the road system, has faced huge pressures due to the increased trends in population growth and urbanization. One of the negative side effects of traffic growth is road accidents. Road accidents have been identified as one of the main causes of deaths and have a significant effect on public health challenges, economic growth and development. According to the latest World Health Organization (WHO) data published in 2020, the number of road traffic deaths continues to rise steadily, reaching 1.35 million people, and about 20 to 50 million people sustain serious injuries in crashes around the world every year [1]. Every day, over 3,700 people die on the world's roads, and tens of millions of people are injured or disabled every year. Moreover, road traffic incidents are currently the leading cause of death for children and young adults aged 5–29 years and were the eighth highest cause of death globally. This statistic demonstrates how dangerous the problem of traffic accidents is, as the fatalities are most often young and healthy before the accident [2].

Traffic accidents have become a serious threat to economic resources and have caused a loss of human energy, which is considered the main element of society. Around the world, the year 2020 witnessed an exceptional drop in road deaths, primarily because the spread of the COVID-19 global pandemic forced all countries to impose restrictions on travel which cause a considerable reduction in mobility. While 2021 was also significantly disrupted by the pandemic, traffic accident data for 2020 represent an inadequate reference point for benchmarking progress. Therefore, the annual road safety report compares the 2021 road accidents data to averages for the period 2017-2019. Road casualties in 2021 increased by 0.1 % compared to the average for the period 2017-2019 [3]. Researchers must therefore make efforts to find solutions to reduce the effect of road accidents and study their causes, which can be broken down into the driver, the road, and the vehicle. Save Our Lives (SOL) is a successive project to build road safety policy and develop strategies through the involvement of local communities to produce a safety-conscious culture in society [4].

At political and technical levels, political commitment and institutional structures in many countries show weaknesses in dealing with road safety issues and are not strong enough to face the increase in mortality and morbidity rates from traffic accidents [5]. Iraq is at a global forefront in terms of road traffic accidents. Consequently, road traffic accidents in Iraq are currently one of the main causes of death. The Iraqi Central Statistical Organization (ICSO) of the Ministry of Planning publishes annual traffic accident statistics based on police reports. Not a day passes without road traffic accidents on the roads in Iraq, in which a countless number of people are killed or disabled. Every year more than 2,500 people are killed in traffic accidents, and injuries number among 10,000 to 15,000 as reported by ICSO. Based on these reports, road traffic accidents pose huge risks and are comparable to current terrorism operations in terms of the harm caused, which is a reason for concern for all members of the community in Iraq. Accident data analysis in 2020 shows that in Iraq, approximately six people die every day in traffic accidents and there is a traffic accident every hour, therefore the government of Iraq should take further protective measures to decrease the number of traffic accidents and apply a new traffic law to improve road safety.

Four decades ago, Iraq ran an excellent and extensive transport system in the Arabic region, but the transport infrastructure has suffered from the effects of war, carelessness, and a lack of investment [6]. Leidman, E. et al. [7] analyzed the accidents for four years from 2010 to 2013 in the following eight provinces: Baghdad, Al-Anbar, Basrah, Erbil, Kerbala, Maysan, Ninevah, and Al-Sulaimaniya. The results revealed that there were 7976 traffic accident fatalities (most within the age group 15–34 years) and 78.2 % of them were male, moreover; more than one quarter were children (below 18 years), and approximately half occurred between pedestrians.

Locally, various traffic accidents studies have been conducted by Iraqi researchers at different periods and cities in Iraq, such as that of Muhammad, S. [8] who studied accident mortality in Salah-Aldeen province during 2002 (prior to the war) and concluded that the first cause of death was traffic accidents, making up 48.32 % of total deaths, with a majority of the mortalities in traffic accidents occurring among pedestrians. In addition, Al Obaidi, S. et al. [9] found that the age group of 14 years and under was involved in more accidents in Najaf during 1996 to 1998 and that 2–6 pm was the time period with the most accidents.

In the province of Diyala, Muhammad, W. M. [10] studied traffic accidents for the years 2009 and 2010 based on the data collected by a local traffic agency in Diyala. The total number of accidents was 400 and 131 of these were fatal, moreover, most accidents occurred in June and July (summer season) due to the effect of the increasing temperatures on drivers during these months, whereas the accident rate decreased in November and December (autumn season). Two-thirds of accidents in Diyala were of a collision type.

Al-Anbari, H. G. [11] and Al-Ghabban, S. et al. [12] studied motorcycle accidents in the province of Holy Karbala. The former study analyzed accidents over an eight month period in 2008 (January till August) and found that most of the victims were male (female: male, 1:5.3) and young (below 20 years), whereas the latter study examined the accidents from November 2010 to February 2011 and concluded that more than one-quarter of the injured motorcyclists were within 15 – 19 years of age, and approximately 32.7 % of these had a history of previous accidents.

Aljoborae, S. F. and Al Humairi, A. K. [13] conducted a study of accidents in the Babylon province for seven months (from May to November) during 2013 and found that 83 % of the mortalities were male and approximately half of the drivers had no driving license. Furthermore, more than two-thirds of victims were involved in traffic accidents during the day, with 83 % of accidents occurring on main roads.

Al-Obaedi, T. J. [14] stated the causes of road accidents in Al-Diwaniya city (the capital city of Al-Qadysia Governorate) for the period 2004 – 2013 and used questionnaire data and data from the local traffic agency in Al-Diwaniya city. The results showed that the average fatality rate of accidents in the city was 33 per 100,000 population, which is considered extremely high when compared to the global rate (18 fatalities per 100,000). In addition, Dhahad, S. N. [15] studied the causes of and solutions to traffic accidents in the Thi-Qar governorate for the years 2004 - 2011 based on data obtained from the Thi-Qar traffic directorate and a questionnaire. The results indicate a continuous rise in the incidence of road accidents.

Albayati and Ramadan [16] investigate the relationships between fatal crash rates, speed, and flow characteristics on three selected multilane rural highways in Wasit governorate. Accident data are collected from two sources: police stations and traffic surveys. The results revealed that the increased hourly traffic flow increased the need for safe traffic facilities.

Alwan, F. [17] reviewed traffic accidents over the past decade (2005 - 2015) to assess the causes and effects of accidents in Iraq. Meanwhile, Al-bayati, A. H. and Latief, R. H. [18] investigated the road traffic accidents data during the period of 2002–2015. They used both a traditional statistical regression and an artificial neural network approach to conduct a statistical analysis for road traffic accidents in order to correlate the criterion variable of accident number, fatality, or injury to the predictor variable of motorization level or population. Also, Albayati A. H. and Lateef I. M. [19] evaluated traffic accidents in Baghdad that occurred from 2006–2016. The results show that 12,019 accidents occurred in Baghdad, 22 percent of these accidents are deadly.

In December 2019, the world experienced a series of unprecedented events after the detection of the COVID-19 [20]. Officially in 2020, WHO declared on March 11 that Covid-19 is a pandemic and expected to spread over all countries in the world [21]. As a result, lockdowns, stay-at-home orders, and curfews were imposed across the world. At the end of 2020, COVID-19 has spread and cause 1,922,617 deaths in all countries around the world [22].

A series of heavy restrictions like physical distancing and restrained movement is imposed in all countries to control the spread of Covid-19 virus, therefore stay-at-home order has been instructed. Crowded places like schools, colleges, restaurants, picnic areas, and malls have been shut down. Consequently, transportation through all means has reduced in a never-before-seen manner. The medical reports stated that bed occupancy in emergency rooms has reduced for traffic accident trauma [23].

Based on the road safety annual report in 2020 and 2021, the traffic volumes and rate of road deaths dropped during the first months of 2020 because of lockdowns imposed in many countries during the spread of COVID-19. 2020 is an exceptional year, the average annual reduction in the number of road casualties for the years 2010-2019 was 2 %, while it was nearly ten times that at 19.2 % in 2020 [1, 24]. Several academic articles like (Aloi, A. et al. [25], Velayudhan, B. and Mohammed, I. [26], and Brodeur, A. et al. [27]) study the drop in traffic accidents across the world in the period of lockdown to face the spread of COVID-19. The researchers find a positive side during the COVID-19 pandemic lockdown that the severity level of traffic accidents decreases with the number of accidents. Overall, the impact of COVID-19 on road traffic safety is far more complicated than a blunt reduction in traffic and accidents.

The main objectives of this study are to perform a graphical analysis of road traffic accidents for 15 governorates in Iraq, shed light on the current situation of traffic accidents during the period 2010 - 2020, and study the effect of COVID-19 lockdown in 2020 on traffic accidents.

2 Data collection

The traffic accident data used in this study were obtained from ICSO in the Ministry of Planning [28]. Essentially, the Police Affairs Agency in the Ministry of Interior is responsible for recording all traffic accidents in Iraqi governorates, which are then collected annually by ICSO. The accident data used in this study is from the period 2010–2020 for the fifteen governorates. The accident police report consists of: i) the main information such as date, time, location, and people involved in an accident; ii) road characteristics such as roadway type; iii) driver's information such as age, gender, driver's licence, and wearing seatbelts; iv) vehicle features such as type and license number; v) accident characteristics such as cause, type, and severity of the accident; and vi) fatality and injury numbers. Although Iraqi police reports of traffic accidents contained a considerable amount of information, some of the details of the accident were missing, such as the use of a cell phone and speed limits.

3 Traffic accident data analysis

The analysis study was based on the road accident data in Iraq for the years 2010-2020 with the aid of the data obtained from ICSO reports that include population and registered vehicle number, accident number, fatality, injury, driver age group, accident type, severity of accident, cause of accident, light condition, functional class of highway, wearing of seatbelts, and vehicle type involved in the accident.

3.1 Trends in population and registered vehicles

The primary transportation method in Iraq is by vehicle, used to transport both people and goods, due to the lack of a metro rail network or waterways. The high dependence on vehicle usage

leads to severe urban mobility problems and increases the intensity of traffic accidents for the Iraqi people.

The number of registered vehicles increased from 2002 to 2020 by approximately threefold, according to data obtained from ICSO. The drastic increase of vehicles in Iraq was attributed to the economy's recovery after the removal of the economic restrictions following the war in 2003 [6]. Consequently, one in six Iraqis owned a vehicle in 2020, Fig. 1.

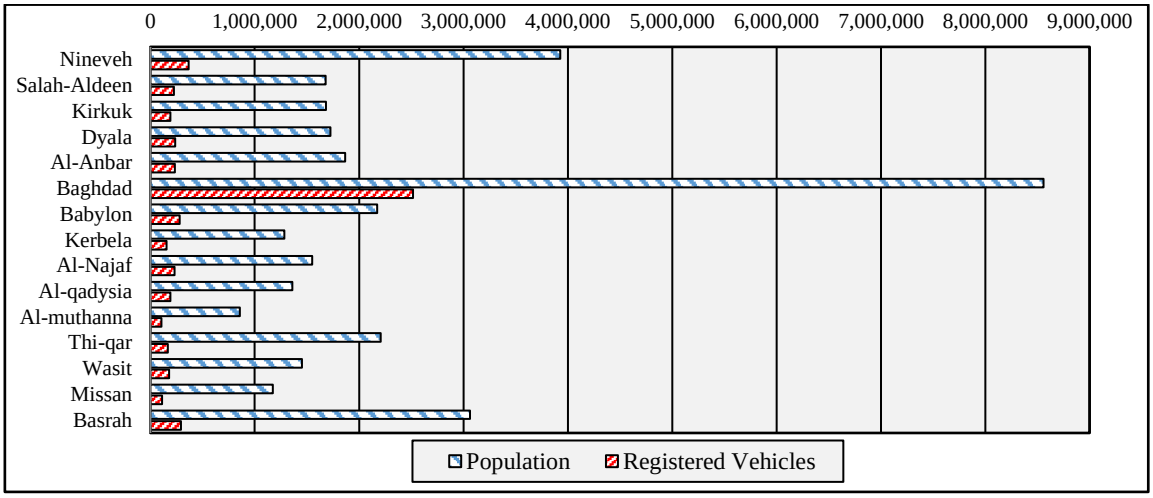

Fig. 1: Registered vehicles and population for Iraqi governorates in 2020.

Baghdad is the largest city in Iraq and also its capital and the second-largest city in the Arab region. It is located in the center of the country and contains vital infrastructure and governmental facilities. It has an estimated population of 8,558,676 and is followed by Nineveh, with a population of 3,928,240 and Basrah with a population of 3,063,071, Fig. 1. Residents of Baghdad own approximately 45.9 percent of all registered vehicles in Iraq.

3.2 Trends in traffic accidents

The order of Iraqi governorates based on the number of accidents is illustrated in Fig. 2. Data analysis highlights that approximately 38 percent of road accidents occurred in three governorates: Baghdad, Basrah and Babylon. Of the three, Baghdad has the highest number of road traffic accidents and the deadliest roads among Iraq's 15 provinces. On average, seven people die in road accidents every day, and there are approximately 25 accidents daily in Iraq.

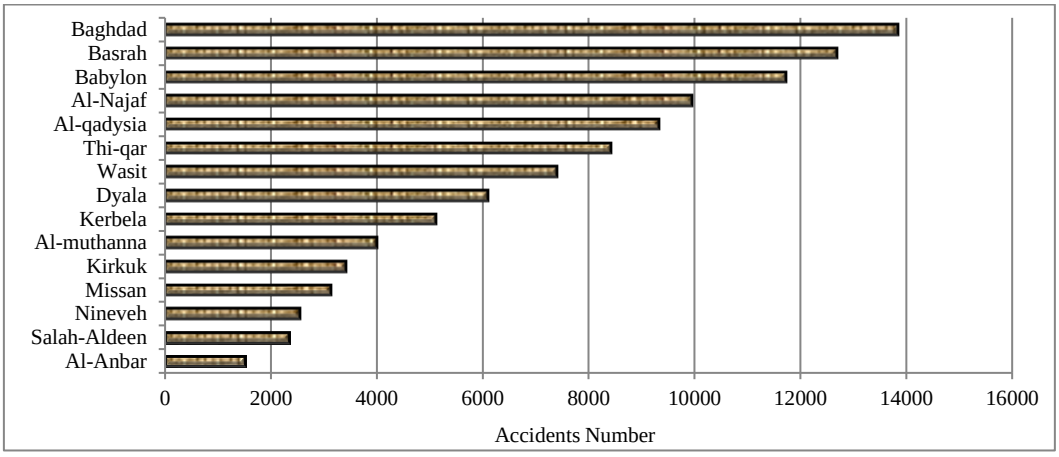

Fig. 2: Accidents distribution.

Assessing the problem of accidents based on the number of accidents and neglecting the effect of population size and number of registered vehicles, as in Fig. 2, is no longer valuable; therefore, for evaluation, the accident rate was calculated with reference to 100,000 population or 10,000 registered vehicles, as follows:

$$\textit{Accidents Rate (AR)} = \frac{Total\ Number\ of\ Accidents\ in\ Specified\ Year}{Total\ Number\ of\ Population\ in\ the\ Same\ Year} * 100{,}000, \quad (1)$$

$$\textit{Accidents Rate (AR)} = \frac{Total\ Number\ of\ Accidents\ in\ Specified\ Year}{Total\ Number\ of\ Regisered\ Vehicles\ in\ the\ Same\ Year} * 10{,}000. \quad (2)$$

For accident data in the year 2020 as an example, considering the population of each governorate via ranking the governorates according to the number of accidents per 100,000 population as calculated by applying Eq. (1), Baghdad ranked 14th in the list of governorates, which was headed by Al-Najaf with an average of 50 accidents per 100,000 population, Fig. 3. Thousands of vehicles from all governorates enter Al-Najaf province every day because most Iraqis visit the holy thresholds and observe the religious ritual; consequently, the chance of traffic accidents occurring has increased.

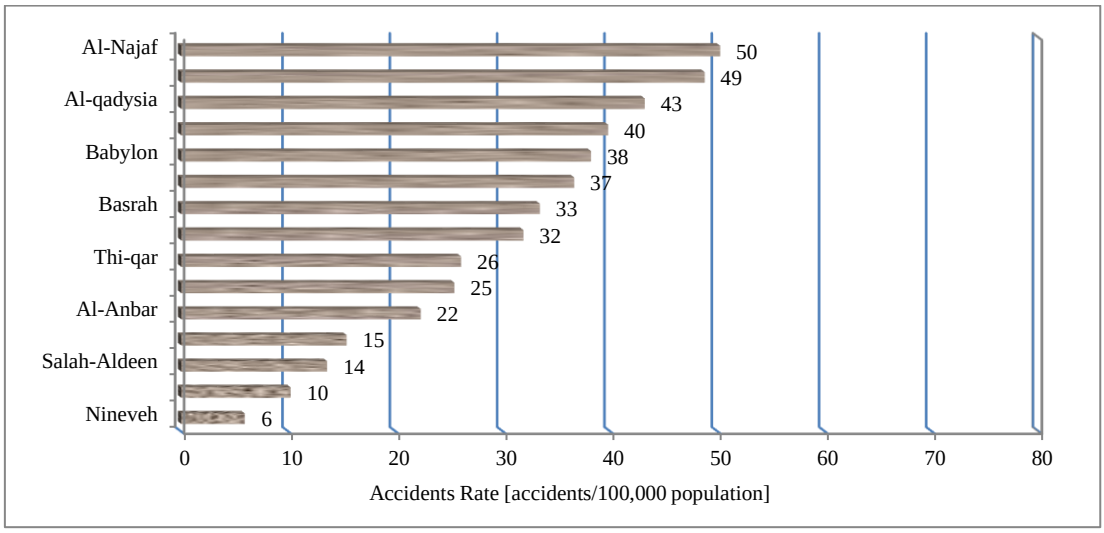

Fig. 3: Accidents rate.

3.3 Trends in fatalities and injuries by road accidents

The main negative effect of road transportation systems is injury and death as a result of traffic accidents. Every day thousands of people are killed and wounded on roads worldwide. Millions of people each year will spend multiple weeks in hospital after severe crashes, and many will never be able to live or work as they used to.

Between 1998 and 2020, the number of fatalities due to road accidents increased by 82 %. During the study period, more than 100,000 traffic accidents occurred in Iraq and about 29,000 people died due to these accidents. As seen in Fig. 4, a person dies in a vehicle traffic accident on Iraqi roads every three hours. Baghdad has a high rate of accidents and fatalities due to its large population and large number of registered vehicles in the city. A total of 13,829 accidents took place in Baghdad and 3,368 people lost their lives during the study period.

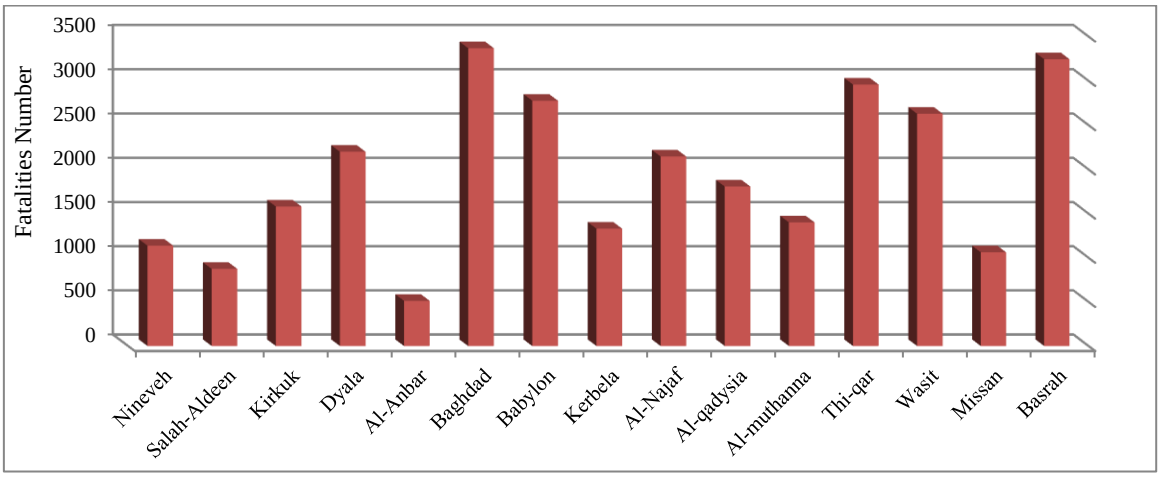

Fig. 4: Fatalities number.

Globally, males are three times more likely to die in traffic accidents than females [1]. In Iraq, the risk of death for a male due to a traffic accident is more than four times higher than that for a female, as seen in Table 1, and 84 % of the injured were males compared to just 16 percent for females.

Table 1: Fatalities and injuries number based on gender.

Governorate	Injuries number		Fatalities number	
	Female	Male	Female	Male
Nineveh	555	2542	249	984
Salah-Aldeen	275	1202	149	762
Kirkuk	553	2016	344	1237
Dyala	1008	6392	387	1813
Al-Anbar	203	1330	68	444
Baghdad	1525	8811	598	2770
Babylon	2059	11270	669	2133
Kerbela	596	4257	320	1010
Al-Najaf	2629	10124	524	1622
Al-qadysia	1616	8392	391	1416
Al-muthanna	1041	4319	313	1088
Thi-qar	1627	8365	622	2336
Wasit	1594	8118	433	2145
Missan	497	2432	278	874
Basrah	1504	10116	707	2597

Counting fatalities and injuries can be useful for conveying the size of the problem of traffic accidents and providing the necessary healthcare resources. Many measures are utilized to evaluate the severity of road accidents in a selected area. Fatality and injury rate are the main regularly employed accident measures in road accident studies. For comparisons between provinces or countries, the use of the fatality and injury rate per 100,000 population more accurately reflects the size of the problem than absolute numbers. For example, using the total number of fatalities alone can be misleading because it leads to comparisons of populations of unequal size. Around the world, Norway recorded the lowest fatality rate in recent decades, with 1.5 casualties per 100,000 population in 2021 [3]. These rates can be found with reference to a 100,000 population, as follows:

$$\textit{Fatality Rate (FR)} = \frac{Total\ Number\ of\ Fatalities\ in\ Specified\ Year}{Total\ Number\ of\ Population\ in\ the\ Same\ Year} * 100{,}000, \quad (3)$$

$$\textit{Injury Rate (IR)} = \frac{Total\ Number\ of\ Injuries\ in\ Specified\ Year}{Total\ Number\ of\ Population\ in\ the\ Same\ Year} * 100{,}000. \quad (4)$$

Fig. 5 compares the accident fatality and injury rates of the Iraqi governorates. According to the statistics report by the WHO [1], the average traffic accident fatality rate worldwide in 2016 was 18.2 deaths per 100,000 population. Based on the data for 2020 in Fig. 5, Baghdad ranks 15th (last) with a 2.7 fatality rate, and Wasit ranks 1st with a fatality rate of 13, which is lower than the global rate of 18.2.

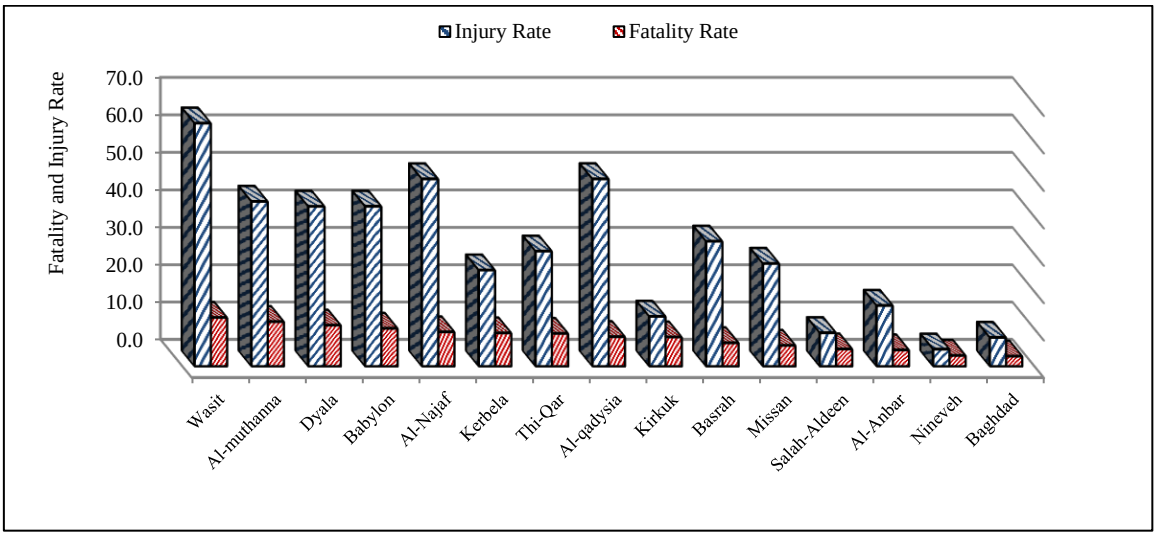

Fig. 5: Fatality and injury rate for Iraqi governorates in 2020.

AL- Kut city, the center of the Wasit governorate, is a linking point between six cities – Amarah, Nasiriyah, Hilla, Diwaniyah, Diyala, and Baghdad – in addition to being a link with the port border of Iran, which leads to increased traffic density. Most of the fatal accidents in Wasit occur on the highways because of the lack of traffic guiding signs, the bad lighting system, driving at high speeds and roads with a length of more than 700 km that require maintenance and rehabilitation.

Wasit heads the list of governorates due to an injury rate of 64.9 injuries per 100,000 population, followed by Al-Najaf and Al-Qadysia with a rate of 50.1, and then Al-Muthanna with a rate of 44.1. In addition, Nineveh records the lowest injury rate of 4.3. Furthermore, Baghdad ranks 14th with a rate of 7.7.

The southern governorates of Wasit, Al-Muthanna, Al-Najaf, Thi-Qar and Al-Qadysia have the highest fatality and injury rates compared with the other governorates. Based on this, the Iraqi government must give priority to minimizing road accidents in the southern governorates by improving road safety, developing the roadway design features, applying traffic laws, and using traffic control devices.

3.4 Age distribution for drivers

Drivers over 16 years old are permitted to have a motorcycle driving license according to Iraqi traffic rules in 2004; the age limit for a heavy vehicle driver is more than 20 years old and more than 18 years old for a passenger car license. In Iraq, those who drive without a license are jailed for one to six months. It can be seen that in Iraq, 67.4 percent of total accidents are caused by drivers aged 35 years and under Table 2. The tendency to cause accidents decreases dramatically with an increase in driver age. Due to speeding, careless overtaking, and recklessness in driving, young drivers are more responsible than other age groups for killing themselves and other people. In contrast, the age group of 60 years and older is the least likely to cause accidents.

Table 2: Drivers' age distribution.

Governorate	Age (Years)									
	Less than 17	18-23	24-29	30-35	36-41	42-47	48-53	34-59	More than 60	Unknown
Nineveh	169	638	890	781	556	325	188	64	10	8
Salah-Aldeen	67	359	560	469	351	206	126	58	4	1
Kirkuk	59	498	689	712	559	335	210	93	75	173
Dyala	269	2235	1926	1719	1178	799	378	191	51	39
Al-Anbar	46	507	567	521	326	136	64	5	7	11
Baghdad	710	3081	3833	3405	2189	1091	535	230	35	17
Babylon	590	2785	3711	3594	2282	1254	690	485	399	189
Kerbela	985	1495	1399	1235	738	1050	316	149	90	4
Al-Najaf	994	2683	3345	3259	2553	1623	963	530	141	18
Al-qadysia	657	2486	3058	2772	1621	866	456	147	88	17
Al-muthanna	309	1137	1233	1329	839	583	381	204	184	66
Thi-qar	446	2073	2554	2745	1901	1278	633	376	327	26
Wasit	523	1734	2280	2779	1701	1015	430	256	79	21
Missan	179	797	841	631	422	340	155	126	98	175
Basrah	1525	2487	2341	1888	1311	962	599	385	177	1021

3.5 Types of traffic accidents

The accident data for all governorates except for Baghdad in Fig. 6 show that the most common type of accident is collision at 49.2 %; run over accidents come in second place at 38.2 percent, whereas the percentages of other types of accidents are relatively low over the study period.

A traffic collision occurs when a vehicle collides with another vehicle (moving or parked), a train, a pedestrian, a motorcycle, an animals or other fixed objects, such as a fence or pole. In 2020, accident data showed that collision accidents occurred between moving vehicles. On the other hand, overturn accidents had a rate of 11.1 %, which is considered low when compared with collision and run over accidents. Finally, "others" represents the 1.6 % of accidents that occurred when the vehicle was on fire or fell into the river.

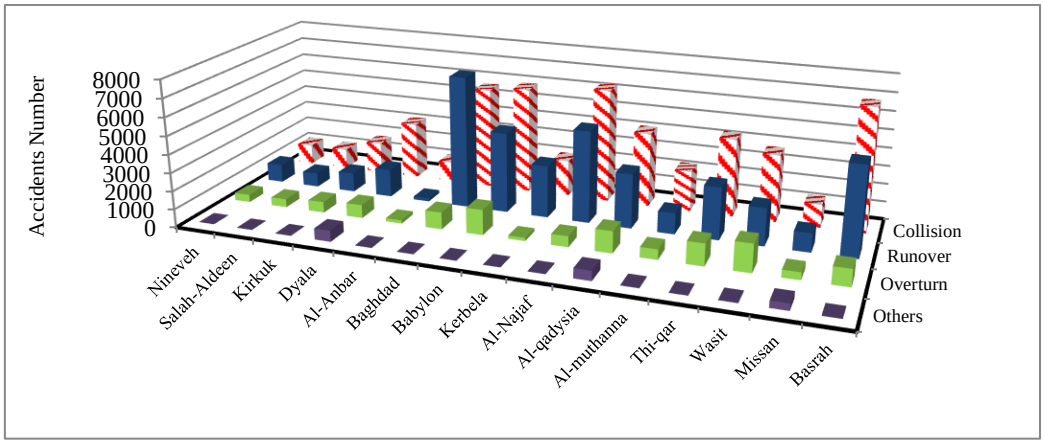

Fig. 6: Accidents type.

3.6 Severity of traffic accidents

Fig. 7 shows the types of accidents based on severity, divided into four groups: "no injury", "minor injury", "fatal injury" and "fatal". Minor injury accidents constitute 59.4 % of the total accidents. Furthermore, for every 10 accidents on Iraqi roads, approximately two are fatal, whereas for every 14 accidents, approximately two are non-fatal. Approximately 57.8 % of fatal accidents occurred in the following five governorates: Baghdad, Babylon, Basrah, Thi-Qar, and Wasit.

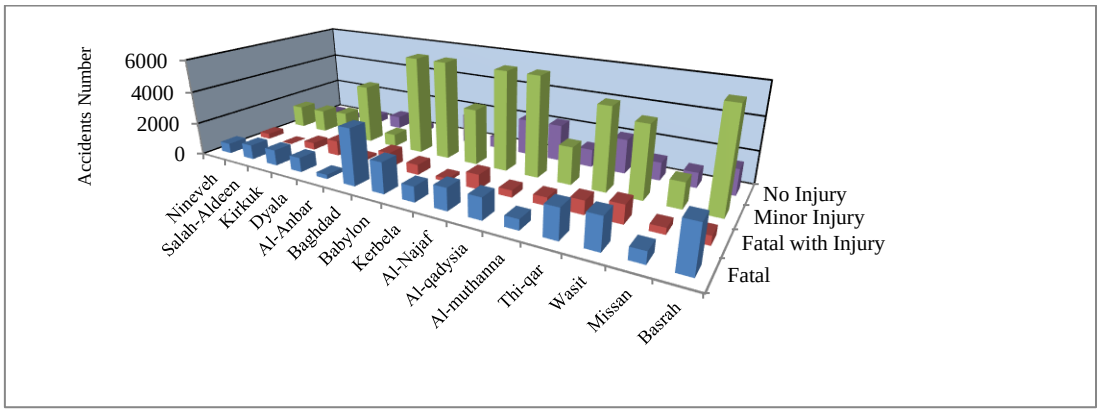

Fig. 7: Accidents severity.

3.7 Causes of traffic accidents

In most cases, accidents were caused by drivers' error, road characteristics, vehicle characteristics, or caused by a combination of two or more of these factors. On the other hand, pedestrian and passenger causes were considered minor factors because many do not abide by driving rules and road regulations, and do not follow the instructions necessary for their own safety.

Drivers' mistakes are normally responsible for most accidents in all governorates, with a percentage rate of 72.6 %, which is followed by vehicle features at 12 %, as shown in Fig. 8.

Driver impairment is an important component of road accidents in Iraq. The major reasons for accidents involving drivers are that many of them do not wear a seat belt, drive without a helmet in the case of motorcycle drivers, are tired and sleepy, engage in reckless driving, overspeed, violate traffic, and safety rules, are under the influence of drugs and alcohol, and frequently use mobile phones while driving. Many drivers can get away with unsafe driving because traffic and safety laws do not strictly apply, so applying the laws is therefore the best solution to reducing the severity of road traffic accidents.

For vehicle features, no doubt well-maintained vehicles with good breaks, lighting, tires, etc. will reduce accidents; in addition, vehicles should be provided with seatbelts and other necessary safety provisions (such as airbags).

Approximately 6.8 % of accidents occur due to road features; over the past few years, the lack of maintenance and rehabilitation has made most roads very dangerous, so the roads should be well maintained with frequent resurfacing of road surfaces and markings of road safety signs.

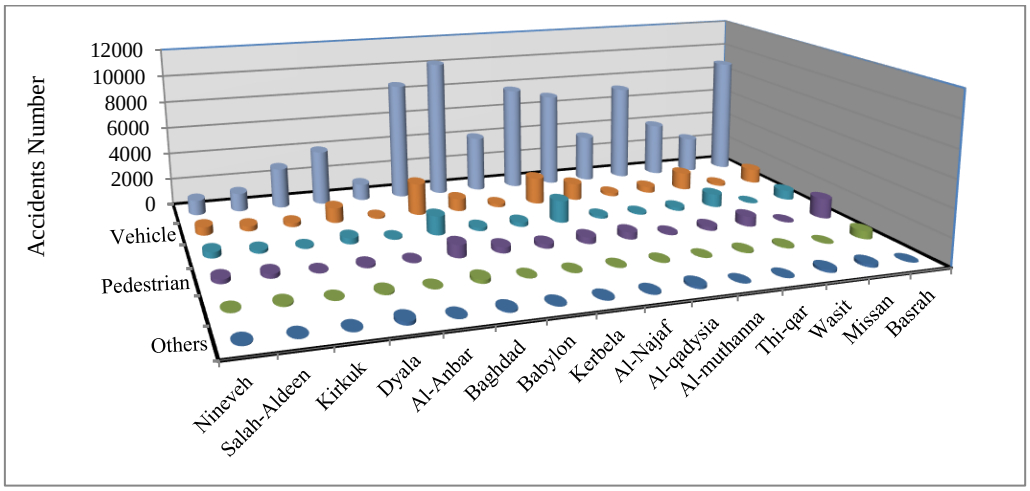

Fig. 8: Accidents causes.

3.8 Light condition analysis of traffic accidents

The numbers of road traffic accidents for four-light conditions were recorded. The light conditions included: day light, dark, sunrise, and sunset. Fig. 9 indicates the distribution of road traffic accidents based on light conditions. The results clearly show that approximately two-thirds of

accidents occurred during the hours of daylight; this may be caused by congestion during daylight, thus leading to more accidents, which are caused by the enforcement of the curfew during the night hours in many of the Iraqi governorates due to the hazardous security situation and lockdown decreed by the Iraqi government to combat the spread of COVID-19 through the study period.

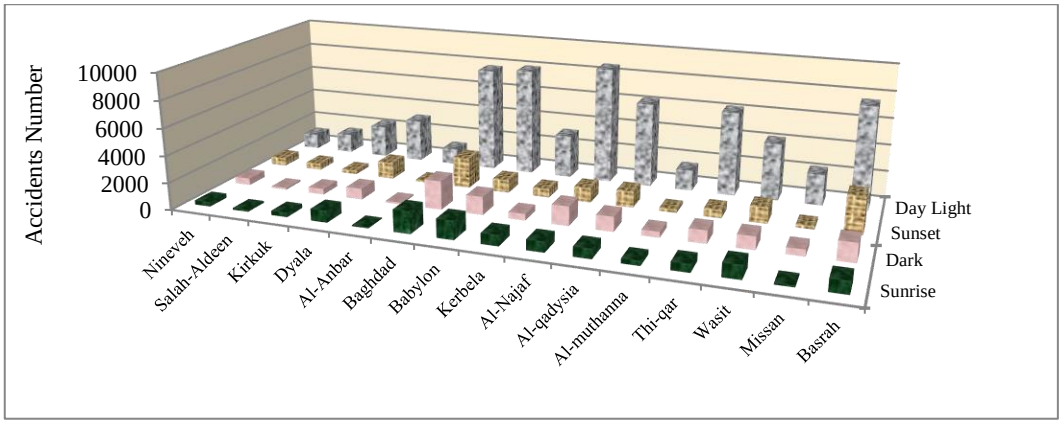

Fig. 9: Road accidents by light condition.

3.9 Traffic accidents based on functional class of road

Eleven years of police reports in Iraq show that approximately half of traffic accidents occurred on arterial roads, a finding this may be explained due to the fact that the arterial network in Iraq exhibits high traffic volumes, especially in urban zones and in the Central Business District (CBD) zones of major cities. Therefore, arterial roads are considered dangerous in all governorates except the Basrah governorate. Approximately 50 % of total accidents in Basrah occur on collector roads, moreover; local roads in Basra are not safe when compared to Baghdad, as shown in Table 3. As a result, the rate of local roads accidents in Basrah was more than six times that of Baghdad. Most of the fatal accidents occurred on highway roads connecting the governorates. Most cases, accidents were caused by drivers' error, road characteristics, vehicle characteristics, or caused by a combination of two or more of these factors. On the other hand, pedestrian and passenger causes were considered minor factors because many do not abide by driving rules and road regulations, and do not follow the instructions necessary for their own safety.

Table 3: Accidents by functional class of road.

Governorate	Road classification			
	Expressway	Arterial	Collector	Local
Nineveh	814	744	453	527
Salah-Aldeen	421	1357	383	172
Kirkuk	1024	1761	414	214
Dyala	863	3763	1108	364
Al-Anbar	176	1076	213	31
Baghdad	4141	6950	2439	299
Babylon	2333	6878	1788	717
Kerbela	1191	2026	1306	581
Al-Najaf	2255	7491	1474	733
Al-qadysia	1139	5754	2076	338
Al-muthanna	558	2180	999	601
Thi-qar	1273	5339	1390	1156
Wasit	2117	3530	1125	1096
Missan	14	1875	1133	390
Basrah	1175	3706	6946	1883

3.10 Effect of wearing seat-belts on traffic accidents

The wearing of seatbelts is considered one of the effective methods of reducing the risk of death and minimizing the severity of traffic accident injuries. According to the WHO report in 2018, fatalities among front-seat vehicle occupants were reduced by up to 50 % and 25 % among rear-seat vehicle occupants. Approximately 105 countries worldwide have applied seatbelt laws for both front and rear occupants [1].

Based on the Iraqi traffic rules enforced in 2004, only drivers and passengers in the front seat of a vehicle must wear a seatbelt. Furthermore, child restraints are very important for saving lives in traffic accidents. Therefore, 84 countries have enforced child restraints laws; these laws depend on the age, height and weight of the child. In addition, children are not permitted to sit in the front-rear seat. Child restraint systems decrease the risk of death in a traffic accident by nearly 60 % [1]. Failure to wear a seatbelt is most common among Iraqi passengers. Approximately 57 % of accidents occurred when drivers and passengers were not wearing seatbelts. Iraqi traffic laws must therefore be adjusted by adding provisions for enforcing the wearing of seatbelts in the front and rear seats of a vehicle and using child restraints to reduce the fatality rate and severity of injuries.

3.11 Effect of vehicle type on traffic accidents

The different types of vehicles have a significant role in the occurrence of traffic accidents. From the distribution of accidents by vehicle type in Table 4, it is evident that more than two-thirds of the accidents are caused by passenger vehicles and approximately 14 % by motorcycles. Moreover, buses, trucks and construction vehicles are responsible for 8 %, 6.8 % and 3.9 % of accidents respectively. The outcome of accidents reflects the traffic composition in Iraq.

The transport system in Iraq is mainly based on passenger vehicles, as they represent approximately 83 % of the traffic composition, followed by buses with 5.2 %, as seen in Table 5. Among all the governorates, the data shows that Baghdad has the highest traffic accident rate due to passenger cars, Table 4. This can be explained based on the data of registered passenger cars, which shows that Baghdad makes up 50 % of the total.

Most of the motorcyclists, particularly in Al-Najaf Governorate, drive at a high speed without wearing a safety helmet; in most cases, this behavior leads to dangerous accidents and even death, although motorcycles constitute approximately 3 % of registered vehicles. Globally, approximately one-quarter of road accident fatalities occur among motorcyclists; the WHO report concludes that wearing the helmet correctly can minimize the risk of fatal injuries by approximately 42 % and the severity of head injuries by 69 % [1]. In addition, segregated bicycle lanes alongside urban roads would reduce deaths among cyclists.

Table 4: Accidents by vehicle type.

Governorate	Vehicle type				
	Passenger car	Bus	Truck	Motorcycle	Construction vehicle
Nineveh	235129	4864	21968	6914	20853
Salah-Aldeen	136648	3066	8148	2193	10278
Kirkuk	161162	3167	4786	433	13526
Dyala	185458	12894	12972	8216	14449
Al-Anbar	141133	5436	18443	1540	16849
Baghdad	2155181	146113	58300	28149	58816
Babylon	221642	21237	6146	12664	20706
Kerbela	121220	14346	5332	9347	8149
Al-Najaf	153245	9281	11937	17955	9692
Al-qadysia	147167	7407	5035	12285	17281
Al-muthanna	82981	3745	6524	7933	5796
Thi-qar	131653	4872	6139	6194	15915
Wasit	124336	7774	6905	20120	20501
Missan	89707	3625	2458	2846	9430
Basrah	216064	23848	20782	12559	23749

Table 5: Registered vehicle distribution.

Governorate	Vehicle type				
	Passenger car	Bus	Truck	Motorcycle	Construction vehicle
Nineveh	235129	4864	21968	6914	20853
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4 Impact of imposing covid-19 pandemic lockdown on traffic accidents

In the wake of the spread of COVID-19, on 27 February 2020 in Iraq, the Iraqi Government decreed a partial lockdown to combat the spread of COVID-19 and curfews on weekends that apply to everyone in all provinces. Due to lockdown, a sharp drop in vehicular mobility was observed. However, in a case of an emergency, the government authorized a special pass-permit for people to use private vehicles. Only vehicles required for essential services, i.e. police, fire service, ambulances, and food deliveries were allowed on the road without a need for a permit.

Prior to the COVID-19 pandemic, traffic accidents are a major cause of death. The lockdown decreased traffic volume and the accident rate significantly because people were driving a lot less. Before the partial lockdown, during two months (January and February), it was observed from police data that the number of accidents was higher, see Fig. 10.

The analysis of accidents data during the lockdown period (March - December 2020) found that the stay-at-home order led to fell in accidents by 28.5 % in relation to the equivalent period in 2019, Fig. 10. In total, there were 6,584 traffic accidents recorded by the traffic police in 306 days of the partial lockdown from all provinces of Iraq, an average of 21.52 accidents/day, which is lower than the 30.1 accidents/day average of the same period in 2019. In addition, Traffic accident fatalities and injuries were lower compared to pre-pandemic rates: there was a 28 % reduction in the number of injuries and an 18.4 % reduction in fatalities.

Obviously, the number of accidents for December, as seen in Fig. 10, is increased by a rate of 10.7 % compared to the data in 2019 because of some easing of the lockdown restrictions in Iraq as decreed by the government, like reopening schools, universities, malls, and restaurants, and taking some of the precautionary measures to face the spread of COVID-19. Consequently, traffic mobility has increased, and that has caused a rise in the rate and severity of traffic accidents.

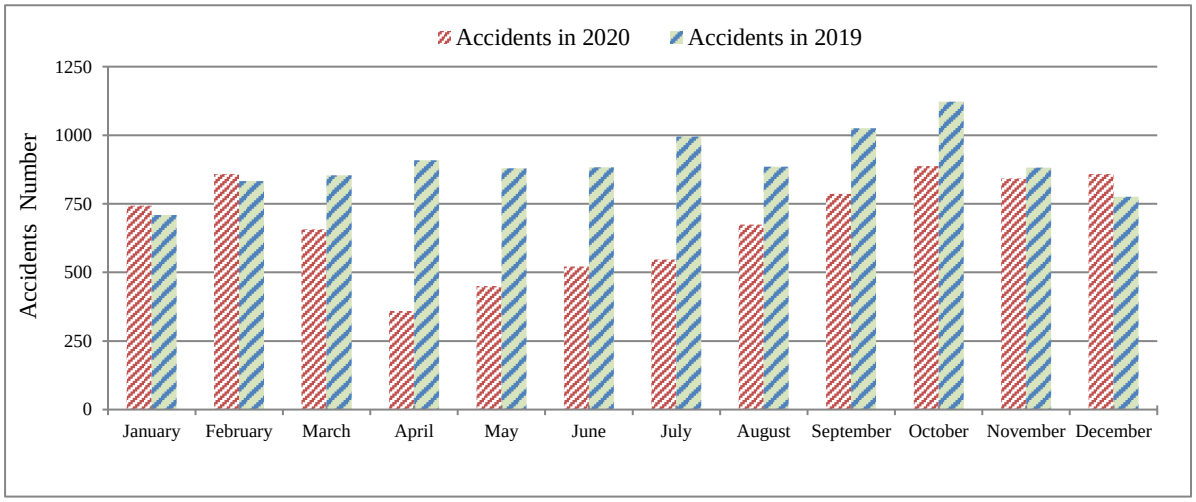

Fig. 10: Monthly variation in accidents for years 2019 and 2020.

5 Conclusions

Based on the above analysis of traffic accidents in Iraq, the following conclusions can be drawn:

1) Al-Najaf province recorded the highest rates of traffic accidents compared with other Iraqi governorates. This is because most Iraqi people visit the holy thresholds and observe religious rituals there; as a result, thousands of vehicles from all governorates enter Al-Najaf province every day, and the chance of traffic accidents increases accordingly.

2) During the COVID-19 lockdown period, there was a year-over-year reduction in fatalities from 2636 in 2019 to 2152 in 2020. That's technically an 18.4 percent decrease in overall traffic accident deaths. This reduction was as expected during the strict restrictions on mobility imposed throughout the lockdown period.

3) The general directorate of traffic in the Ministry of Interior should set out plans and goals to control the deterioration in traffic accidents and decrease road deaths because Iraq has no known road safety target. The goals include developing road safety strategies, implementing good practices, improving the quality of data collection, strengthening road safety management, increasing funding to support road safety, and adjusting traffic instructions.

4) Road safety strategy in Iraq is not supported. The Supreme Council Road Safety at the Ministry of Interior should be funded in the national budget to evaluate, monitor, coordinate, and legislate road safety strategies in addition to implementing a Safe Systems approach.

5) Iraqi people can play an essential role in achieving road safety and decreasing deaths and injuries on the roads by adhering to traffic instructions and creating a culture of safety through the collaboration of all members of society.

6) The road infrastructure in Iraq is in dire condition because of corruption, civil war, and decades of sanctions. The key to saving Iraqi people's lives from traffic accidents and promoting economic growth is the development of infrastructure, expanding the network of roads, and supporting the public transportation system in the country.

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