ABSTRACT

Incessant of transportation demand growth in developing countries in latest years has led to several traffic issues in city areas, among the most challenging ones are vehicular emission, traffic congestion, and accidents. The growth of transportation demand has great influences, and very unfortunate impact on the society regarding crashes, death, and injuries from road accidents have reached epidemic proportions worldwide. The variation increased in speeds and vehicle density resulted in high exposure to accidents which lead loss of life and permanent disability, injury, and damage to property. This paper classified and investigate the most critical factors affect road traffic accidents (RTAs) in Tripoli the capital city of Libya. Four main categories were chosen to build the questionnaire, namely; human factors, road factors, vehicle factors and environmental factors. Moreover, a quantitative method was used to collect the data from the field, 400 respondents include; drivers, pedestrian and passengers were the sample size of the questionnaire and relative importance index (RII) were used for classification of one group and among all groups. The results show that more than 84%of respondents considered the over speeding as the most significant factor causes of RTAs among all groups, while 81% considered the disobedience to driving code such as children who are playing on the road as the most influential factor in human factors group. Also, nearly 74% of respondents seeing that poor brakes or brake failure factor has a high and considerable impact on the RTAs among the vehicle factors. Regarding the road factors group, 79% of the respondents ranked poor or no street lighting factor as one of the most effective factors on RTAs in road factors and third effecting factor concerning all factors, on the other hand, the environmental factors have the slights impacts compared with other factors. On another hand, unfortunately, the Libyan accidents data collection missing much information in recent years, so this study developed a new system for gathering all information on the site of accidents known as Libyan traffic accidents report system (LRTARS).

Keywords: Road traffic accidents; Libya; accident factors; relative importance index (RII); and Libyan Road Traffic Accidents Report System

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Son yıllarda gelişmekte olan ülkelerde ulaştırma talebinin artması, kentlerde birçok trafik sorununa yol açmıştır, bunların arasında araç emisyonu, trafik sıkışıklığı ve kazalar en zorlayıcıdır. Ulaşım talebi büyümesiyle, çarpışma, ölüm ve yaralanma gibi yol kazalarının dünya çapında yaygın olarak toplumlar üzerinde olumsuz etkileri vardır. Hız ve araç yoğunluğundaki artış, yaşam kaybı, kalıcı sakatlık, yaralanma ve maddi hasarla sonuçlanan kazalara maruziyetle sonuçlanmaktadır. Bu çalışmada, Libya'nın başkenti Trablus'ta trafik kazalarını etkileyen en kritik faktörler sınıflandırılmış ve araştırılmıştır. İnsan faktörleri, yol faktörleri, araç faktörleri ve çevresel faktörler anket oluşturmak için dört ana kategori olarak seçilmiştir. Ayrıca, alandan veri toplamak için nicel bir yöntem kullanılmıştır. Sürücüler, yaya ve yolcular içeren 400 kişilik anket, bir grup ve tüm gruplar arasında sınıflandırmada göreli önem indeksi (RII) kullanılmıştır. Sonuçlarda, ankete katılanların %84 ünden fazlasının, trafik kazalarında aşırı hızın en önemli factor olduğunu düşünürken, %81 i sürüş kurallarına itaatsizlik olarak değerlendirmiştir. Örneğin, yolda oynayan çocuklar insan faktörleri grubunda en etkili faktör olarak görülmüştür.Ayrıca, katılımcıların yaklaşık %74ü zayıf frenler veya fren arızası faktörünün trafik kazaları üzerinde yüksek ve önemli etkiye sahip olduğunu görmektedir.Yol faktörleri grubunda, ankete katılanların %79u, trafik kazaları üzerinde en etkili faktörlerden biri olarak sokak aydınlatma faktörünün zayıf veya olamamasını, tüm faktörlere ilişkin üçüncü etki faktörü ise, diğer faktörlerle karşılaştırıldığında, çevresel faktörlerinden olan etkilerdir. Libya'da son yıllarda kaza verilerini toplamada eksiklikler vardır, bu çalışma ile Libya trafik kazaları rapor sistemi olarak bilinen sitede kazalar hakkında tüm bilgileri toplamak için yeni bir system geliştirilmiştir.

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FARIS A. A. ELTURKI

INVESTIGATION OF FACTORS AFFECTING ROAD TRAFFIC ACCIDENTS IN TRIPOLI-LIBYA

NEU

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Approval of Director of Graduate School of
Applied Sciences

Prof. Dr. Nadire ÇAVUŞ
Director

We certify that this thesis is satisfactory for the award of the degree of Master of Science in Civil Engineering

Examining Committee in Charge:

Prof. Dr. Hüseyin GÖKÇEKUŞ	Department of Civil Engineering, Near East University
Assist. Prof. Dr. Salem Mokhtar TARHUNİ	Department of Architecture, Near East University
Dr. Shaban Ismael ALBRKA	Supervisor, Department of Civil Engineering, Near East University

I hereby declare that all information in this document has been obtained and presented by academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I had fully cited and referenced all material and results that are not original to this work.

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Date:

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Last but not the least; I would like to thank my colleagues, brothers and sisters for supporting me physically and spiritually throughout my life.

To my parents

ABSTRACT

Incessant of transportation demand growth in developing countries in latest years has led to several traffic issues in city areas, among the most challenging ones are vehicular emission, traffic congestion, and accidents. The growth of transportation demand has great influences, and very unfortunate impact on the society regarding crashes, death, and injuries from road accidents have reached epidemic proportions worldwide. The variation increased in speeds and vehicle density resulted in high exposure to accidents which lead loss of life and permanent disability, injury, and damage to property. This paper classified and investigate the most critical factors affect road traffic accidents (RTAs) in Tripoli the capital city of Libya. Four main categories were chosen to build the questionnaire, namely; human factors, road factors, vehicle factors and environmental factors. Moreover, a quantitative method was used to collect the data from the field, 400 respondents include; drivers, pedestrian and passengers were the sample size of the questionnaire and relative importance index (RII) were used for classification of one group and among all groups. The results show that more than 84%of respondents considered the over speeding as the most significant factor causes of RTAs among all groups, while 81% considered the disobedience to driving code such as children who are playing on the road as the most influential factor in human factors group. Also, nearly 74% of respondents seeing that poor brakes or brake failure factor has a high and considerable impact on the RTAs among the vehicle factors. Regarding the road factors group, 79% of the respondents ranked poor or no street lighting factor as one of the most effective factors on RTAs in road factors and third effecting factor concerning all factors, on the other hand, the environmental factors have the slights impacts compared with other factors. On another hand, unfortunately, the Libyan accidents data collection missing much information in recent years, so this study developed a new system for gathering all information on the site of accidents known as Libyan traffic accidents report system (LRTARS).

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LIST OF ABBREVIATIONS

RTAs	Road Traffic Accidents
WHO	World Health Organization
EMRO	Eastern Mediterranean Regional Office
GNP	Gross national product
INSEE	National Institute for Statistics and Economic Studies
NJDOT	New Jersey Department of Transportation
RTIs	Road Traffic Injuries
ABS	Anti-skid Braking System
SPSS	Statistical Package for the Social Sciences
RII	Relative Importance Index
LTARS	Libyan Traffic Accidents Report System

LIST OF SYMBOLS

M	Mean
SD	standard deviations
n	sample size from a finite population
N	Overall population
V	Sample Population Standard error
S^2	Population Elements Standard Error Variance
X	The relative value of the answering respondent
W	Weight/ rank of each answer
$W_{highest}$	The highest rank/weight

CHAPTER 1

INTRODUCTION

1.1 Background

Road traffic accidents (RTAs) considers as one of the main problems in the world. The RTAs were classified as the 11th cause of death worldwide where about 1.25 million people die each year as a result of road traffic crashes, according to the World Health Organization's (WHO) Global status report on road safety 2015, despite improvements in road safety. With more than 300.000 deaths a year, road traffic injuries remain the number one cause of death among people aged 15-29 years(Violence, Prevention, & WHO, 2015). Consequently, the physical disability for drivers, passengers and pedestrians in developing countries were caused as a result of RTAs (Zimmerman et al., 2012). However, in non-developing countries where the road networks are in an inferior condition such as Libya, the number of vehicles have dramatically increased with these critical road networks. Increased urbanisation and increase in the number of cars has resulted in a traffic jam in urban centres and consequently to road traffic accidents. The significance of traffic safety measures originates from the increasing number of vehicles as well as growth in urbanisation resulting in increased road traffic accidents. A prediction of 1.9 million deaths as a result of road traffic crashes annually by 2020 may occur if no actions are taken. Only about 28 countries, with 416 million people (7% of world's population) boast adequate laws that cover the risk factors (Drink-driving, seatbelts, speed, child restraints, and helmets) (Violence et al., 2015). A securer highway system may bring about decrease or eradication of accident causing factors (Ismeik, Jrew, & Abbas, 2010). According to (Makinde & Opeyemi, 2012), the increase in road traffic accidents cost the nation its treasured human resources. It was observed that economic and social trauma resulted from these road traffic accidents. Road accidents can be limited by mainly enforcing traffic laws and enlightening drivers on defensive driving skills.

The study will be conducted in Libya, Libya is located in North Africa, and it is categorised under the Eastern Mediterranean Regional Office (EMRO). The area of the country is about 1,750,000 kilometres square and is covered by the desert. Almost 80% of the population resides within the narrow 1200 mile coastline bordering the Mediterranean Sea. The population of the state of Libya is 6.1 million. It is a middle-income nation (per capita 9010$) boasting registered vehicles more than 1.8 million. The city of Tripoli is the most critical area in the country regarding social and economic activities as it's the capital of the country. The population of Tripoli is approximately 1.2 million (WHO, 2009). The case study of this research is Tripoli (the capital of Libya) because a maintained city ranked as a higher percentage of traffic accident if we compared it with the other cities in Libya such as Benghazi, Misrata or Sabha. Moreover, there are a lot of reasons for this high rate of accidents such as the inferior condition of road infrastructure, over speeding (due to no Road speed control devices), reckless drivers, break red light, no traffic campaigns and Lack of traffic awareness among the drivers. The affected people who face these road traffic accidents such as drivers, passengers and pedestrians can be prevented, and changing the habits of the drivers can reduce its effects, as well as roadway geometry condition, vehicle design, and travelling environment.

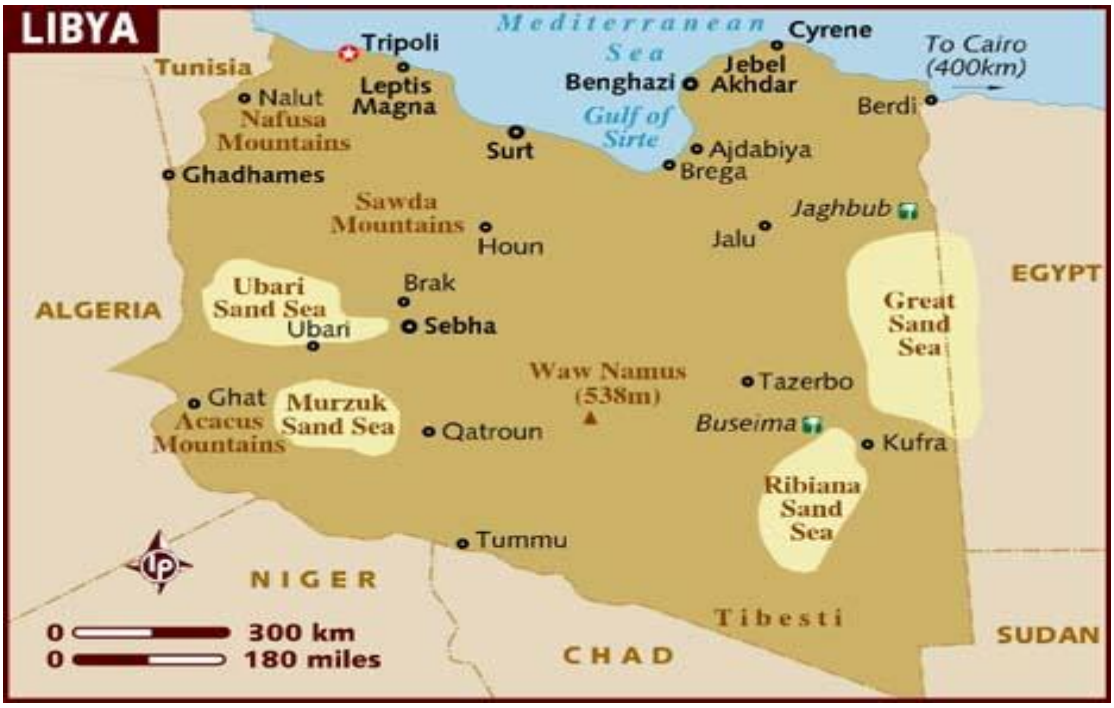

Figure 1.1: Map of Libya (WHO, 2009)

1.2 Problem Statement

The phenomenon of existence and increasing the RTAs leads to several problems in Libya especially in Tripoli city in last six years. Thus, several losses in human lives, properties or even physical disabilities from savage injuries, which leads to increase in the burden on the Libyan state in all aspects, particularly in financial cost. Therefore, the investigation of the factors that cause such accidents in Libya and conduct a study on RTAs in Tripoli city to address all these issues and made that needs to take additional action to decrease the problems and to make roads safer for all users.

1.3 Aim and Objective of the Study

The main aim of this research is to investigate the factors influencing the road accidents in Tripoli city. The investigation of these factors can lead to reducing the road traffic accidents (RTAs), which has become the most recent cause of death and injuries in Tripoli. To achieve this aim, the following objectives were followed:

- To review the major causes of road traffic accidents in Tripoli critically.
- To identify the factors affecting RTAs, and ranked them according to their importance and impact on RTAs.
- To design traffic department application, which helping to collect the data of accidents more easily.
- To inform stakeholders in the traffic departments about the importance of road traffic safety to reduce road traffic casualties.

1.4 The scope of the Study

This study will be limited to evaluate the road traffic accidents in the capital of Libya "Tripoli" only and to design a traffic accidents application system to provide efficiency

process in the site to report the information needed the central office and better arrange if the data was requested.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

The increasing number of private vehicles used in the city area has caused problems, such as traffic congestion, environmental pollution, and traffic accidents. Previous studies have shown some factors affecting accidents in Tripoli, such as the increase in the number of private vehicles due to poor public transport in Tripoli (Ahmed, 2013; Hammoudi, 2014; Ismail & Yahia, 2011).

Over 90% of victims of these accidents are in low-and-middle-income countries (approximately one million people). This difference continues when accounting for population distribution; the traffic casualty rate in countries of low-income was 17.4 per 100,000 people, and now they have highest annual road traffic fatality rates, at 24.1 per 100,000, while the rate in high-income countries was 12.6 and decreased to 9.2 per 100,000. Furthermore, over half of the victims are exposed road users, including pedestrians, bicyclists and other unprotected travellers (WHO, 2015). Libya as a developing country is faced with the issue of excessive road crash rate. Figure 2.1 shows Traffic fatality for many countries.

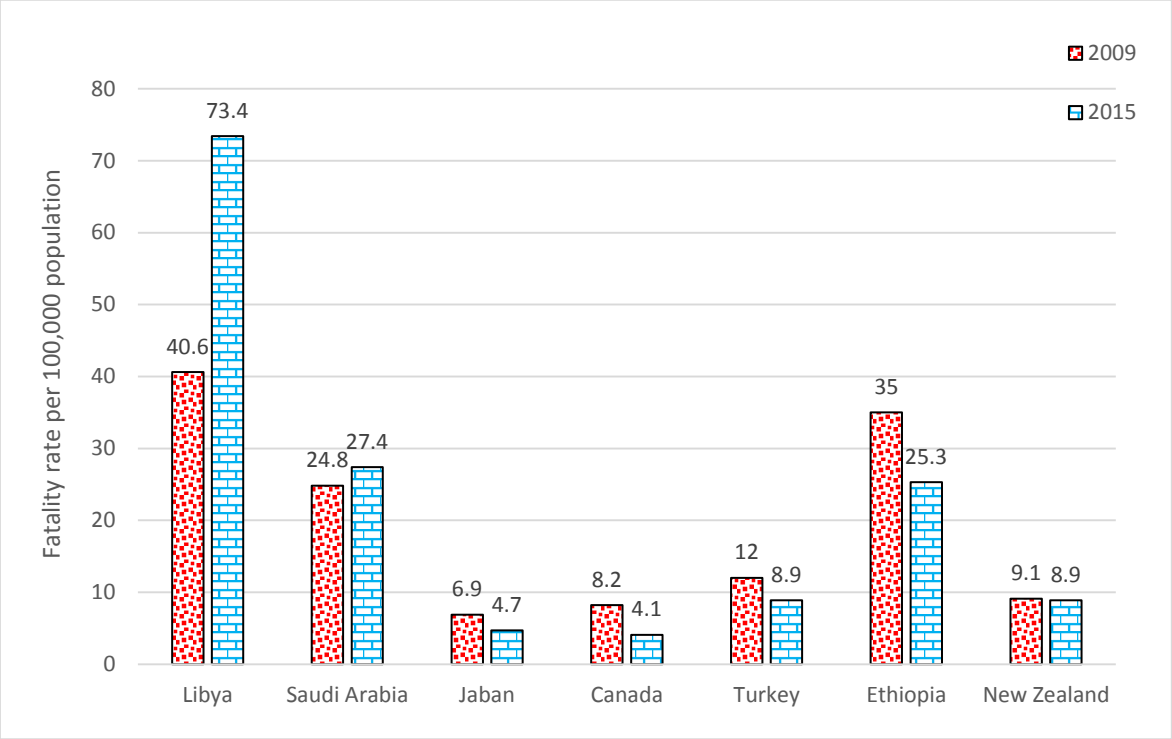

Figure 2.1: Traffic fatality for selected countries, (WHO, 2009 & 2015)

Road traffic accidents (RTAs) remain a worldwide public health issue. Presently placed ninth, RTAs are projected to become the fifth leading cause of death in 2030. Each year, over a million people perish worldwide as a consequence of RTAs, over 2500 casualties daily. Low and middle-income countries account for 90% of fatalities linked to RTA (WHO, 2015).

By 2030, road accidents are expected to become the fifth leading cause of accidents around the world (WHO, 2009). In addition, in high-income countries, traffic accidents are expected to reach 2% of the Gross national product (GNP), while in middle-income and low-income countries it will reach 1.5% and 1% respectively (Sabbour & Ibrahim, 2010). Therefore, countries should take more actions for decreasing the problems and to make roads safer for all users.

Overall registered vehicles recorded in the year 1995 were 109,750, and that number increased to 2,424,385 as the population increased by 67% in the year 2010. Around 10% of mortality rate in Libya is brought about by road crashes, which much higher in comparison with advanced countries such as European countries and the US. Libya noted 22.3 fatalities

per 10,000 registered vehicles. Other Arab nations like Saudi Arabia and Qatar recorded 14.8 and 7.8 deaths, respectively per 10,000 registered vehicles (Bener et al., 2010).

Koushki, Ali, & Al-Saleh (1998) examined the connection between the use of seat belt and road traffic law infringements in Kuwait because of poor driver behaviour and weak traffic law enforcement, which is also the significant roots of the dangerous driving environment.

Also, Shinar, Schechtman, & Compton (2001) applied to survey data obtained from Prevention Magazine in a study made on the correlation four demographic attributes (age, gender, education, and income), limit compliance, drunk driving and seat belt use. The results indicated characteristics are very detached from one another, and, inverse to some stereotypes, the three driving characteristics cannot be violated by a single high-risk category. The single constant effect was gender; women possessed higher observance rates of all three characteristics. With both men and women, the use of seat belts rises with education and age.

Similarly, Vlahogianni (2013) deduced that gender is an essential influence on the duration of overtaking in two-lane highways. Female drivers were noted to take the shorter period to return to their first lane than male drivers. Alexander et al. (2002) discovered older drivers of both genders to make more massive gaps than younger drivers. Yan, Radwan, & Guo (2007) also revealed that elderly road users take more massive gaps as they drive slowly, turn more slowly and maintain longer car following distances.

In a study that has been in Tripoli-Libya, age and gender difference in traffic law knowledge and behaviour of road users in Libya were investigated. The results indicated a distinction in (younger) males from females in the understanding of traffic laws. Males (18-25 years of age) are more likely to break traffic regulations than females in Tripoli- Libya. Road traffic crashes cannot be eliminated entirely. However, some casualties can be kept to the minimum or removed by simple protective measures like driver behaviour, car conditions, road conditions, use of seatbelts and speed control(Yahia, Ismail, Albrka, Almselati, & Ladin, 2014).

There are several factors which increase RTAs and traffic casualties, and these factors can be classified into the following three categories: human error, unsafe vehicles and the

infrastructure of roads (Chen, 2010; Cornelissen, Salmon, McClure, & Stanton, 2013; de Oña, Mujalli, & Calvo, 2011). Every country must, therefore, focus on reducing accidents and developing good data recording systems. The causes of accidents must also be identified and analysed, and it is vital to find appropriate countermeasures (Hammoudi, 2014).

2.2 Definitions Related to Road Accident

2.2.1 Accidents types

According to (John Nellthorp, Bristow, & Mackie, 2005) the United Nations Cost-Benefit Analysis of Transport Infrastructure Projects (2003) states kinds of accidents as following:

i. A fatal/deadly crash is one in which there is minimum one fatality.
ii. A serious crash is one in which there is minimum one serious injury without deaths.
iii. A minor crash is one in which there is minimum one injury but without serious injuries and no deaths.

2.2.2 Road accidents

Casualty severities: Fatality-death inside 30 days originating from the crash, while Serious injuries are the injuries that need hospital treatment and lasting injuries, but do not cause death within the recording period for a death. Slight injuries are injuries that do not require hospital treatment, or if necessary, the effects of the injuries soon diminish (J Nellthorp, Mackie, & Bristow, 2003).

Also, The National Institute for Statistics and Economic Studies (INSEE) in 2013 has defined a road crash as any crash consisting a minimum of a single road vehicle, taking place on the road open to public circulation, and in which a minimum one person is injured or demised. Natural disasters, suicide, and murders are not included.

2.2.3 Road Traffic Accidents types

RTAs were classified into the following classes according to the New Jersey Department of Transportation (NJDOT).

1. Head-on: Two vehicles are coming from opposite routes crash in a frontal or angular style resulting from one vehicle crossing the median or centreline. It also comprises of overtaking.
2. Collision with animals: This collision has to happen on the road.
3. Collision with pedestrian: A vehicle hits a person on the road.
4. Red-light: Two automobiles crash with each other as a result of one of them ignoring the red light.
5. Rear-end: Two automobiles one behind the other crash irrespective of movement of either car.
6. Turning: Two or more automobiles crash in a condition in which no less than one of the automobiles was turning into a driveway or road, or is crossing a road.
7. Sideswipe same direction: Two automobiles going side by side each other and crash. This kind would consist a collision as a result of one of the cars making an improper turn, for example, a right from left lane or vice-versa, or making a left turn from the shoulder coming onto the lane and colliding an automobile going on this lane.

2.2.4 Pedestrian

An individual involved in a crash that was not at that moment riding in/on any electrically or mechanically powered device.

2.2.5 Passenger

An individual aside from the driver travelling in the vehicle.

2.2.6 Accident

It is a catastrophic event that takes place suddenly and unintentionally (Oxford university press, 2001).

2.2.7 Run-off-road

A vehicle crosses a painted or unpainted centre or edge line or otherwise departs from the travelled way. This type may occur on all road element locations and includes collisions with the crash barrier.

2.2.8 Black spot

It is a technical term in engineering that signifies the segment of a road network where traffic crashes regularly occur.

2.2.9 Occupant

An individual that is operating or about to operate or an individual that is being transported in an automobile meant to carry people or goods from a place to another.

2.2.10 Speed cameras

It is placed at fixed locations or held by police officers to take pictures of automobiles that exceed the speed limit. They are a method of speed limit enforcement.

2.3 Case Study City

Transport is essential for the economic and social development of all Libyan cities (Hokoma & Bindra, 2010). Poor public transport system services and lack of access to safe and effective transport, constrain development in many cities especially for those situated on the shore of the Mediterranean Sea with high population density such as Tripoli. Population growth exacerbates This problem, increased private vehicles‟ ownership and urbanisation. All these are causes of many traffic issues like traffic congestion, accidents, air pollution and noise. Abuhamoud & Rahmat, (2010), in their study, show that a fast rise in private automobile ownership has brought about the increase in traffic congestion, accidents, lack of parking space, noise and air pollution, among other problems. By 1985, there were 313,000 vehicles and trucks in the country, as well as about seventy thousands of public and private buses of different types. At the end of 2008, the number of vehicles had increased approximately to 2,052,679 vehicles. Figure 2.2 shows the growth of private cars and privately-owned transports namely taxi, microbuses and coaches during registration years since 1998 – 31st October 2009.

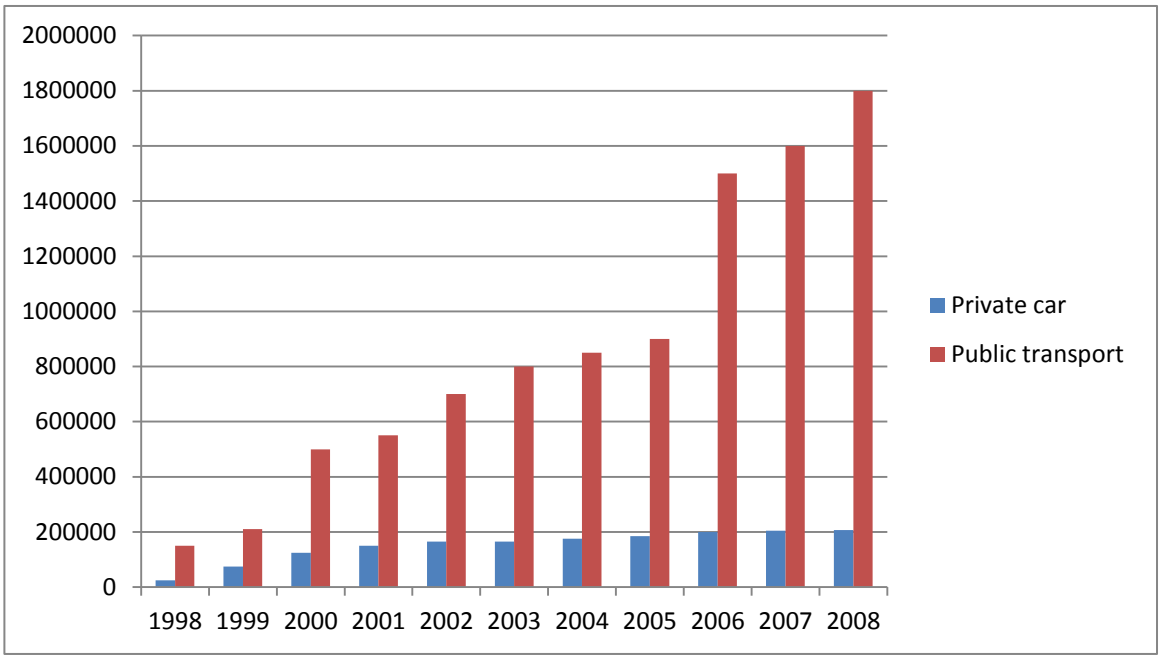

Figure 2.2: Growth public transport and private cars in Tripoli from 1998 to 2008 (Abuhamoud & Rahmat, 2010)

Previous studies on this topic have concentrated mainly on private car safety problems rather than recognising issues influencing vehicle use and mode choice habits of cars users. They come up with an answer to these issues, where the concentration is on offering personal transport users road transport substitutes as a countermeasure aimed at moving car users to other means to reduce travel duration, air, and noise pollution and to improve road safety. In estimated 2375 people died and 14025 were injured in road traffic crashes RTAs in Libya in 2010. The numbers of deaths from road traffic injuries RTIs every day in the increase and It's highest in Arab country compared to the number of residents not to exceed 6.5 million (Ismail & Yahia, 2011). The analysis and recording of RTAs throughout Libya in general and in the most crowded regions in particular in Tripoli city have not received enough attention from the concerned authorities until only the last few years. The Traffic Statistics at the Ministry of Public Safety and Traffic Management as the show in Figure 2.3, which showed a rise in numbers of deaths, especially in recent years.

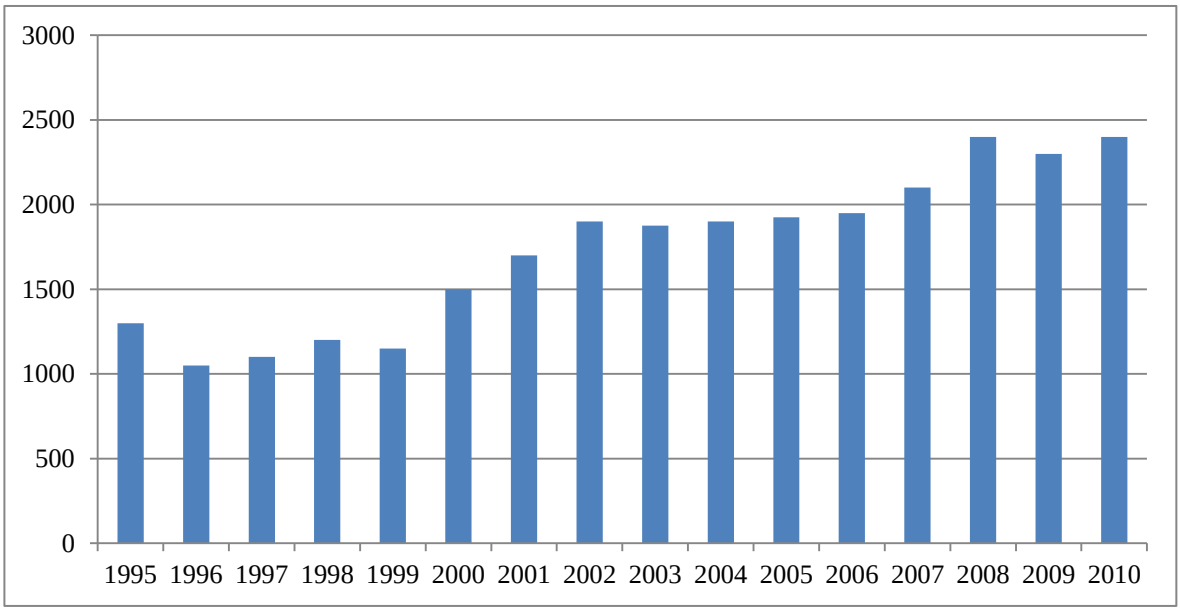

Figure 2.3: Deaths of road traffic accidents 1995-2010 (Ismail & Yahia2011)

During investigating experts have observed a mismatch in the growths in the number of vehicles versus the potential of present roads (Ismail & Yahia 2011). Therefore, some suitable verities to quicker, safer and cost-effective ways to keep up the pace with this ongoing growth must be widely studied. Also, a solution to avoid the current and potential risks due to traffic congestion, accidents and which eventually lead to casualties of human and material damages has to be implemented.

2.4 Road Accidents Factors

Traffic safety and crash investigations have been in the study area through the last two decades expansively as the increase in crashes have been alarming all over the world. From studies done by researchers, it can be concluded that traffic crashes result from four main reasons:

- Human behaviour and personal factors.
- Road factors.
- Vehicle factors.
- Environmental factors.

Rumar (1999), stated that 57% of accidents resulted exclusively from driver factors and 27% from combine driver and road reasons. İn addition, 6% from combine driver and vehicle reasons, while 3% exclusively from road reasons, 3% from combine driver, vehicle and road causes, 2% exclusively from vehicle reasons after he used American and British accident reports as data as illustrated in Figure 2.4.

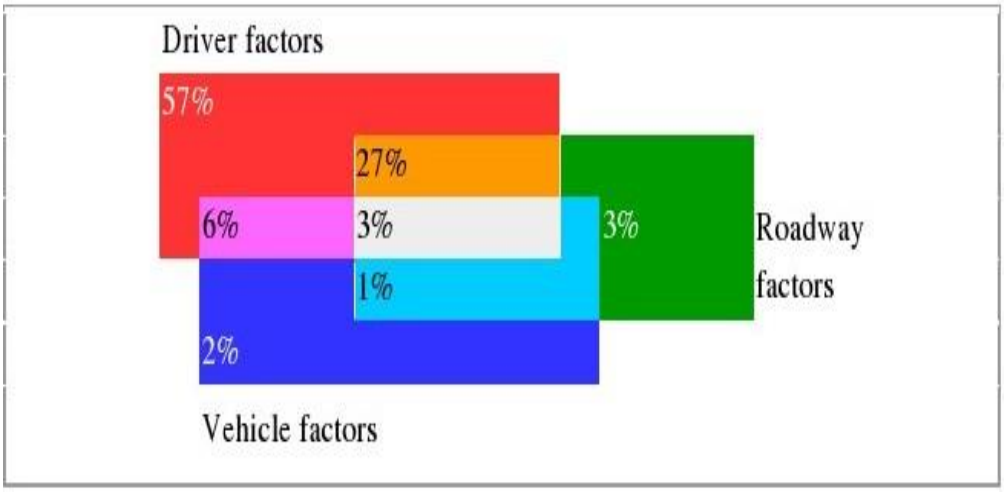

Figure 2.4: Breakdown of British and American Accident Causes (Rumar 1999)

2.4.1 The effect of human behaviour factors on RTAs

The causes of RTAs consist of four main components: the driver, the road, vehicle, and environment. Ninety percent of RTAs result from human error,(James Mearkle, 2009; WHO, 2009; Sabbour & Ibrahim, 2010). According to The Ministry of Interior statistics report in the UAE, the highest cause of road accidents is carelessness. In Abu Dhabi in 2010, nearly 506 RTAs occurred as a result of carelessness were 599 people injured, and 91 were died because of this type of negligence. One of the essential aspects helping to improve traffic behaviour involves police enforcement.

The traffic department records in Tripoli many different causes for traffic accidents inside the city Figure2.5, as high speed (speeding), lack attention, improper stopping, driving under the influence of drugs Ogundele et al., 2013. Also, it was found that the inappropriate turning, violation of traffic laws, ignoring priority of way, using mobile phones during driving play a significant role in accidents in the city of Tripoli.

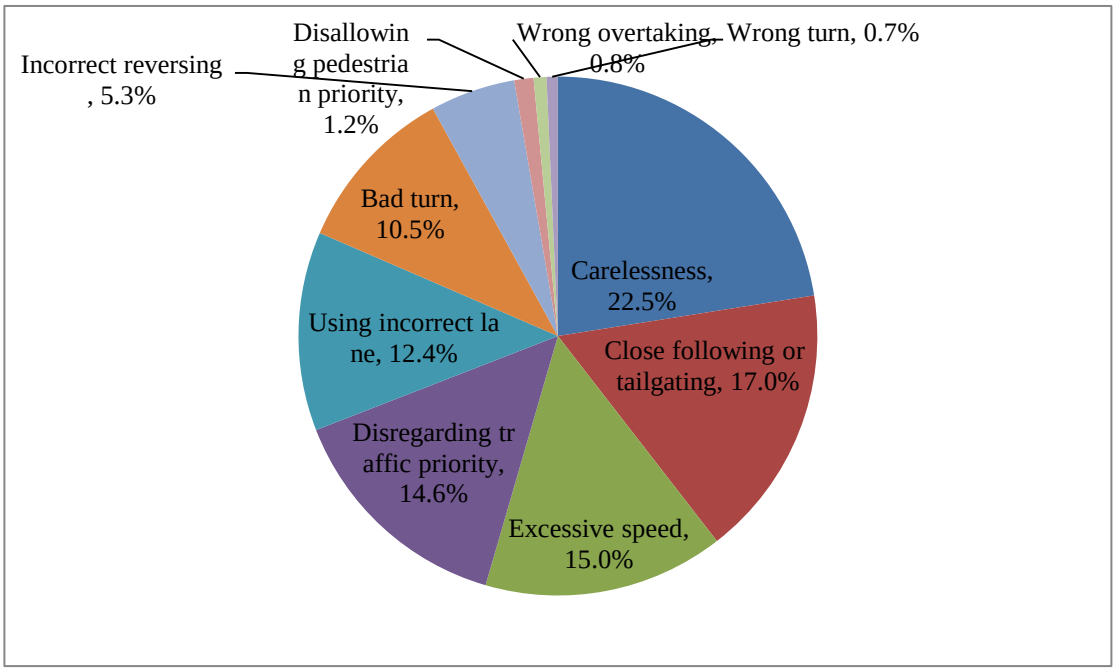

Figure 2.5: The human factors are effecting on traffic accidents 2007 - 2010 (Ogundele 2013)

The traffic sector requires further traffic legislation and more enforcement efficient system, for instance, to develop traffic performance most of the road users. Traffic enforcement had a direct effect on the increase of the seat belts wearing percentage from52% to 92% for front-seat passengers and from 9% to 80% for rear-seat within European Union countries (WHO, 2009). Cars seat belts consider as one of most significant factors that prevent human hazards around 50% of fatal injuries in a traffic accident (Ogundele et al., 2013). Failing to fast seatbelts is mostly unsafe for drivers. Thus this action leads to catastrophes worse than any other wrong driving actions (Fernando et al., 2012).

Drivers should also take into account the traffic regulations and laws. Many drivers have experienced the transportation risks on roads, such as RTAs - these usually occurring to privately owned cars or public-transport (e.g., bus or train). The majority of stakeholders are concerned with how gender, age, and education level effects on RTAs (Harper et al., 2012; Li, Xie, Nie, & Zhang, 2012; Moen & Rundmo, 2006). Furthermore, there is a distinct relationship between the increasing number of accidents and driver rushing actions, such as speeding-up, instantaneous braking, and false steering actions (Af Wåhlberg, 2008). Hence, it is necessary to improve driver actions to prevent RTAs from accruing. Moreover, Texting While Driving, driving under the influence and the failure to a wear seat belt can all be

avoided, however, failing to implement of these actions seriously leads to RTAs (Stanojević, Jovanović, & Lajunen, 2013).

Rumar (1999) researched RTAs and the factors affecting it, it was found that 57% of crashes were due to driver factors. That indicated to found the human factors as a most critical factor which effete on the RTAs. Also, Odugbemi (2010) found that RATsoccurrence based on location along Akure-Owo road from 2010 to 2015 in Nigeria. Moreover, Figure 2.6 shows the various accidents and causative factors and its appearance in each of the year considered. Data collected from FRSC Akure office for the year 2010 to 2015 showed that the highest number of accident occurrence was caused by human factor, which was followed by the vehicle factor for each of the years. This indicates that human and vehicle factors are the primary cause of accident occurrence on the route under consideration. From the dissection above, it could be concluded that the human factors are the most critical factor affecting the road traffic accidents RTAs.

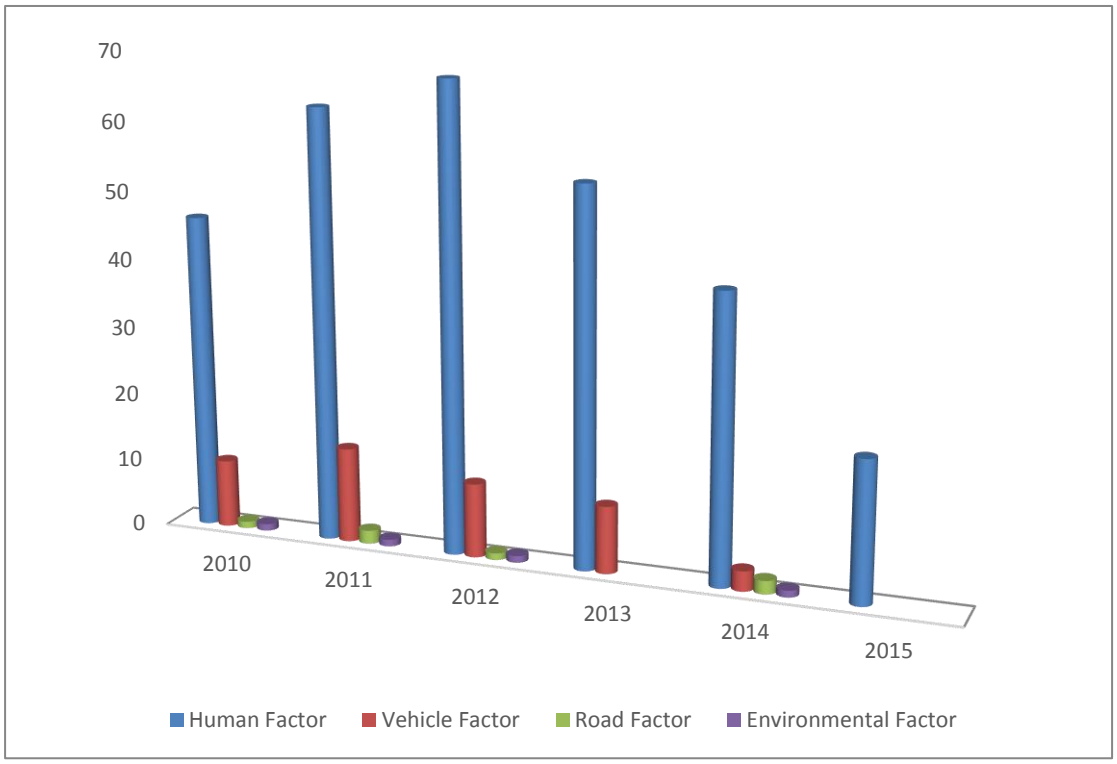

Figure 2.6: RTAs Occurrence Based on Location along Akure-Owo Road 2010 **-**2015 (Odugbemi, 2015)

2.4.2 The effect of vehicle factors on RTAs

Vehicle factors are important factors affecting RTAs in the world, and consideration of these factors lead to reduce RTAs, The European Commission approved that half number of injuries and fatalities could be prevented if crash protection systems are fitted all vehicles were fitted with collision protection systems (EUROPA, 2006).In high-income countries, all cars are required to have standard safety regulations, like airbags, seat belts, etc. Meanwhile, low-income countries have lack standard regulations for safety, which means that many motorcyclists pedestrians, pedestrians, and cyclists experience RTAs (WHO, 2009). There are also faults on vehicles that could lead to severe injuries and fatalities.

There are a lot of vehicle factors effect on the roads as example Defective braking systems - anti-skid braking system (ABS), An useful ABS is essential for any vehicle as it helps the driver to control and steer the car while braking, and also prevents skidding (Zeng & Gao, 2013). Furthermore, Defective head or rear lights cause a lot of accidents If vehicles are

driven less at night, then a third of motorcycle accidents could be avoided, and 10% of car accidents would be prevented (WHO, 2009).

The most critical factor in vehicle factors is Defective tires, which cause a lot of accidents in Libya and worldwide, Defective tires lead to the driver losing control of the vehicle. There are many causes of defective tires, such as low air pressure, the overloading of vehicles and tire manufacturing defects (Shen, Yan, Li, Xie, & Wang, 2014). The New Zealand Land Transport Safety Authority underlines this, indicating that 40% of fatal accidents in this country result from faulty tires. Similarly, in Australia in 2000, 15 fatal crashes and 110 injury accidents were the results of defective tires (Paine & Magedara, 2007). The statistics of the General Directorate of Traffic Coordination at the Ministry of Interior UAE, show that between 2010 and 2012 the people driving with defective tires resulted in a 278 RTAs with 88 deaths and 656 injuries (Hammoudi, 2014).

2.4.3 The effect of road infrastructure factors on RTAs

Road infrastructure performs an essential part of road safety. Even though roadway factors exclusively cause a small proportion of crashes, include road factors in a way. The second pillar of the UN Global Plan for the Decade of Action for Road Safety 2011-2020 places utmost importance on increasing the protection and safety of road networks for the good of road users (Ahmed, 2013).

The coastal road (1700 km) is the primary highway in the Libyan road network, with one-third of the fatal crashes and about half of the deaths (1977) occur. One of the fundamental design deficiencies is that although the acceptable speed on it is high, access to the road from secondary roads is not limited. Furthermore, the road goes across inner parts of villages and towns (Mekky, 1984). Different factors affect road safety in the nation; like the absence of separated lanes for various types of vehicles, the absence of pedestrian crossing facilities, inadequate lighting for the roads, and lack of road signs that may cause the drivers to surpass speed limits. Furthermore, conditions such as heavy rains narrow and damaged roads due to erosion (McSweeney et al., 2010) making the road boundaries hard to see. Land reform programs bring about security fence vandalism that was meant to restrict animal movement

onto the roads. Hence, many animals stray onto the road causing RTAs. There are no lanes for alternative transport like walking and cycling (Pucher & Dijkstra, 2003).

Knowing the limitations that affect road safety could aid in planning, designing, building and maintaining of road structures to provide a safe road environment. The planning of roads performs a crucial function concerning road safety. The idea of "lenient road design" has to be applied and the "positive guidance" approach ought to be used to decrease the road accident occurrence and severity. From international incidents, we can see that interventions concerning road infrastructure to better road infrastructure can financially sustain themselves and the financial investments can be recovered in a short duration.

2.4.4 The effect of environmental factors on RTAs

As shown in Table 2.1 some Road accidents caused by road environment factors in Great Britain 2015, the environmental factors that directly or indirectly contribute to RTAs thus leading to road safety problems. Shankar et al. (1995) found that the rainfall plays a significant role in RTAs. They discussed that higher rates of fatalities resulting from road traffic crash in poor weather conditions could be explained by (a) week visibility as a result of rainy or snowy weather (b) the road surface which may be more slippery thereby reducing the vehicle-roadway friction. Figure 2.7 shows the number of accidents caused by an environmental factor.

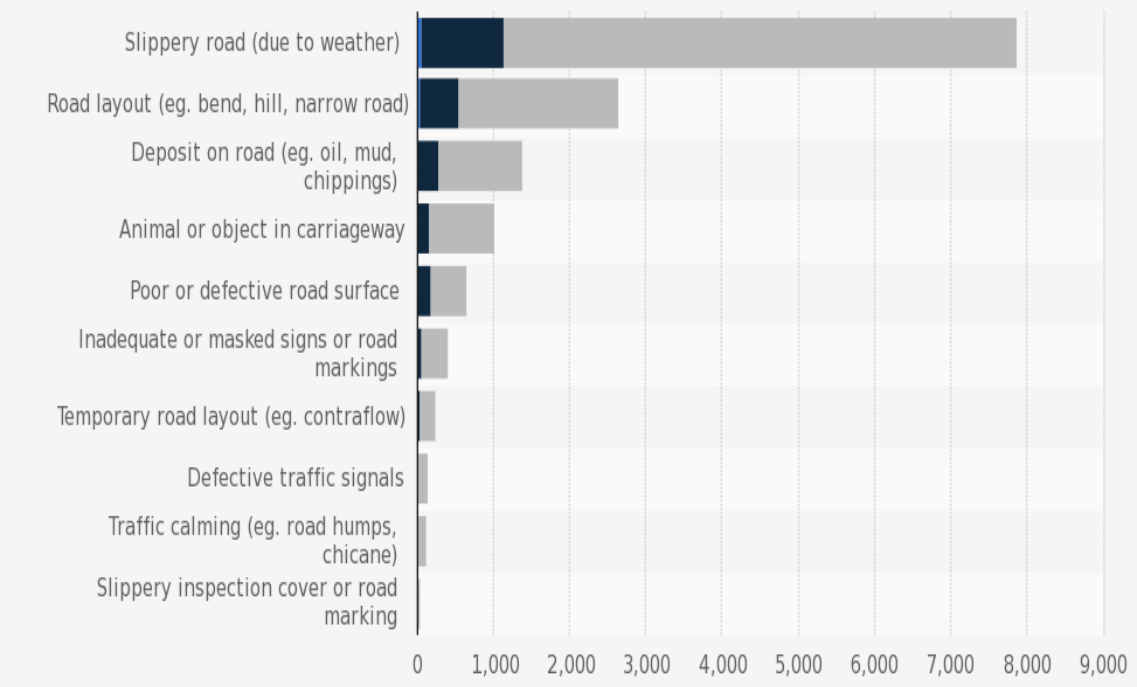

Figure 2.7: Number of road accidents caused by road environment in the UK in 2015 (Great Britain traffic department)

Table 2.1: Road accidents caused by road environment factors in Great Britain 2015, by severity (Great Britain traffic department)

Description	Fatal accidents	Serious accidents	Slight accidents
Slippery road (due to weather)	66	1,068	6,754
Road layout (eg. bend, hill, narrow road)	45	512	2,100
Deposit on the road (e.g. oil, mud, chippings)	5	282	1,100
Animal or object in the carriageway	8	161	840
The poor or defective road surface	12	164	473
Inadequate or masked signs or road markings	0	64	348
Temporary road layout (eg. contra flow)	2	30	220
Defective traffic signals	1	11	126
Traffic calming (e.g. road humps, chicane)	3	18	109
Slippery inspection cover or road marking	1	10	33

(Híjar, Arredondo, Carrillo, & Solórzano, 2004) stated the link between traffic accidents and environed mental conditions like fog, rain, wet pavement. But Kashani et al. (2012) indicated that road and weather, road width and type of shoulder, location type as well as lighting, inducing the severity of injury by traffic accidents than the use of seat belt, the cause of accident and crash type.

Lankarani et al. (2014) revealed that environmental factors are significant causes of road accidents. It was established that dusty conditions had the highest fatality in comparison with other weather conditions. The research revealed that downhill/uphill winding road was the road geometry with the first rate of RTAs. This road geometry impedes the vision of the driver and brings about the difficulty in controlling the automobile at the time of the accident with a resulting rise in deadly risk of RTAs. Also, there is a connection between time weather and seasonality in road RTA incidence (Jegede, 1988). Fatal accidents have been reported during the winter season. For instance, a study carried out by Kong et al. (1996) it discovered

that majority of the crashes occur at night or on weekends during the Northern winter (e.g., October to December). Shibata & Fukuda (1994) observes that informal tertiary sector activities along the roadside tend to increase exposure risk to traffic accidents. Also, better roadway condition could lead to behavioural adjustments regarding additional risk-prone driving (Jorgensen & Abane, 1999).

2.5 Road Safety Strategies Worldwide

In developing nations, the traffic crash problem is not until now adequately studied to establish the causes and solutions to come up with effective and preventive plans and strategies (An Analysis of Traffic Accidents in Libya, and Some Mitigation Strategies). For example, in 2006, the UK had a road death rate of 5.4 per population of 100,000. The Office for National Statistics stated in 2008 that the United States had a road death rate of 14.3 per 100,000 population, Australia had 7.8 per 100,000 population and Japan had 5.7 per 100,000 population (Transport, 2009). Road traffic accidents in Libya cannot be eradicated entirely. Nevertheless, the government could aid in the decreasing of the issue, and that's with the aid of traffic officers, police officers, engineers, and citizens. The government has to encourage citizens to use public transport between and within the cities and has to control the importation of automobiles. Also, it should motivate people to use seatbelts, and children seats will be an efficient and straight forward step in decreasing the deaths and injuries related to traffic crashes (Ismail & Yahia, 2011). However, People must acceptable and safe traffic ethics; the media holds an essential and helping role to play in this issue. And Road networks should improve linking large cities with small towns. However, most of the following countries had created Strategies to mitigate the high rates of RTAs.

According to the organisation of EU Road Safety Sector, In the UK, there are two traffic safety strategies. The first one is a strategic framework for road safety, and it is implemented in Great Britain. The second one is the road safety strategy which is used in Northern Ireland (WHO, 2009).

- The "Strategic Framework" for Road Safety in Great Britain aims to decrease traffic losses to 37% by 2020.

- The "Road Safety Strategy" in Northern Ireland has the objective of decreasing traffic losses to 60% by 2020.

In the USA, Road safety strategy has successfully achieved reducing the fatality rate to 1.05% per 100 million vehicles per mile. This approach also aimed to reduce fatalities resultant from DUI to 32% and keeping fatalities of motorcycle accidents at low levels with the percentage of 14%. In Saudi Arabia, in addition, the Strategic Traffic Safety approach aims to decrease the number of road traffic fatalities inside the city of Riyadh by 30% of the statistical numbers of road accidents for the year 2014. Due to applying this strategy, there was a clear reduction in the number of fatalities up to 266 deaths with an average of 22 deaths case per month, compared to the average of 26 deaths per month during 2013 (Qhtani & Al Fassam, 2011). In the state of Qatar, the National Strategy for Traffic Safety main goal was to reduce deaths through RTAs from the present number of 220 to 130 within few years, and also the expected the rate of serious injuries is approximated to decline from 500 compared 300 injuries per year (Hammoudi, 2014).

2.6 Car Accidents in Libya

Libya is ranked third in the fatal RTAs per capita in the world with a figure of 40.5/100,000 people per year (WHO, 2009), only Cook Island and Eritrea hold greaterFigures respect to per capita traffic crash fatalities. In Libya, the situation is terrible, unfortunately, the statistic that RTAs are the leading killer in the country. It is seen as an ‘epidemic' in all parts of the Libyan society. Table 2.2 shows the accidents in Tripoli between 2008-2017.

Table 2.2: Road Traffic accident in Tripoli from 2008 to 2017 (Tripoli traffic department, 2017)

Years	Fatalities	Serious accidents	Slightly accidents	Total		Damaged vehicles	Costs of accidents
				Accident	People		
2008	263	1068	1146	3011	2477	4223	4621145LD
2009	267	961	1076	3068	2304	5263	5819650LD
2010	315	1035	1188	3365	2538	5390	5489612LD
2011	200	414	418	1270	1032	2158	1311310LD
2012	294	355	467	1264	1116	2005	2527850LD
2013	351	276	258	1161	885	2377	3983000LD
2014	282	152	158	675	592	1439	2339000LD
2015	314	175	223	657	712	1273	1761000LD
2016	302	160	215	677	750	1225	1621000LD
2017	282	152	158	670	592	1525	2142000LD

CHAPTER 3

METHODOLOGY AND DATA COLLECTION

3.1 Introduction

In this chapter, the research procedure and the methods applied as highlighted in Chapter 1 of this study were discussed. The quantitative research to assess the degree of factors that directly affect the road accidents in the capital of Libya (Tripoli) was the methodology adopted for this study. The chosen method to accomplish the study employs the techniques as follows: a literature review related to safety performance, the research design information, research location, questionnaire design and research population.

3.2 Data Collection

For most of the research projects, the two primary methods applied are quantitative and qualitative (Rimola et al., 2011). It was decided to use the quantitative approach in this research to the help in collecting data of RTAs in Tripoli. The distribution of questionnaires done by the quantitative approach and has been targeted drivers, pedestrians, passengers and also ordinary people. Two ways were used to distribute the questionnaires; the first one is to create google forum on the internet to reach a target people who can fill it online, and this method was a beneficial way to reach to the significant number of people in the short period. The second one was a convenient way to distribute printed questionnaires.

3.3 Supporting Elements of the Study

The support elements had been identified as potential sources of information and data on the subject of research, as well as identifying tools to support research by the following points:

- Access to online databases such as journals (articles and conferences) and books.
- Field studies and field survey to collect data, and official documents of the case study.
- The use of the SPSS version (19) and spreadsheets employed to analyse the statistical data and to prepare graphs that highlighted the features of the study, analysis and scientific outcomes.

3.4 Quantitative Method

In quantitative research, the methods used are involved phenomena explanation by analysing numerical data collected using methods that are mathematically based (statistics in particular). Also, it is essential to collect statistical data for the description of a specific phenomenon, especially questions that seem to be studied immediately to be answered by the application of quantitative methods" (Muijs, 2010).

Table 3.1: Some properties of quantitative methods

Properties	**Quantitative methods**
Flexibility	Inflexible
Sample size	Large number
Selection of respondents	Randomly
Collection data method	Surveys and controlled Experiments
Data types	Objective

3.4.1 Advantages and disadvantages of the quantitative method

In quantitative research, the methods used are controlled experiments and surveys (Creswell, 2013). These technique's disadvantages are that it's costly, and the participants and researchers have no interaction between them. Mathematical description provided by the answers which people's opinions are not necessarily reflected accurately. However, the quantitative methods involve some advantages that their aim is to display the represented results samples via random data and respondent's selection to answer definite questions and constitute causes from large groups of people. Quantitative methods assist in where, how, and when things happen. Applying these methods, the significant data amount can be obtained by the researchers which can be converted to graphs or charts easily as they deal with statistics and numbers (Creswell, 2013).

3.4.2 Quantitative data methods for the research

The method of the quantitative data was applied in this study via questionnaire surveys; drivers, pedestrians, passengers and ordinary people were asked to determine the relevant factors contributing to RTAs in Tripoli. To do this, they were requested to complete questionnaires and provide data, which could then be analysed and categorised.

3.5 Research Design

The research starts with identifying the aims to give insight into the problem statement and developing clear objectives is also clarified within the plan of the study. The literature on road traffic accidents RTAs and their factors were reviewed in Chapter 2, where research involved summarising the comprehensive literature review. A pilot study was done in the capital of Libya to assess the factors affecting the RTAs in Libya, which helps to prove by testing so respondents could understand that contents of the questionnaire. Also, the distribution of the survey was focused on the research. Questionnaires (numbering 400) were distributed to the targeted respondents from drivers Statistical Package performed passengers and pedestrians, the obtained data discussion and analysis for the Social Sciences,

(SPSS). Finally, the conclusions and recommendations explained in the last chapter. Figure 3.1 shows the methodology flowchart.

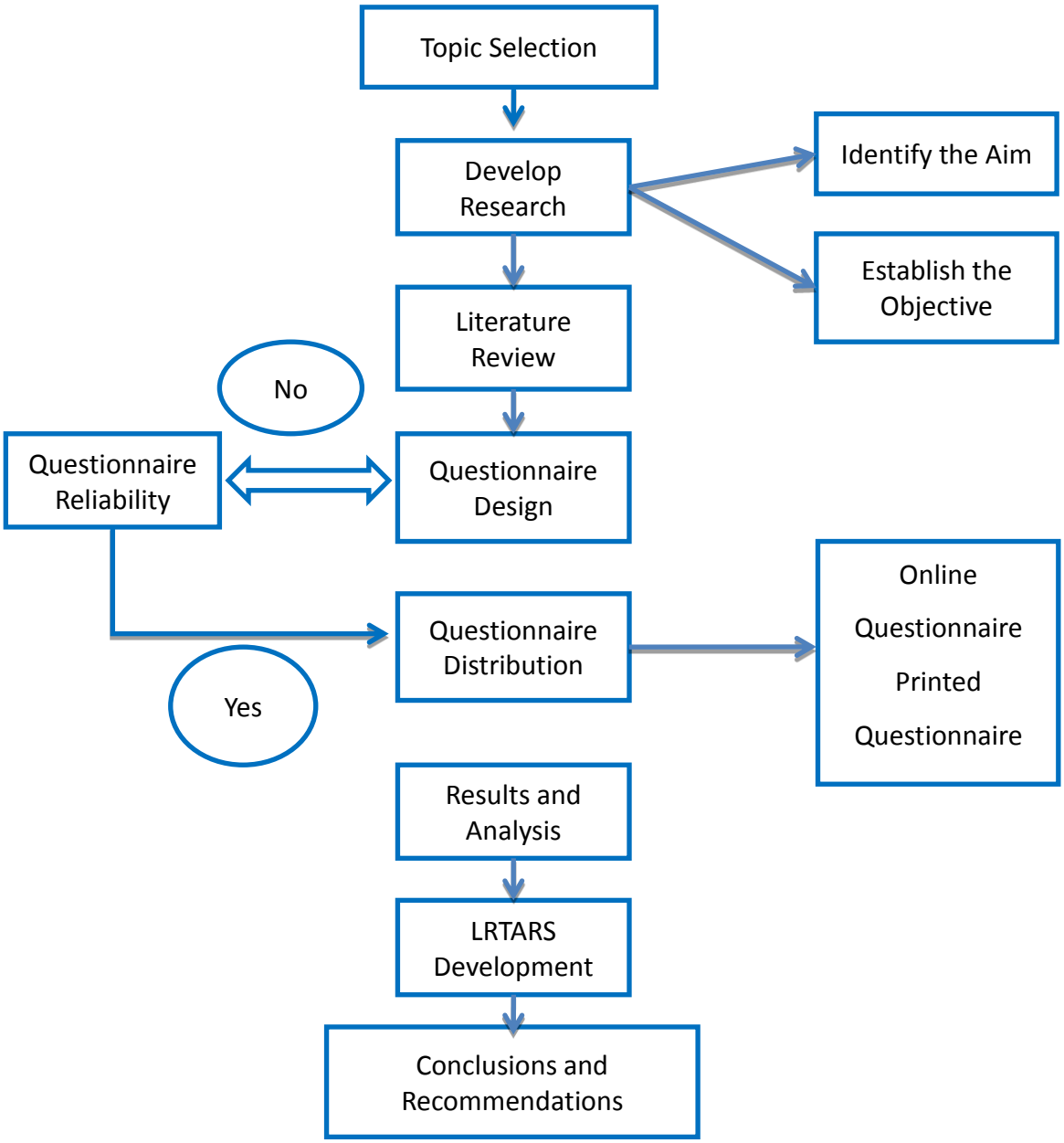

Figure 3.1: Methodology Flowchart

3.6 Research Location

The most significant city in Libya was considered for this research which is located in the west; several reasons prompted the selection of Tripoli as the case study area due to its traffic problems which are:

- Tripoli is a busy area apart from being the capital of Libya.
- The population growth is high in Tripoli, whereby around 30% of the total population of Libya resides in Tripoli.
- The rapid growth of private vehicles which involve taxis, cars, coaches, and microbuses are among the major causes of congestion.
- The non-existent conventional public transport system such as public buses and trains namely, light rail, metro and heavy train.
- Lack of car parks in the Tripoli area despite the increased number of vehicles.
- The deteriorating road system is another cause for concern, and the roads are poorly developed.
- The port that handles the most substantial volume of cargo is located in Tripoli city, indicating the crucial need to overcome congested traffic and provide a better transport networking system, as it can see in Figure 3.2. The Tripoli large detailed.

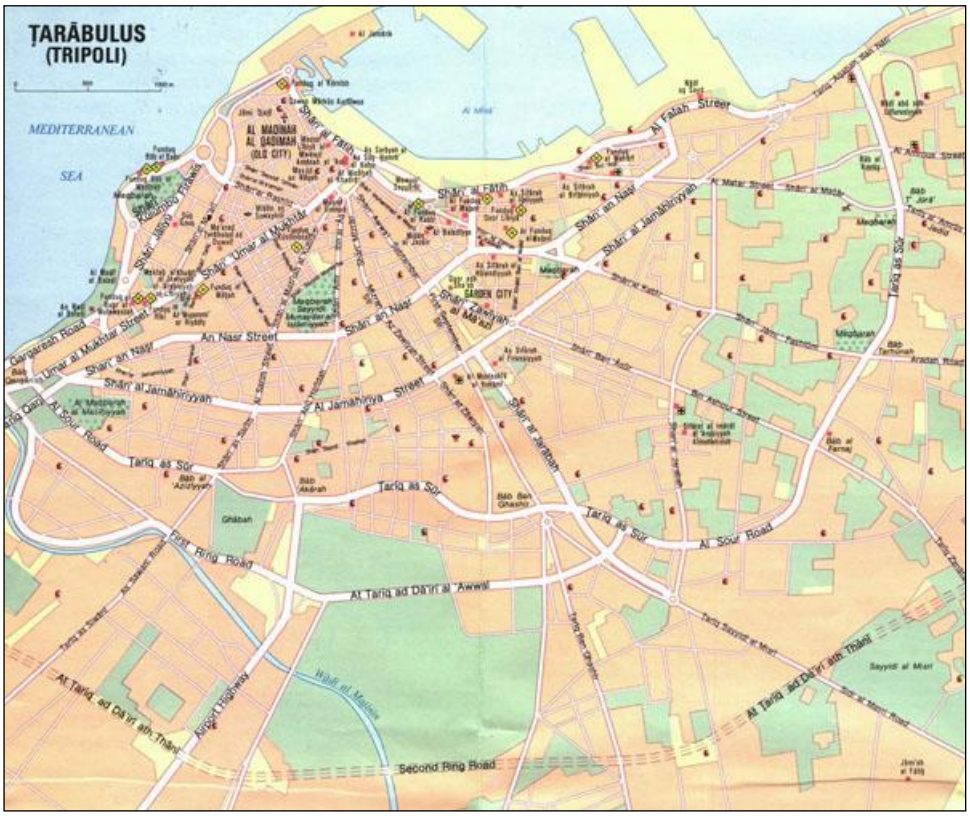

Figure 3.2: Tripoli large detailed road

3.7 Questionnaire Design

The questionnaire was designed with the objective of obtaining information from drivers, passengers, pedestrians and ordinary people to get more opinions about the factors affecting the road traffic accidents in Libya. Broadly, the questionnaire grouped into four separate sections. The first part was regarding respondents personal information, while the second part, was asking the respondents about their daily trip characteristics. The third part, the respondents were asked to answer the questions to assess the factors that are affecting the RTAs, in particular, this section was divided into four parts which include :

- Human Factors.
- Vehicle Factors.
- Road Factors.
- Environment Factors.

However, each part contains questions regarding each factor and their impact on the RTAs. Lastly, subsequent remedial measures that may be taken to avoid more injuries and harm less likely to occur by car accidents by giving their own opinion on closed-ended questions. Hence, questionnaires for the survey were distributed in two versions: Arabic, and English. To be able to get answers to the questionnaires from all those involved, this was necessary.

3.8 Sample Size

This sample size represents the targeted population was obtained by the use of the given by researchers such as (Gogtay, 2010).

The sample size can be calculated by the following equation, to achieve 95% confidence level.

$$\mathbf{S} = \frac{\frac{\mathbf{z^2 \times p(1-p)}}{\mathbf{e^2}}}{\mathbf{1} + \left(\frac{\mathbf{z^2 \times p(1-p)}}{\mathbf{e^2 N}}\right)} \qquad (3.1)$$

$$\mathbf{S} = \frac{\frac{\mathbf{1.96^2 \times 0.5\ (1-0.5)}}{\mathbf{0.05^2}}}{\mathbf{1} + \frac{\mathbf{1.96^2 \times 0.5\ (1-0.5)}}{\mathbf{0.05^2 \times 1500000}}} = 384$$

In which;

N: number of vehicles

e: Margin of error (5% put into decimal form for example 5%=0.05)

z :z-score (equals 1.96 for confidence level 95%)

P: sample proportion, at confidence level 95%, maximum P=0.5

S: sample size

Due to the inability to access the data on the population in the area of Tripoli as a result of the situation of the country. Also, these data were not found after 2011. Therefore, it was considered that the population of the capital is 2 million and we also imposed that 75% of the population of Tripoli have vehicles which represent 1,500,000 vehicles, so 400 people were selected as sample size.

3.8.1 Factors affecting the road traffic accidents RTAs

For each factor, there is a question, for measuring the degree of impact on road traffic accidents. Respondents will be invited to state any other factors that affect road traffic accidents and to rate these factors. The degree of impact is based on a five-point Likert scale as shown in Table 3.2. These five points are:

No opinion (N.O) = 1.0–1.49, No impact (N.I) =1.50–2.49, slightly impact (S.I) =2.50–3.49, considerably impact (C.I) = 3.50–4.49, Great impact (G.I) = 4.50–5.0.

Table 3.2: The degree of impacts in Likert scale

1	**2**	**3**	**4**	**5**
N.O	N.I	S.I	C.I	G.I

3.8.2 Factor Analysis and Reliability Test

The Theory of Classical Test was used for internal consistency by reliability check and test alongside the used homogeneity. Theory of Classical Test applies Cronbach's α (alpha) that mostly measures and depends on the consistency of many items or variables sets and interactions between them (Yitmen, Sevay, Taneri, & Yalçıner, 2006)**.** Cronbach's α (alpha) ranges between zero to one in which zero signifies no consistency variables or no interaction variables while one implies that variables have direct dependency and consistency on each another. The rule accepted is given in Table 3.3. The Cronbach's α minimum accepted value is 0.7 or higher to identify consistency and a good correlation.

Table 3.3: Internal Consistency (George & Mallery, 2003)

Cronbach's α (alpha)	***Internal Consistency rank***
$\alpha < 0.5$	Unacceptable
$0.5 \leq \alpha < 0.6$	Poor
$0.6 \leq \alpha < 0.7$	Questionable
$0.7 \leq \alpha < 0.8$	Acceptable
$0.8 \leq \alpha < 0.9$	Good
$0.9 \leq \alpha$	Excellent

3.8.3 Relative Importance Index (RII)

To relate to each significant factor and to get their understanding, some factors are required. The fundamental and primary factors are the standard deviation and mean value.

$$\boldsymbol{x'(mean)} = \frac{\sum \boldsymbol{x}}{\boldsymbol{n}} \tag{3.2}$$

$$\boldsymbol{\sigma(standarddeviation)} = \sqrt{\frac{\sum_{i=1}^{n}(\boldsymbol{x'} - \boldsymbol{xi})^2}{\boldsymbol{n}}} \tag{3.3}$$

Where:

n**:** The total answers received or the number of respondents.

x**:** The relative value of the answering respondent.

In a multiple-selection question including the involved ones used in the questionnaire, every response ranked in order. It determines how significant the respondent feels the answer should be given. Applying this weight system or ranking, the Relative Importance Index which is the most reliable and accurate average will be determined to take into cognisance, the important of the answer selected by the respondent. (Mackenbach et al., 1997).

$$\boldsymbol{RII} = (\sum \boldsymbol{w})/\boldsymbol{w}_{\boldsymbol{highest}}^{\boldsymbol{xn}} \qquad (3.4)$$

Where:

W: Weight/ rank of each answer

n: The total responses received or some respondents.

$W_{highest}$: The highest rank/weight which is "5" that can be obtained

As shown from the above-given formula, the RII value will always be equal to one or smaller but greater than zero. Considering this as a reference to the acceptance value for RII, the value of 0.7 or higher is acceptable.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

The description of the results obtained and discussion of the findings of the study will be addressed in this chapter. The data was evaluated and analysed to explore and identify the factors affecting RTAs in the city of Tripoli. Also, it shows the ranked of the factors affecting the RTAs regarding most effective factors on the road accidents in Tripoli. The data were collected by questionnaire, and the number of respondents targeted was 400. As mentioned in chapter 3, the distribution of questionnaire was by two ways, namely; online questionnaires by google form and printed questionnaires. Google form was constructive as it reached as many participants in a short time about 350 respondents which represent more than 85% of the total. The printed questionnaire needs more time to distribute to the respondents, about 50 which represent less than 15% of the total respondents as shown in Figure 4.1.

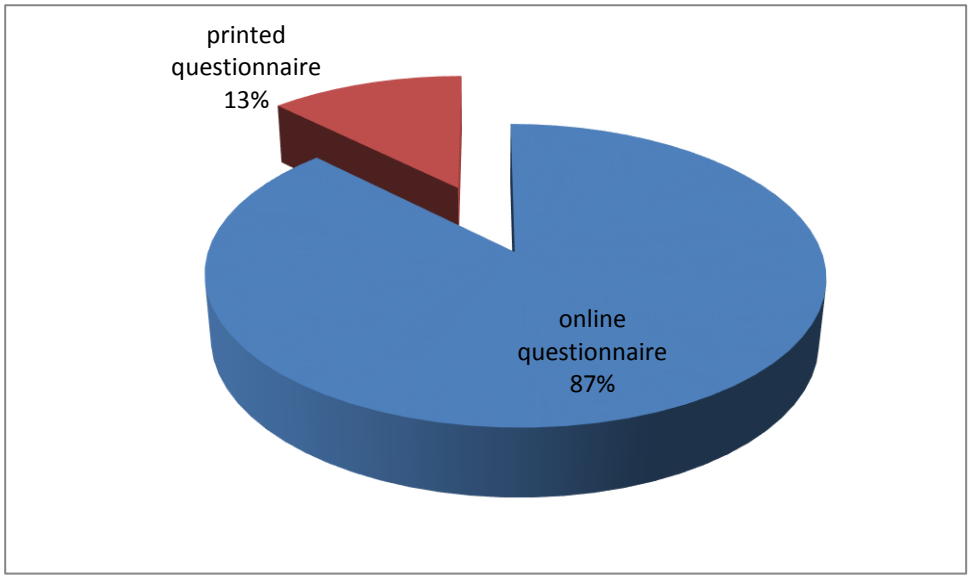

Figure 4.1: Distribution of questionnaire on the respondents

4.2 Reliability

International The reliability as shown in Table 4.1, indicated that a reliable questionnaire (the questionnaire is consistent) therefore it could be used to evaluate and analyse of factors affecting RTAs in Tripoli.

Table 4.1: Reliability of questionnaire

No of items	56
Cronbach s Coefficient Alpha	0.897

4.3 Demographic Characteristics

As a part of the demographic information, the research requested the respondents to indicate their gender, age, marital status, occupation, nationality, education level, income per month and also the place of work or study. This information required to have more information about the respondents who represent a random sample of the study.

4.3.1 Gender

The respondents of the questionnaire were 400, where the target group was road users which involved in RTAs such as; drivers, passengers, and pedestrians, 78.5% of respondents were males while 21.5% were females as listed in Table 4.2 and shown in Figure 4.2.

Table 4.2: Gender frequency and percentage

		Frequency	Percent	Valid %	Cumulative%
Valid	Male	314	78.5	78.5	78.5
	Female	86	21.5	21.5	100
	Total	400	100	100	

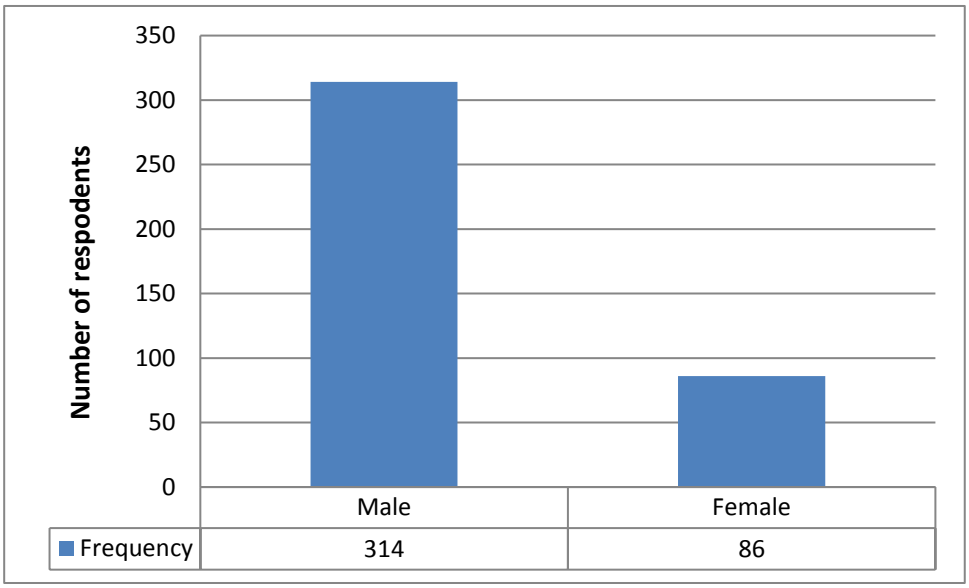

Figure 4.2: Gender frequency

4.3.2 Age

Table 4.3 shows the age of respondents, it was divided into four sections, which starts from 18 years until more than 45 years. It was noted that the majority of the respondents were between 26 and 35 years old with 41.5%. The second highest percentage was between the ages of 18 - 25 years with 32.8%, while seven % their age were more than 45 years old. The results indicate that there was a significantly good proportion of young respondents, which might mean probability to obtain significant results as the young drivers are more involved in the RTAs.

Table 4.3: The graphical diagram of the age of respondents

	Ages (Years)	Frequency	Percent	Valid %	Cumulative %
Valid	18 - 25	131	32.8	32.8	32.8
	26 - 35	166	41.5	41.5	74.3
	36 – 45	75	18.8	18.8	93.0
	> 45	28	7.0	7.0	100
	Total	400	100	100	

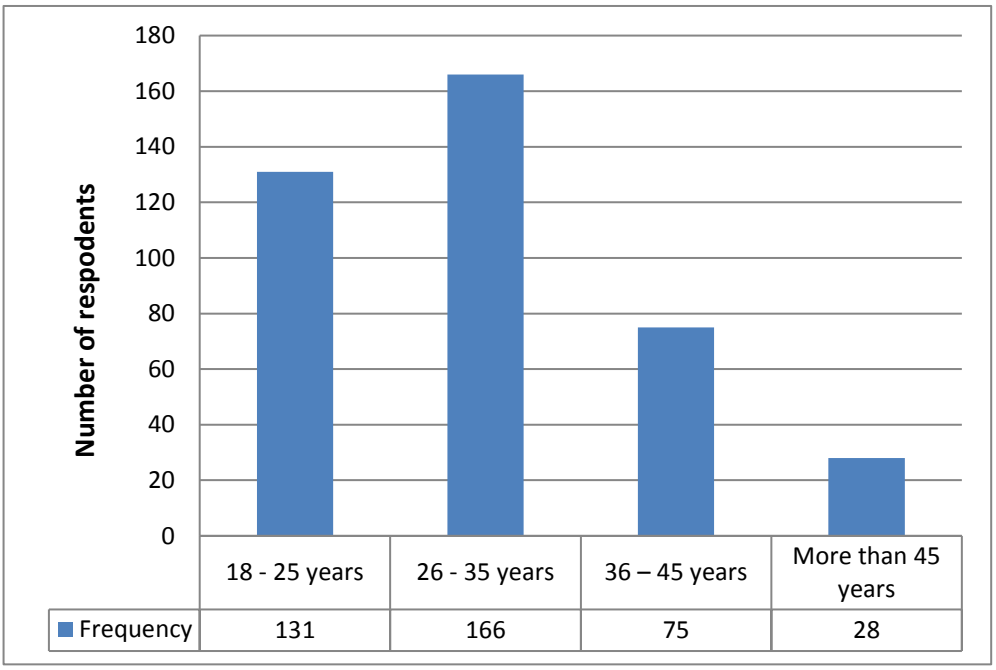

Figure 4.3: Age frequency

4.3.3 Nationality

Table 4.4 obviously shows that the majority of respondents 98% were Libyan, while only 2% were foreigners. The significant difference in the percentage of Libyan and foreigners is due to decreases in numbers of the foreigners in the country das results of severe situation in Libya after the revolution is 2011. The graphical diagram of the nationality is shown in Figure 4.4.

Table 4.4: Nationality of the study samples

		Frequency	Percent	Valid %	Cumulative %
Valid	Libyan	392	98.0	98.0	98.0
	Other	8	2.0	2.0	100
	Total	400	100	100	

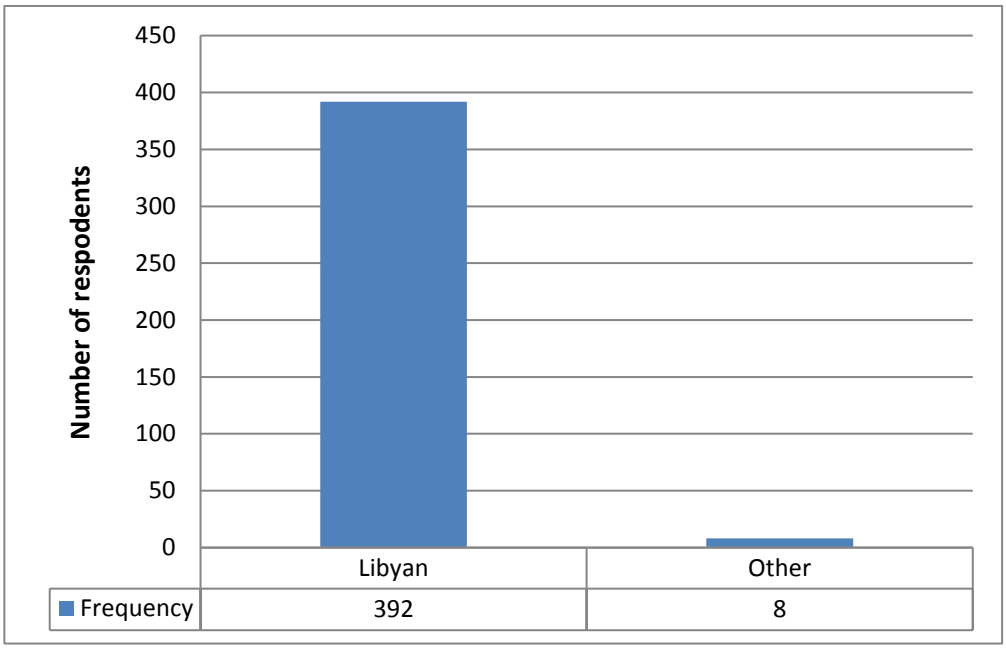

Figure 4.4: Nationality frequency

4.3.4 Marital status

Table 4.5 shows the marital status profiles of the respondents, nearly 59% of the respondents were single, while 39.5% were married and a small number of respondents 1.5% were others. Figure 4.5 shows the graphical diagram of the marital status of respondents.

Table 4.5: Marital status of the study samples

		Frequency	Percent	Valid %	Cumulative %
Valid	married	158	39.5	39.5	39.5
	single	236	59.0	59.0	95.5
	other	6	1.5	1.5	100
	Total	400	100	100	

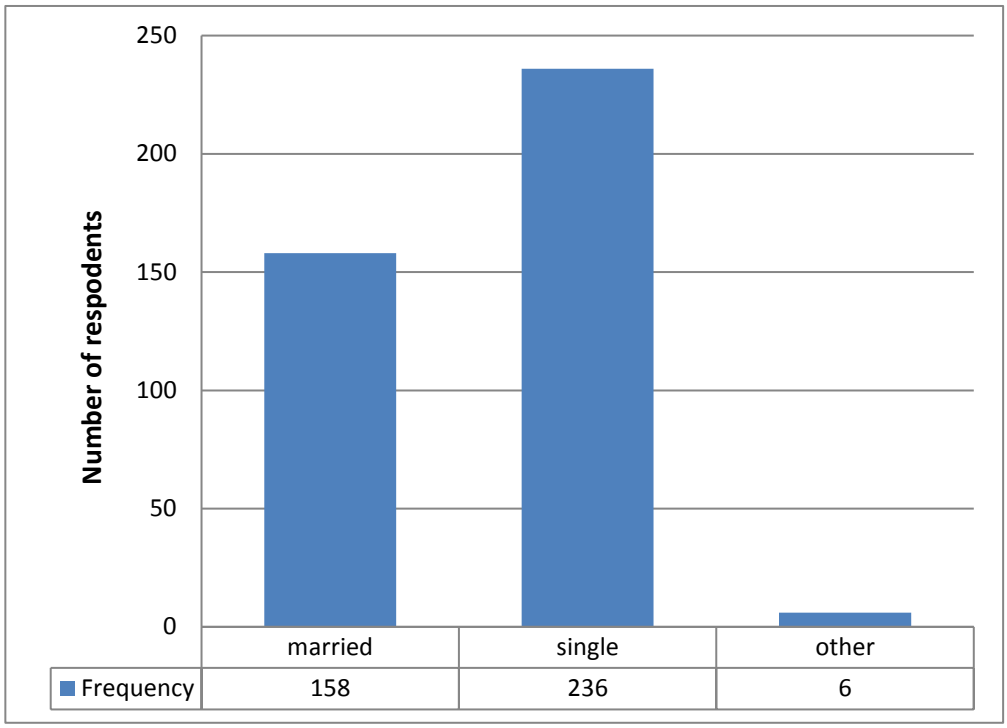

Figure 4.5: Marital status frequency

4.3.5 Occupation

The occupation of the respondents listed in Table 4.6 shows that 37.8% respondent were students, while the unemployed were the lowest proportion of 8.3%. That indicates a large percentage of the participants have experience of using transportation on a daily basis whether they are drivers or passengers. Also, this will help to take the specified opinions about the factors affecting RTAs. The graphical diagram of the occupation of respondents is shown in Figure 4.6.

Table 4.6: Occupation of the study samples

	Occupation	Frequency	Percent	Valid %	Cumulative %
Valid	Full-time employment	144	36	36	36
	Part-time employment	72	18	18	54
	Unemployment	33	8.3	8.3	62.3
	Student	151	37.8	37.8	100
	Total	400	100	100	

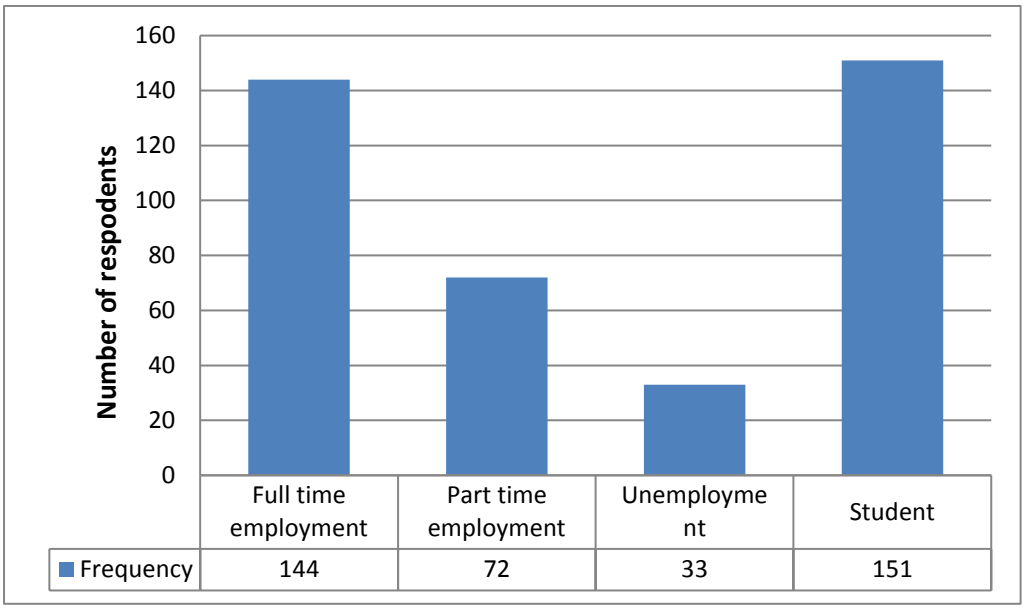

Figure 4.6: Occupation frequency

4.3.6 Education level

The education level is very important in this study as educated people have awareness about any phenomenon and issues more than poorly educated. Table 4.7 shows the education profile of the respondents were 88.3% of respondents were educated to undergraduate or post-graduate level and 9.3% were educated to the high school level. Moreover, 2% were educated to less than high school, and a slight number of respondents were with no qualification 0.5%. Therefore, most of the applicants have been educated to a high level, so they must entirely understand and critically review the issues of traffic and get benefits from its awareness programs. Figure 4.7 shows the graphical diagram of the education level of participants.

Table 4.7: Education level of the study samples

		Frequency	Percent	Valid %	Cumulative %
Valid	No qualification	2	0.5	0.5	0.5
	Less than high school	8	2.0	2.0	2.5
	High school	37	9.3	9.3	11.8
	Undergraduate degree	194	48.5	48.5	60.2
	Post-graduate degree	159	39.8	39.8	100
	Total	400	100	100	

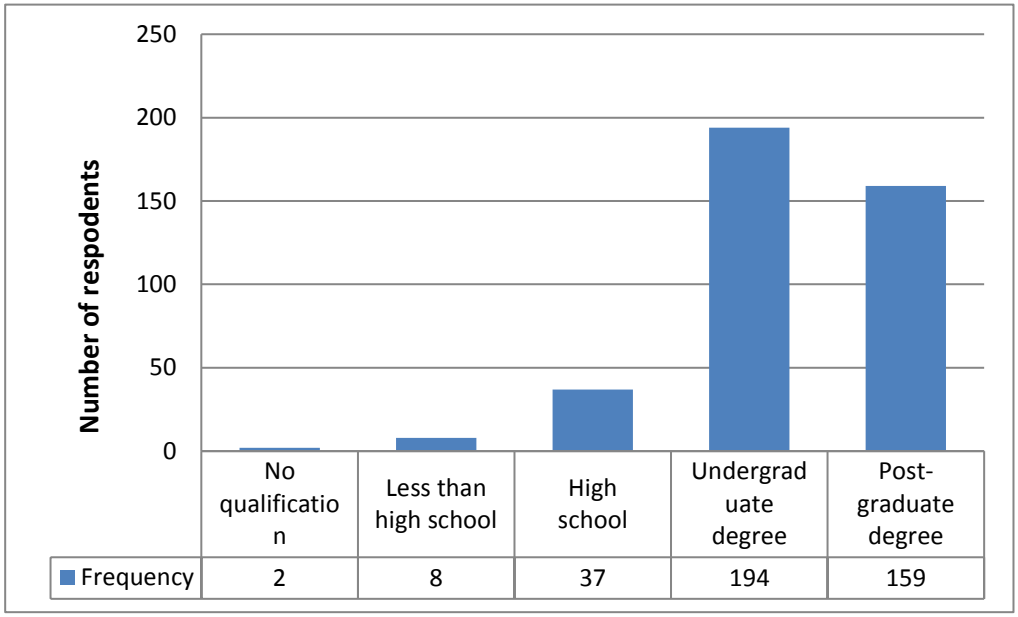

Figure 4.7: Education level frequency

4.3.7 Monthly income

Table 4.8 demonstrates the monthly income profile of the sample of study. The highest number earned was between 600 and 1000 LYD monthly with the rate of 41.3%, while 23.3% of respondents made less than 600 LYD per month. Moreover, 16.3% earned monthly income between 1001 and 1500 LYD and10.3% earned between 1501 and 2000 LYD per month, whereas 8.8 % of respondents made more than 2000 LYD monthly. The result of monthly income evaluation indicate that the participants who can earn around 600 LYD would be able to buy a car, also can manage to pay their traffic fines and registration fees.

However, 23.3% of respondents who can earn less than 600 LYD per month would struggle to buy a private car and to pay traffic violation fines and fees. Figure 4.8 shows the graphical diagram of the monthly income of respondents.

Table 4.8: Monthly income of the study samples

	Monthly income	Frequency	Percent	Valid %	Cumulative %
Valid	Less than 600 LYD	93	23.3	23.3	23.3
	600 to 1,000 LYD	165	41.3	41.3	64.6
	1001 to 1500 LYD	65	16.3	16.3	80.9
	1,501 to 2,000 LYD	41	10.3	10.3	91.2
	More than 2,000 LYD	36	8.8	8.8	100
	Total	400	100	100	

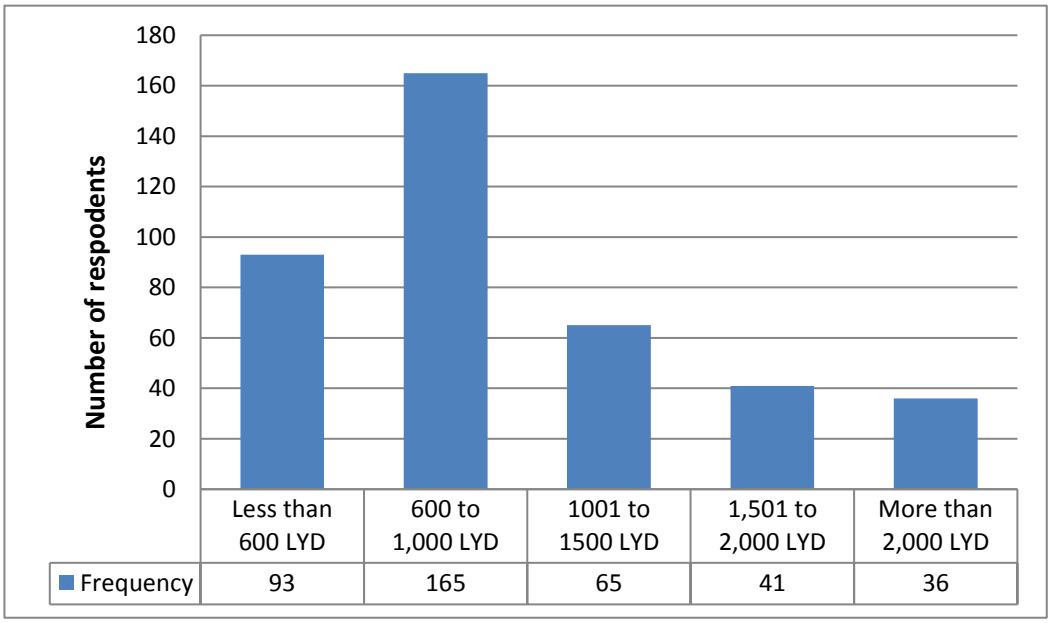

Figure 4.8: Monthly income frequency

4.3.8 Work /study place location

Table 4.9 shows the area of work or study for the respondents. It was noted that 65% of the survey sample were living in the city centre and 30% of the respondents lived in a suburb

area, while 8% of the respondents live in the countryside. The results Figure 4.9 indicate that the most of respondents live in the crowded regions (city centre) and as it's well known the number of accidents increases dramatically in those areas, therefore their opinions would have significant contribution in addressing and specifying the most effects factors causing the RTAs.

Table 4.9: Location of the study samples

	Location	Frequency	Percent	Valid %	Cumulative %
Valid	City centre	260	65	65	65
	Suburb	120	30	30	95
	Countryside	20	5	5	100
	Total	400	100	100	

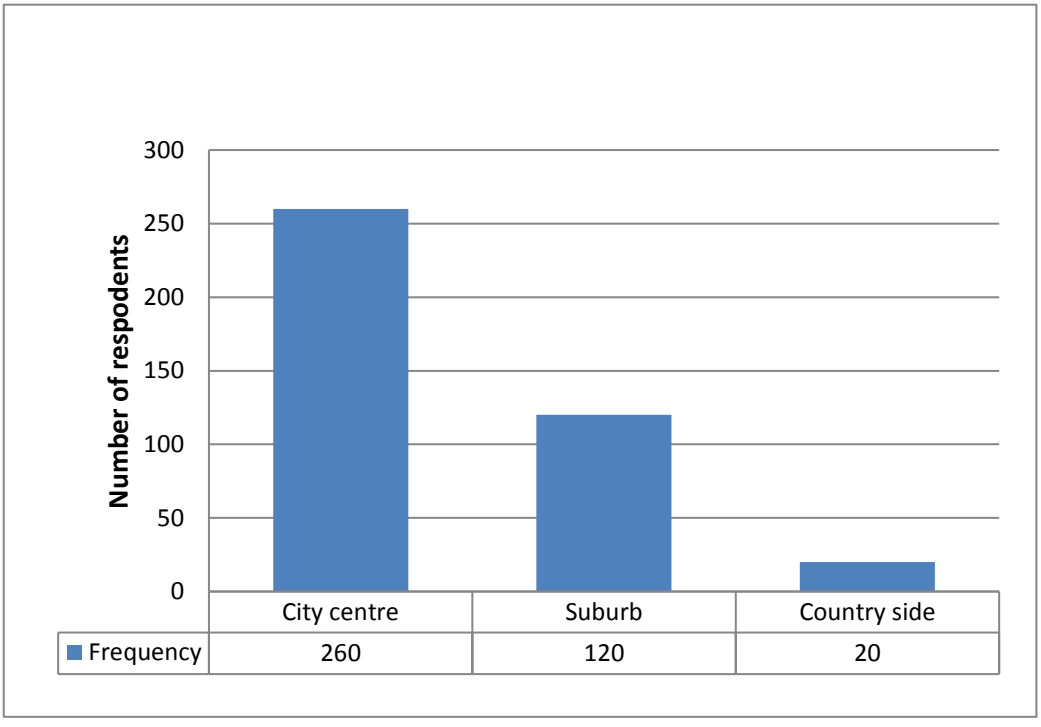

Figure 4.9: Location frequency

4.4 Trip Characteristics

4.4.1 Number of working/studying days of participants

Table 4.10 shows the number working of days of participants. It was observed that nearly 40.3% of participants were going to work/study five times a week, while the rate of those going more than five times is almost 31.5%. Moreover, 15.3% were going to work/study four times a week, and 13% of the respondents go to work/study twice a week. From Figure 4.10 it can be seen that most of the respondents were going to work or study more than 70%, which indicates their frequent usage of transportation during the week, whether they are drivers or passengers.

Table 4.10: Number of working/studying days of participants

		Frequency	Percent	Valid %	Cumulative %
Valid	Twice a week	52	13.0	13.0	13.0
	Four times	61	15.3	15.3	28.2
	Five times	161	40.3	40.3	68.5
	More than five times	126	31.5	31.5	100
	Total	400	100	100	

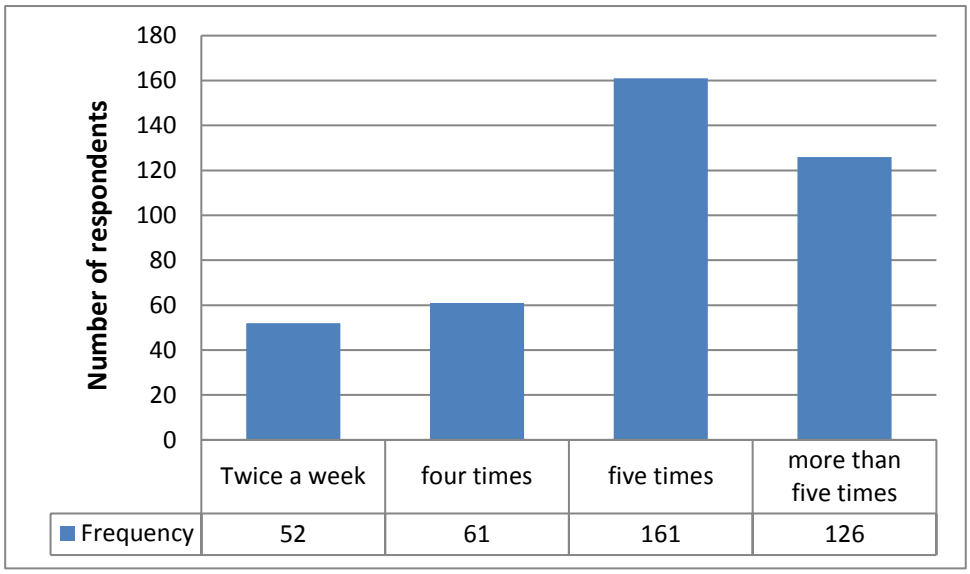

Figure 4.10: Number of working/studying days of participants

4.4.2 Estimate distance of a trip work /Study

Table 4.11 shows the time needed by respondents to reach to their works/studies areas, 43.5% spent 15-30 minutes to reached their works/studies places. Moreover, approximately 31% of them arrived at their works/studies places within less than 15 minutes. Also,15.3% of the respondents generate trips within 31-60 minutes to reach their works /studies places, while 10.3% of the respondents spent more than60 minutes to reach their works/studies places. Figure 4.11 shows the graphical diagram of time spent by respondents to reached there work regions.

Table 4.11: The time spent by participants to reach to the work/study

	Time/minutes	Frequency	Percent	Valid %	Cumulative %
Valid	< 15	124	31.0	31.0	31.0
	15 – 30	174	43.5	43.5	74.5
	31 – 60	61	15.3	15.3	89.8
	> 60	41	10.3	10.3	100
	Total	400	100	100	

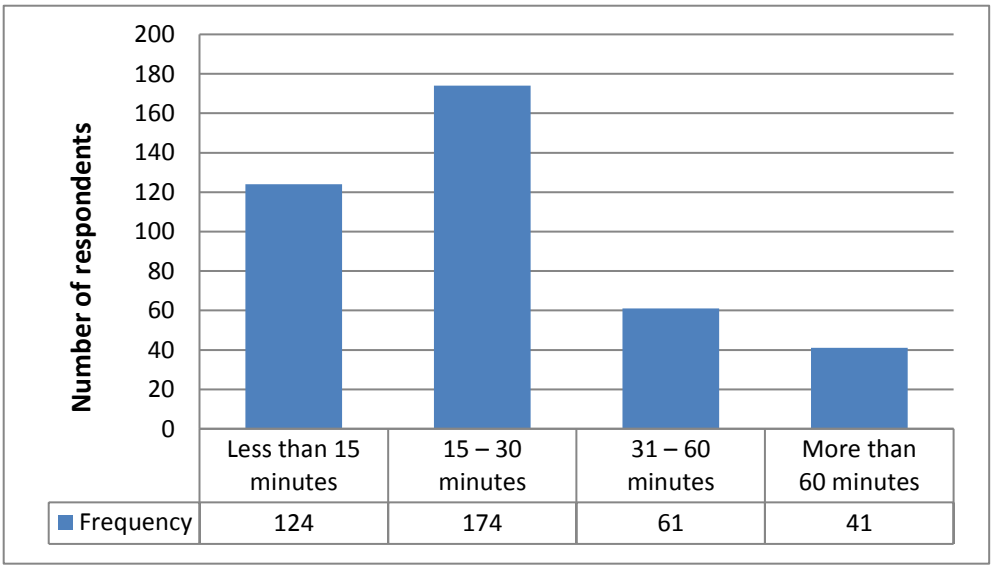

Figure 4.11: The time spent by participants to reach to the work/study

4.4.3 The experience in driving including obtaining a license

Regards the experience in driving, It can be seen that a majority of respondents were had to experience more than 12 years with the rate of 29.8%. Also, 22.8% of respondents were had experience in driving between 8 and 12 years, while 47.5 % of respondents were less than 8years' experience driving as demonstrated in Table 4.12 and Figure 4.12.

Table 4.12: Experience of the participants in driving including obtaining a license

	Years of experience	Frequency	Percent	Valid %	Cumulative %
Valid	1-3	79	19.8	19.8	19.8
	4-7	111	27.8	27.8	47.5
	8-12	91	22.8	22.8	70.3
	> 12	119	29.8	29.8	100
	Total	400	100	100	

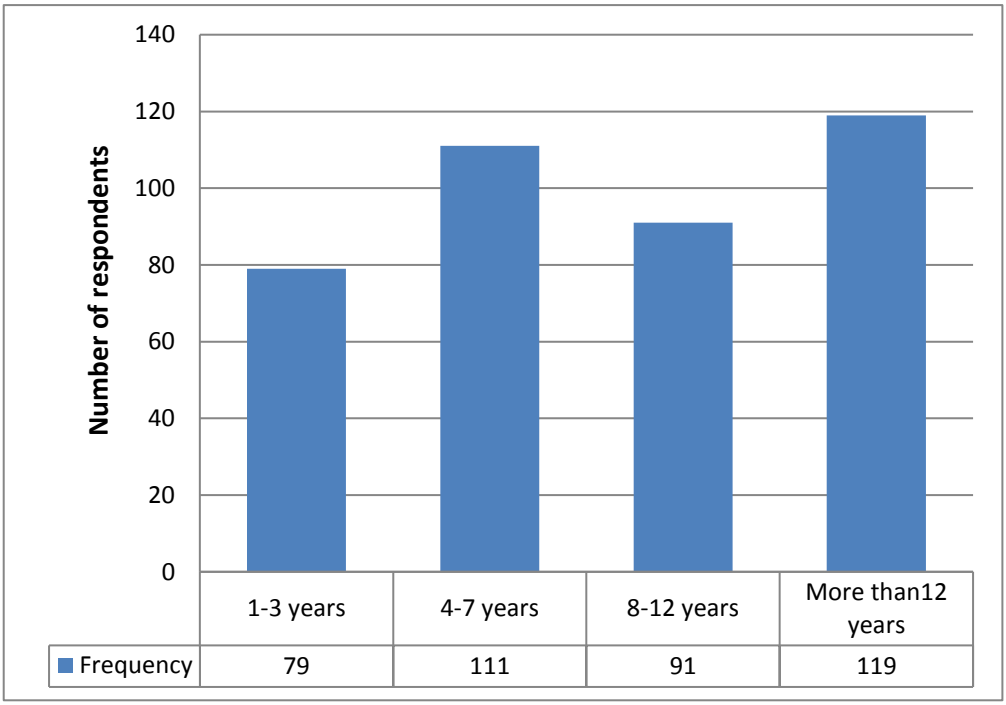

Figure 4.12: Experience of the participants in driving

4.5 Descriptive Statistics

Evaluating the ranking of the factors that effect on the RTAs will not be achieved without measurement of the suitability for the 34 survey items was assessed through descriptive statistics, both the mean of all responses (M) and the standard deviations (SD) per questions were considered to achieve this. If an item was found to have to mean close to either 1 or 5, then eliminating it must be considered because it might affect the standard of correlation between the rests of the items (Kim, 2011). Also, the normality in distribution was verified by checking the skewness and kurtosis before factors affecting on the RTAs. Since the regularity of the distribution was confirmed, a ranking of the factors that is affecting RTAs was conducted using of SPSS.

Table 4.13 shows the statistics descriptive, containing the means, standard deviations, skewness and kurtosis of total sample size (n) is 400 respondents with two missing answers. It revealed that human factors have M = 3.863, and SD = .681, while the M of vehicle factors were 3.201 and SD was 0.723. Also, road factors have M of 3.691 and SD of .7339 respectively. The environmental factors have 3.536 M and the highest SD of .879.

According to Zahediasl (2012), the normality test is usually conducted to find out if the data set is well-modelled through a regular distribution or not. Therefore, there are some criteria used to assess the normality and shape of a data distribution such as skewness and kurtosis test.

Table 4.13 shows the descriptive statistics of 400 respondents (sample size). The value 1.00 – 5.00 represent the lowest and the highest values respectively, which indicated that the distribution of the study is good. Also, the human factors have highest skewed with - 1.437 and highest peak with 2.732 kurtoses (A negative value represent a higher tendency of the distribution to tail to the left) as the histogram 4.13 shows below. Vehicle factors have an approximately symmetric with .104 and high flatness (platykurtic distribution) with -.127 kurtosis for vehicle factors. The road factors listed in Table 4.13 is moderately skewed with -.573, and high flatness (platykurtic distribution) with .701 kurtosis as shown in the histogram4.16. Environment factors have an approximately symmetric with -.402 and high flatness (platykurtic distribution) with -.192.

Table 4.13: Descriptive values of the factors

		Human factors	Vehicle factors	Road factors	Environment factors
N	Valid	398	398	398	398
	Missing	2	2	2	2
Mean		3.8635	3.2013	3.6911	3.5363
Std. Deviation		.68168	.72306	.73396	.87903
Skewness		-1.437	.104	-.573	-.402
Kurtosis		2.732	-.127	.701	-.192
Minimum		1.00	1.30	1.00	1.00
Maximum		5.00	5.00	5.00	5.00

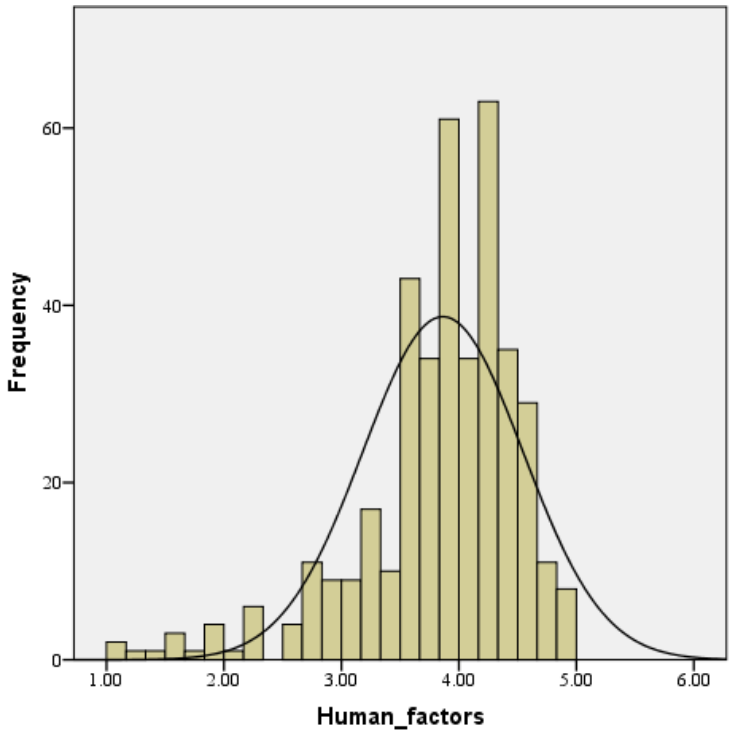

Figure 4.13: Skewness histogram for the human factors group

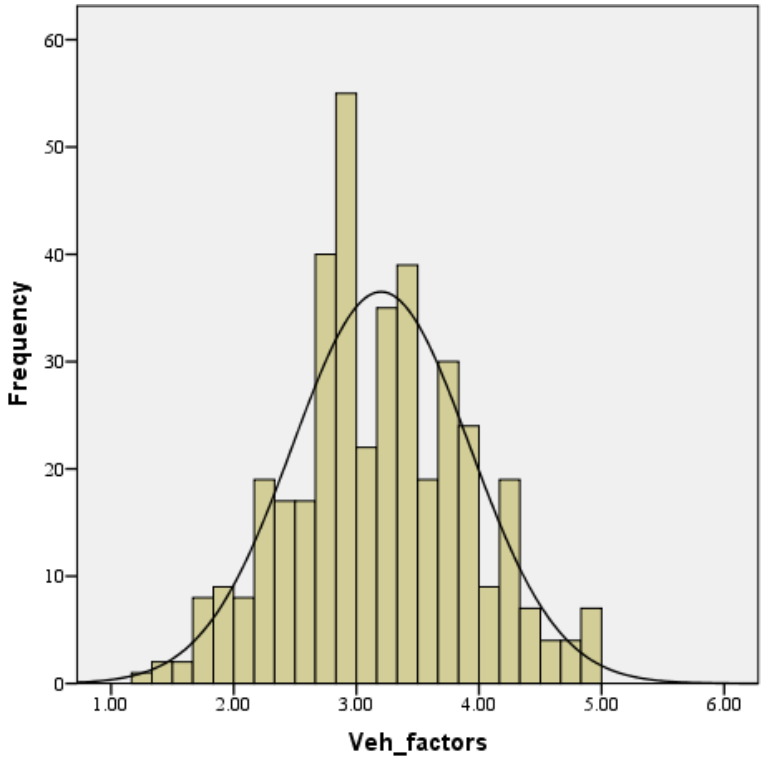

Figure 4.14: Skewness histogram for the vehicle factors group

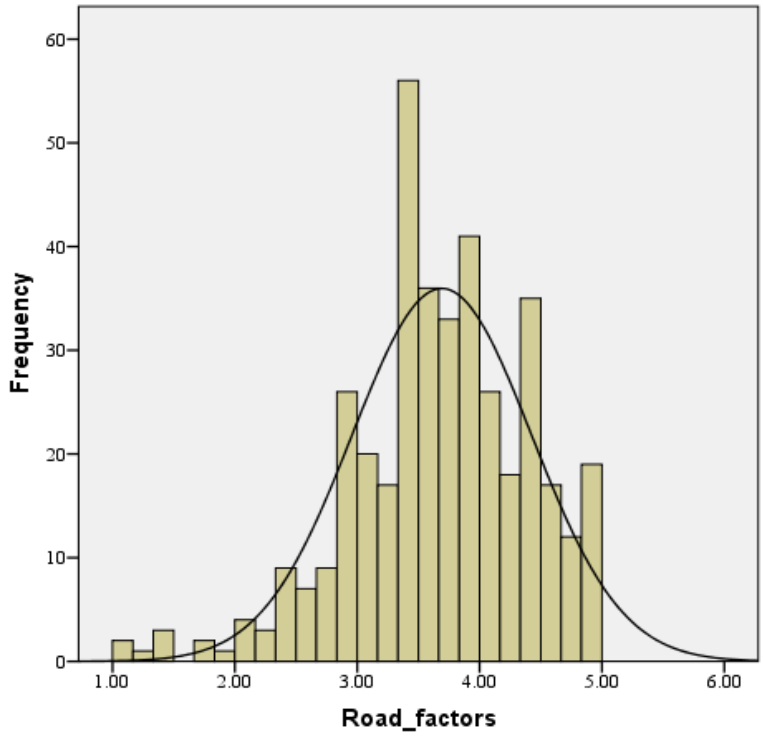

Figure 4.15: Skewness histogram for the road factors group

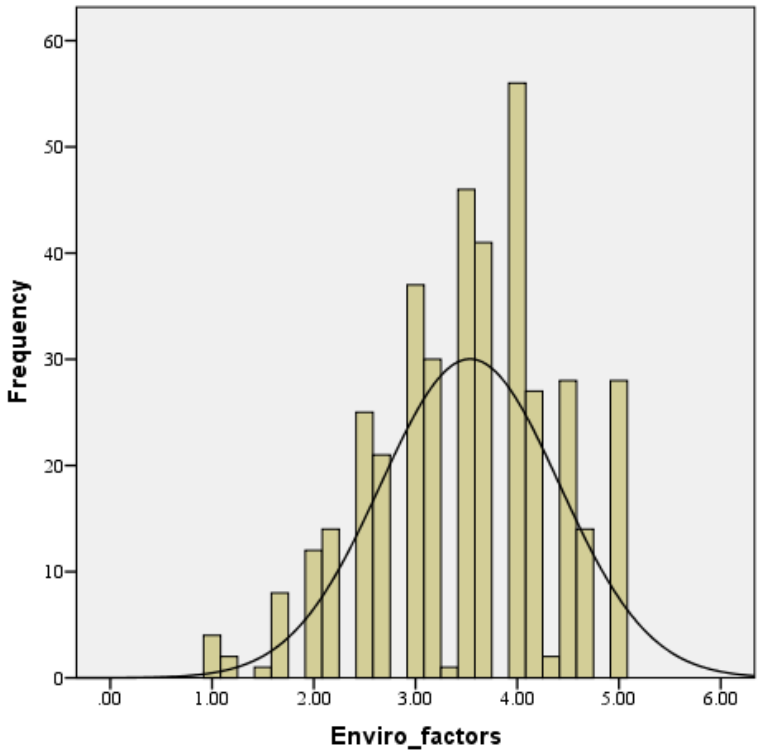

Figure 4.16: Skewness histogram for the environmental factors group

4.6 The Ranking and Analysis of Factors Affecting RTAs

Finding the ranking of the factors affecting RTAs helps to reduce the casualties resulting from these accidents, where through this ranking illustrated which of these factors have significant influences on the RTAs.

4.6.1 Human factors

The Human factors are one of the most critical factors affecting road traffic accidents in Tripoli. The results show that many accidents occur as a result of these factors. Therefore these factors should be considered in particular to reduce these accidents, which leads to minimising the casualties resulting from those accidents. Figure 4.17 shows the human factors which the first group of elements in the questionnaire; this group contains nine factors, where the impact and importance of these factors vary from one factor to another. Hence, these factors were classified according to the significance of each of these factors and their impact on road accidents in Tripoli.

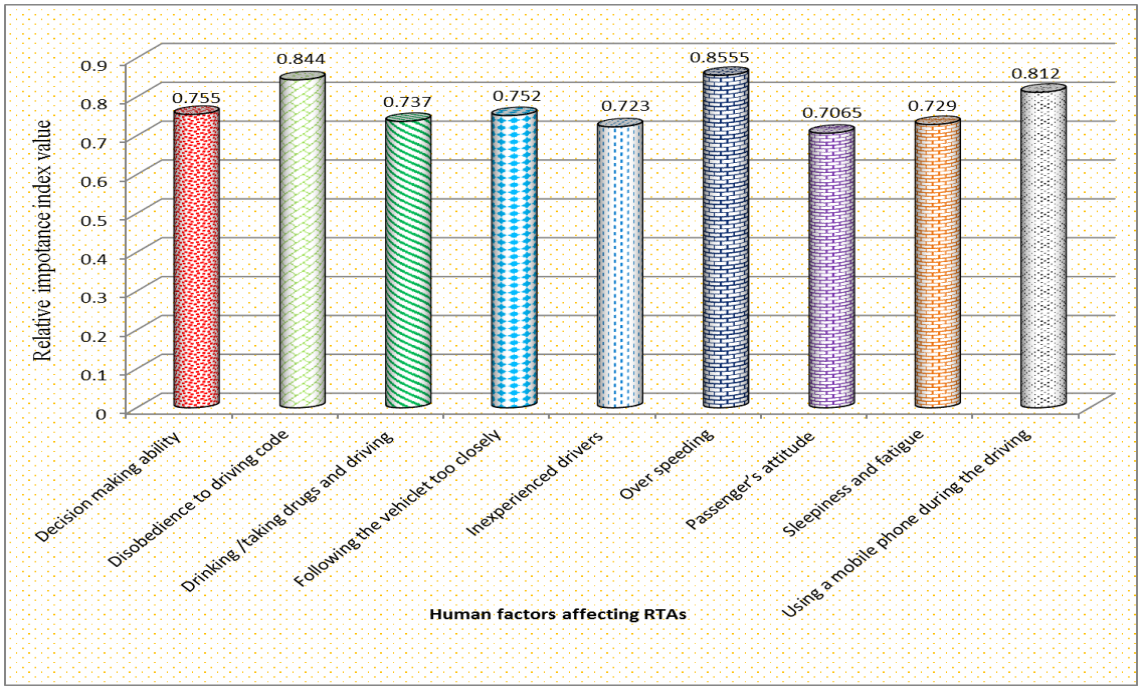

Figure 4.17: Ranking of the human factors group

It was observed from Table 4.14 that over speeding was the most effective factor among the human factors. Also, it has the most effect on the overall groups, which means this factor has a significant impact on the RTAs in Tripoli with a value of RII 0.8555. The second factor which has a considerable effect on RTAs was the disobedience to driving code such as children who are playing with the car on the roads which also ranked as the second overall groups with the RII value of 0.844. In Libya, it a typical behaviour that children are playing with cars on intercity road networks due to the less awareness of kids. Therefore, it is essential to pay attention to these issues. In addition, ignoring the road control devised such as signs and traffic lights which only way to control drivers behaviour on road networks results in many accidents and that causes increase in the injuries and fatalities. Using a mobile phone during driving or crossing streets was as accepted has a significant influence on RTAs, it was ranked the third factor affecting the human factors group, while it ranks as fourth in overall categories with a value of RII was 0.812. Using of mobile phone considered as one of the most critical factors that lead to the occurrence of severe accidents worldwide due to lack of attention to the geometry of roads and objects on the streets during driving.

Table 4.14: Ranking of the human factors group

Factors No.	Factor description	RII	Group	Overall
1	Decision-making ability	0.755	4	9
2	Disobedience to driving code such as children who are playing with the car on the road	0.844	2	2
3	Drinking /taking drugs and driving	0.737	6	13
4	Following the vehicle in front too closely	0.752	5	10
5	Inexperienced drivers	0.723	8	17
6	Over-speeding	0.8555	1	1
7	Passenger's attitude	0.7065	9	22
8	Sleepiness and fatigue	0.729	7	15
9	Using a mobile phone (hands – held) and driving	0.812	3	4

It was observed that the decision making ability (overtaking, breaking, etc.) and following of the in-front vehicle closely was listed as the fourth and fifth rank in the human factors group and ninth and tenth in overall groups, with RII of 0.755 and 0.752 respectively. The decision-making ability is one of the complex behaviours of most of the drivers in Tripoli, the changing in the decision in Libyan cities is a common issue on road networks which lead to increase the number of RTAs. The young drivers a real way trying to show their skills ignoring all the safety and road regulations and driving very close to in front vehicles which lead to increase the number of RTAs. Furthermore, the presence of alcohol and drugs while driving was classified as the sixth factor affecting RTAs in the human factors group, while it is ranked as 13^{th} in the overall with a value of RII 0.737. This due to an increase in alcohol and drugs shipments resulting in the lack of the law due to the palliation issues in the country. Therefore, strict regulations must be taken up to the prison to reduce incidents resulting from these acts.

The Sleepiness and fatigue, inexperienced drivers and passenger's attitude were classified as the last factors in this group, where the ranked in seventh, eighth and ninth with RII of 0.729, 0.723 and 0.706 respectively. The distances inner the city is not that far to make the drivers be under stress that is why this factor has a low impact on the other factors. Also,

inexperienced drivers are not that significant matter since most of the Libyan starts driving at a very young age like 12-13 years old without any driving license, so most of the drives have the initial experience. Regarding passenger's attitude, in recent years the altitude of Libyan drivers enhanced because of blockage of low and the proliferation of weapons inside the city.

4.6.2 Vehicle factors

Vehicle factors contain several factors that might increase the possibility of accidents occurring on the roads in the city of Tripoli, where the importance of these factors varies among each other regarding their impact on RTAs and Figure 4.18 demonstrations the ranking of those factors regarding their importance. From Table 4.15, it was found that poor brake or brake failure has great implications on RTAs as ranked the first factor in the group and fifth factor in the overall categories with RII of 0.808. Furthermore, the faulty light factor is classified as the second factor affecting the RTAs in the group, and fourteenth in overall the groups with RII of 0.73 which means it has a medium effect on the RTAs in Tripoli. Also, the bad tyres were ranked as the third factor affecting RTAs in this group, while it was classified as sixteenth in the overall of the groups with RII of 0.726. From field observation it's well known that the Libyans usually do not care about changing tires unless it explodes, this indicates that they are careless and put their lives at risk due to the possibility of increased risk of accidents due to the tire explosion.

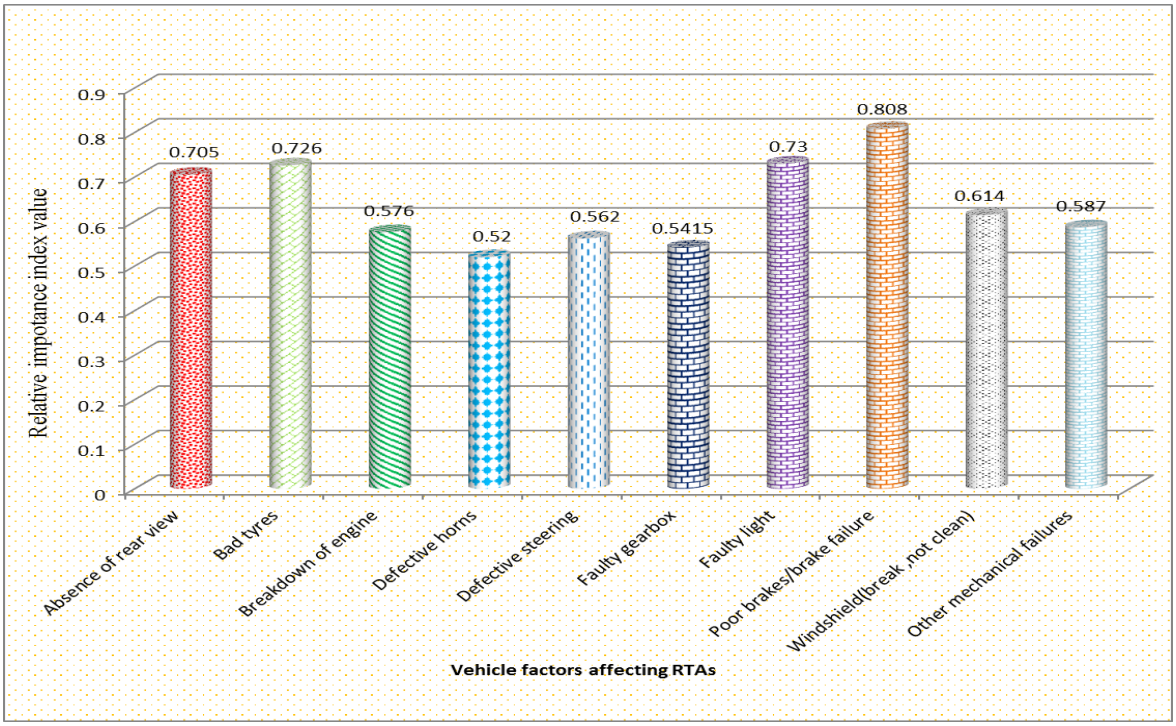

Figure 4.18: Ranking of the vehicle factors group

The absence of rear-view factor was selected as the fourth factor among the vehicle factors affecting RTAs, and it was ranked as 23th in the overall with RII value of 0.705, this indicates that it has a slight impact on RTAs in Tripoli. In addition, the remains factors within this group such as windshield (break, not clean), other mechanical failures, the breakdown of the engine, defective steering, faulty gearbox and horns with RII of 0.614, 0.587, 0.576, 0.562, 0.5415 and0.52 respectively. The RII was less than 0.7, that means they have no sufficient effect on the RTAs in Tripoli. Table 4.15 clarify the importance of the vehicle factors.

Table 4.15: Ranking of the vehicle factors group

Factors NO.	Factor Description	RII	Group	Overall
1	The absence of rear view	0.705	4	23
2	Bad tyres	0.726	3	16
3	Breakdown of engine	0.576	7	30
4	Defective horns	0.52	10	33
5	Defective steering	0.562	8	31
6	Faulty gearbox	0.5415	9	32
7	Faulty light	0.73	2	14
8	Poor brakes/brake failure	0.808	1	5
9	Windshield (break, not clean)	0.614	5	27
10	Other mechanical failures	0.587	6	29

4.6.3 Road factors

The road factors group are one of the groups that affect RTAs in Tripoli, as shown in Table 4.16, this group contains many factors that can increase crashes, which leads to an increase in the percentage of casualties. Consequently, these factors will be discussed due to their impact and importance to road traffic accidents in Tripoli. Table 4.16 signifies the road factors that contained 9 factors. Some of those factors have a great effect on the RTAs while others have a slight impact on it. It was found that poor/no street lighting is located at the first factor has substantial influences in the road factors group, while it was ranked as the 3rd in overall with RII of 0.827. Illuminated roads are one of the critical criteria on the streets to ensure the safety, as it affects the visions of the driver such as field of vision and visual acuity which effect the reaction time of the drivers regardless the eyes diseases and eye-disabilities. Moreover, the insufficient signing was located at the 2nd factor affecting RTAs, and it is ranked as the 6th factor in overall groups with RII0.7875. In Libya, it is well known that the road signs are limited or almost non-existent, and that may lead to many accidents due to the lack of signings especially at curves and turns. Also, the inferior road surface is categorised as the 3rd factor regarding effects on RTAs,and the 7th in the overall groups with RII of 0.785. This factor is having a reasonable impact on the road due to the shortages in maintenance of roads resulting in ratting, fatigue cracking and potholes all those pavement

desire lead to lose control of vehicles with over-speed resulting in an increment of RTAs in Tripoli.

Table 4.16: Ranking of the road factors group

Factors NO.	Factor Description	RII	Group	Overall
1	Poor road surface	0.785	3	7
2	Poor/no street lighting	0.827	1	3
3	Insufficient signing	0.7875	2	6
4	Road humps	0.7625	4	8
5	Regularly roadworks	0.634	8	26
6	Road surroundings (e.g. buildings, fences, vegetation)	0.6115	9	28
7	Animals out of control (e.g. camel, dogs,)	0.717	5	18
8	Road site details (e.g. steep hill, narrow road, bend/winding road, slippery road)	0.7155	7	20
9	Roadway geometrics	0.717	5	18

Also, the road humps factor ranked as the 4th causing factor in the group while it is listed as the 8th in overall groups with RII of 0.7625. The absence of illuminated roads due to the shortage of electric nowadays with over-speed and illegal humps which constructed by residents without following humps standards then the increase in accidents will be an inevitable consequence of all those factors. Further, the roadway geometrics and Animals out of control (e.g., cows, dogs) factors have the same rank (5th) in the road factors group resulted in the same listed in all groups (18th) with 0.717RII. The roadway geometrics is not the main problem, but the lacked signs in the road networks are the primary matter, as the drives will not recognise for example the T-junction of deep left or right curves and allowable speed on the curve which all depends on the experience of the drivers. On the other hand the low in Libya stand with the owners of animals in any collusion, the driver must pay the offence in case of a collision with an animal which leads to careless of the owners regarding controlling their animals. The road site details (e.g., steep hill, narrow road, bend/winding road, slippery road) factor has a slight effect on the RTAs, which is located at the 7th effecting factor in the group and it is ranked as the 20th in overall with RII 0.7155 as shown in Table 4.16. Meanwhile, the factors such as regularly roadworks and the road

surroundings (e.g., buildings, fences, and vegetation) were found to have the values of RII 0.634 and 0.6115 respectively, the value of RII less than 0.7 which means they have no adequate effects on the RTAs in Tripoli. In General, illumination is the very importance to ensure the safety of road user's, and emphasis on street lighting is necessary to reduce accidents. On the other hand, the existence of roads signings one of the sufficient keysto guide the drivers and in the lack of knowledge of the roads networks, while the poor road surface factor also is so crucial in term of efficient on the road traffic accidents, as there are many holes and cracks in the roads, that may lead to the punctured tires and damaged vehicles as well as increase fuel consumption, therefore it is essential to preform a regular maintenance to road networks to prevent accident related to poor road service. As shown in figure 4.19 the ranking of the road factors group.

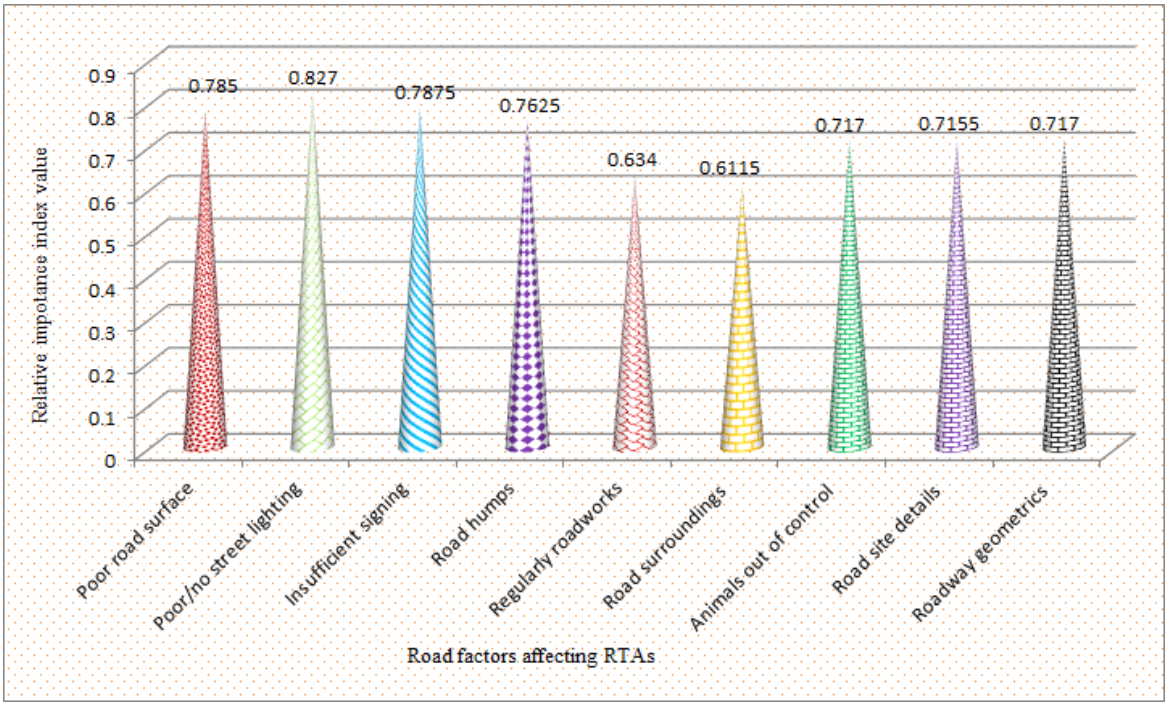

Figure 4.19: Ranking of the road factors group

4.6.4 Environmental factors

The environmental factors group considered as one of the groups that may affect RTAs. This category contains a small number of factors when compared with other groups. However, it provides essential factors which have a significant impact on RTAs in Tripoli. The results displayed in Figure 4.20 show that the glare which the difficulty in seeing in the presence of

bright light factor is the first factor affecting in the environmental factors group and it is ranked as tenth in overall groups with RII 0.752, which indicates a moderate effect on the RTAs.

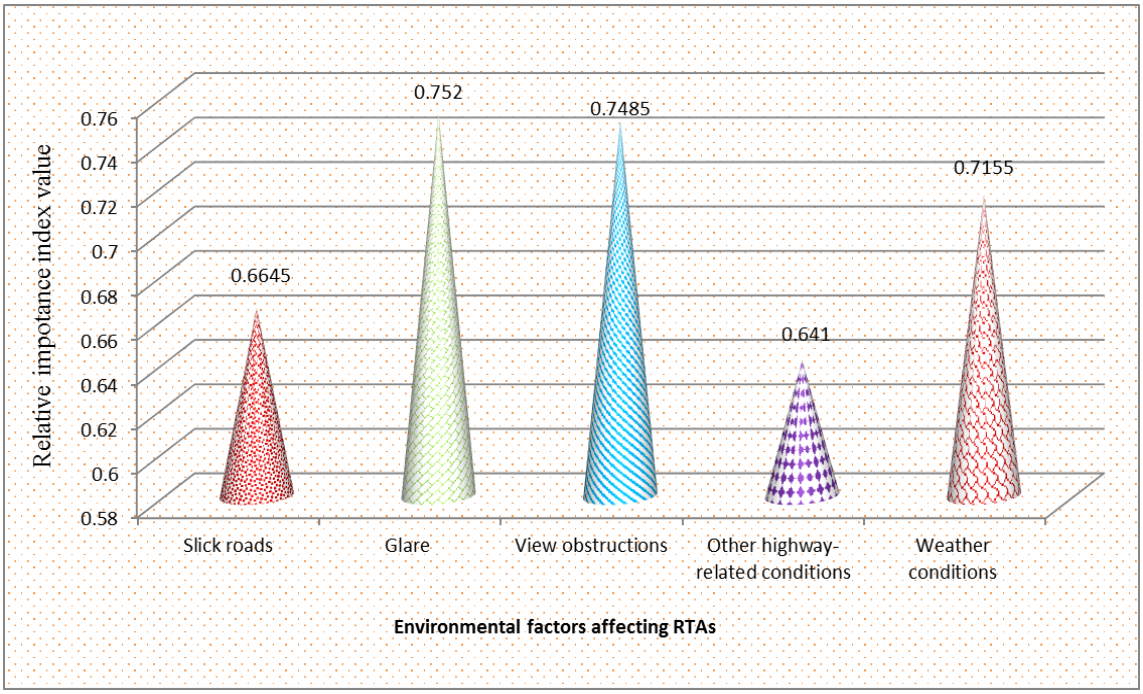

Figure 4.20: Ranking of the environmental factors group

Moreover, the view obstructions factor is found to be the second factor affecting in the environmental and it is ranked as the twentieth in overall the groups with RII of 0.7485 as shown in Table 4.17. The obstructions might prevent vision during driving and cause numerous accidents followed by the weather conditions (Fog, rain, and snow) factor, which ranked the third factor effecting in the environmental factors group, while it is listed as the twentieth in overall with RII of 0.7155. This factor is uncontrollable, but it could be minimised by following the allowable speed on the roads. The evaluation of all factors shows that the relation between the human, vehicles, road and environmental factors have to lead to understanding the increase of RTAs in Tripoli. It shows that the motorists drive with high speed which the first consideration with poor brakes or brake failure as the primary factor result dramatically in loss of control and accidents.

Table 4.17: Ranking of the environmental factors group

Factors No.	Factor Description	RII	group	overall
1	Slick roads	0.6645	4	24
2	Glare (difficulty seeing in the presence of bright light)	0.752	1	10
3	View obstructions	0.7485	2	12
4	Other highway-related conditions	0.641	5	25
5	Weather conditions (e.g. Fog, rain and/or snow)	0.7155	3	20

4.7 Libyan Road Traffic Accidents Report System

The road traffic accidents in Libya are a severe problem that causes many casualties (fatalities and injuries). Also, it has been observed that the data of crashes in Libya are not available as a result of collecting it in traditional methods such as collecting it by writing in a peace of paper and keeping it in the archive. This traditional way may cause loss and damage to the many documents, so it is essential to develop Road Traffic Accidents Report Application (LRTARS) in Libya. This program is assisting traffic officers in data collection in the locations of the accidents, the data collection is all the information of the drivers and vehicles quickly and easily, moreover, the data will be saved database of the system, therefore it can be referred at the time of need with easy way. This software package is used by an application that is downloaded from google store on electronic devices such as smart mobile phones, so the traffic police should get an account from the main office (username and password) and then they will be able to send the traffic accident report to his unite or department.

4.8 Overview of the system

4.8.1 System login

The official interface of the system as shown in Figure 4.21 is known as system login. This page contains the logo of the traffic department and types of account. There are two types of users, namely; general manager and police officer, where each user has different system interface, process and various authorities. In addition, it has recover process if the user forgets his username or password.

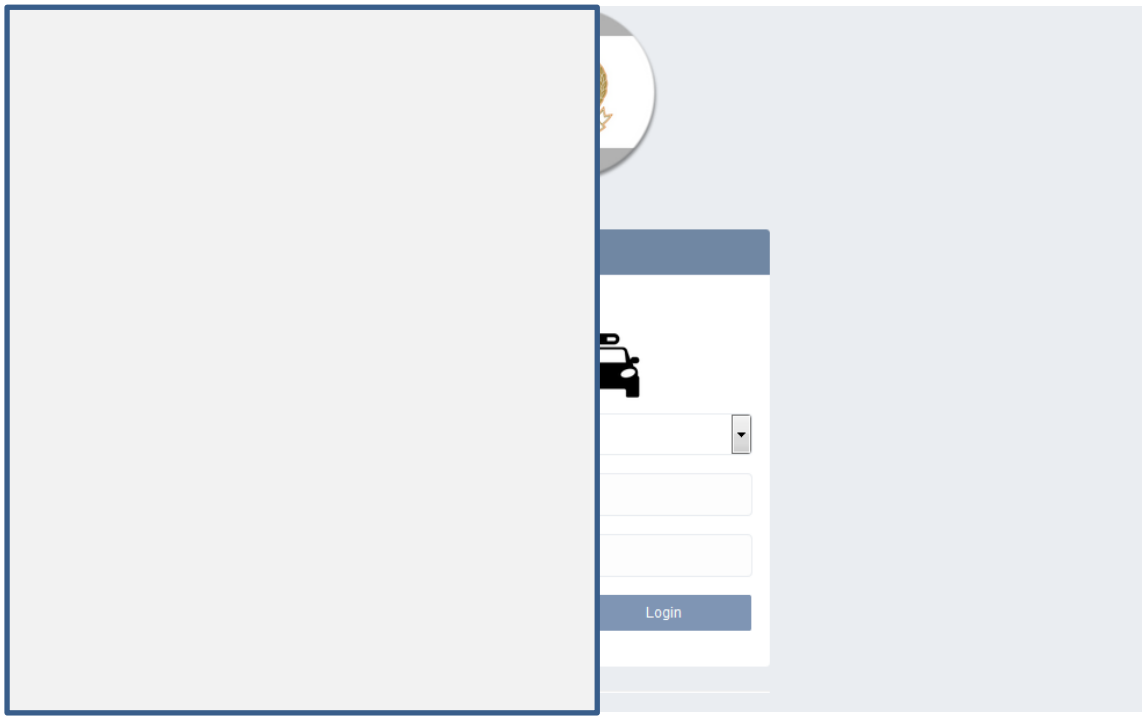

Figure 4.21: Login interface of road traffic accidents report application

4.8.2 General manager

The general manager is the most critical user, he is considered the admin of the whole traffic system, as he has the authority to create main offices and register traffic police officers as well as reviewing all the data in the system. The interface of general manger is as deeply in Figure 4.22.

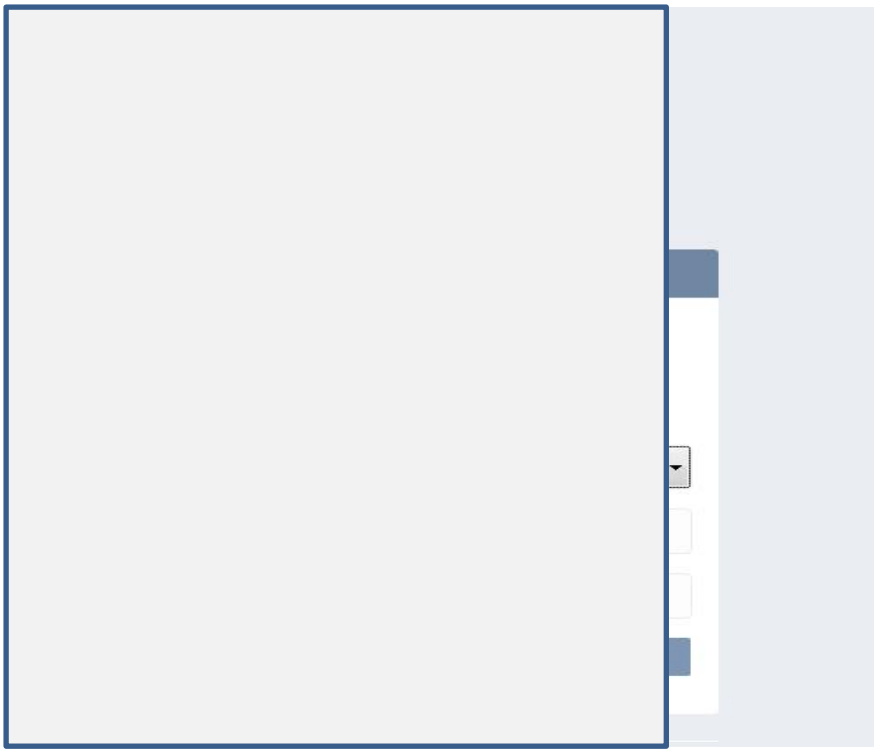

Figure 4.22: General manager login interface

Figure 4.23 shows the main page of the general manager which have five main sections, namely; dashboard, police officer, main office, dormitory and the profile. The dashboard provide quick access to the most important parts, and the first task is to add and manage the main office as shown in Figure 4.24. It is well known that each city has many police station offices and several police officers working under those branches, where the second function is to add each police officer to his branch and provide username and password in order login to the system. In the main office, the required information is the name of office, the location of the office, the contact information such phone number and email of that branch.

Figure 4.23: Manager dashboard

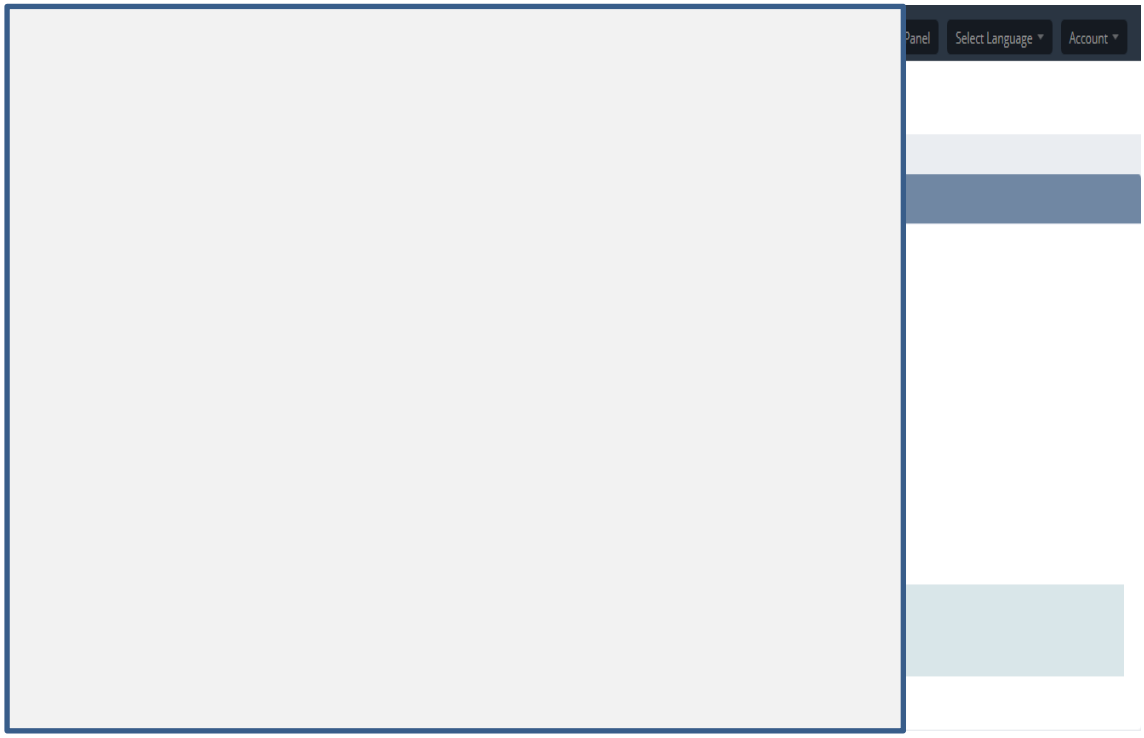

Figure 4.24: Manage the main office in general manager account

The second step is to add the Police officer to the unit that he is registered after selecting the branch as shown in Figure 4.25.

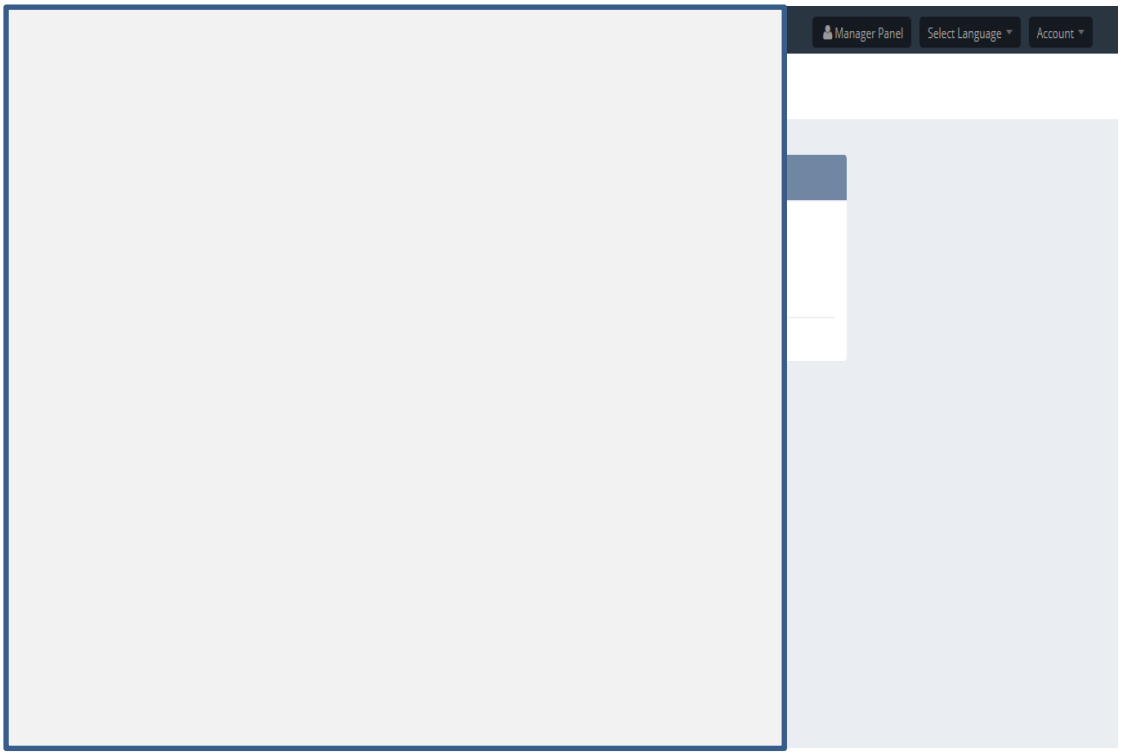

Figure 4.25: Manage the police officer in manager account

In addition, after selecting the brunch, the general manager will add the information of a police officer and create a username and password. Figure 4.26 shows the type of information required to create a username for a police officer is as follows:

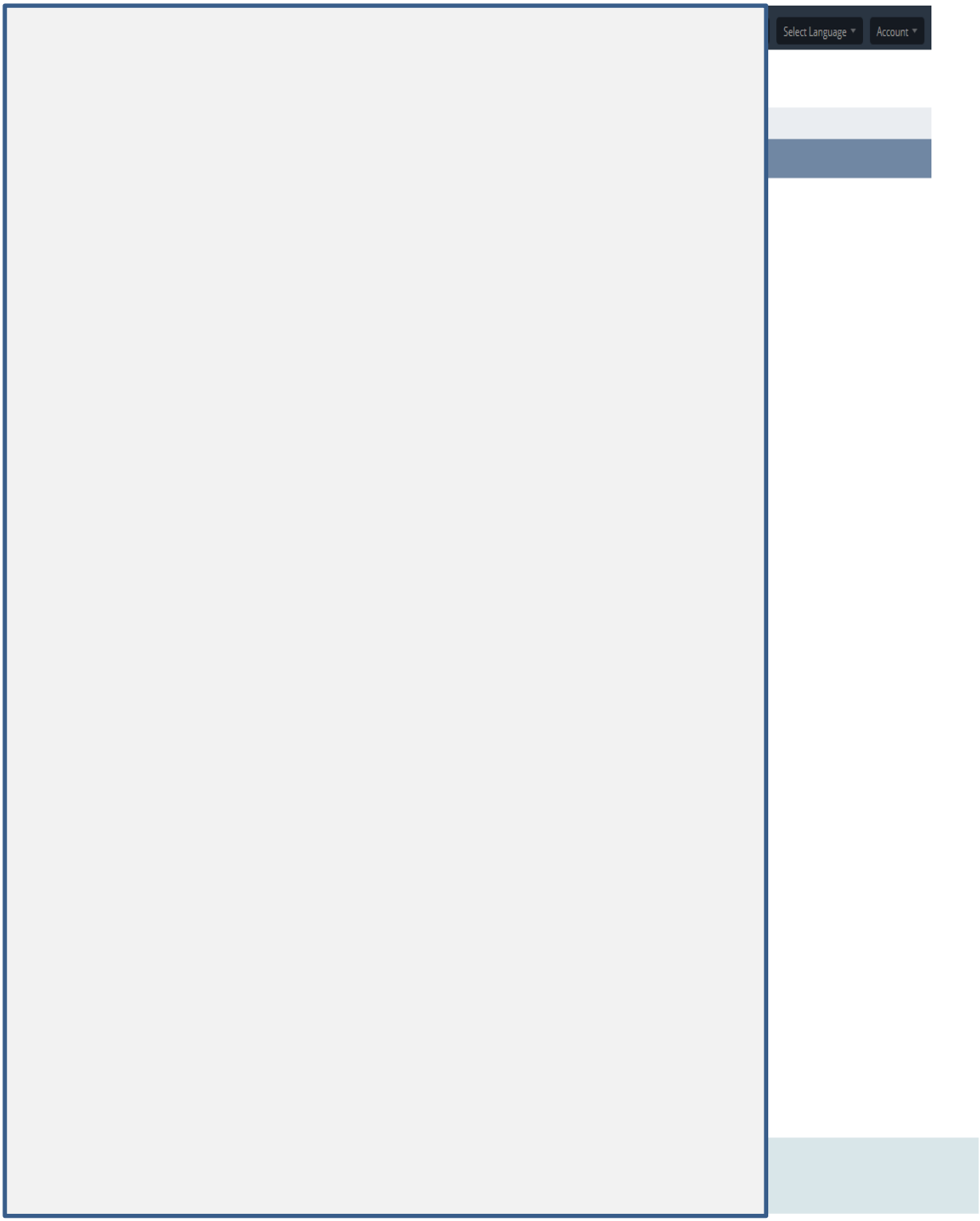

Figure 4.26: Creation of a police officer username account

The last function for the general manager is viewing the data Figure 4.27, as rolling the system as admin, the general manager has authority to display all the data inserted by police officers, but in the same time he can not change or edit any information. Also, he can eliminate any account if the police officer retired, resigned or fired from his work.

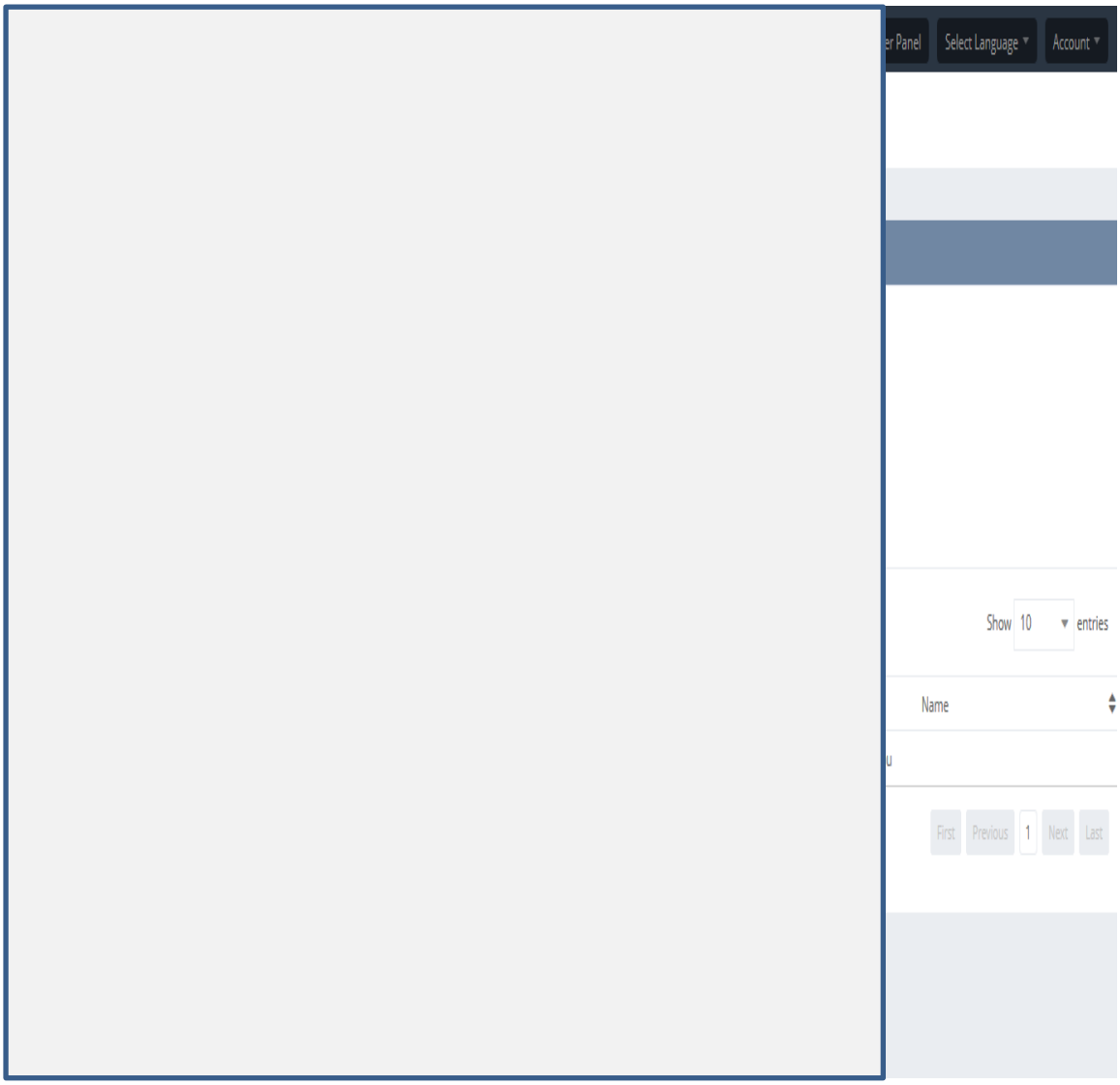

Figure 4.27: Vehicle owner information

4.8.3 Police officer

Figure 4.28 shows the login interface of the traffic police officer using a username and password, and he can recover his account if one of them liosted. The police officers primary user interface (admin dashboard) as showing in Figure 4.29. After the police officer

registered in his unite or branch, then his primary function is to report to his unit the data related to accidents (accidents report) from the location using his device (mobile phone or Tablet). Also, from his profile, he can upload his photo and change his password regarding security.

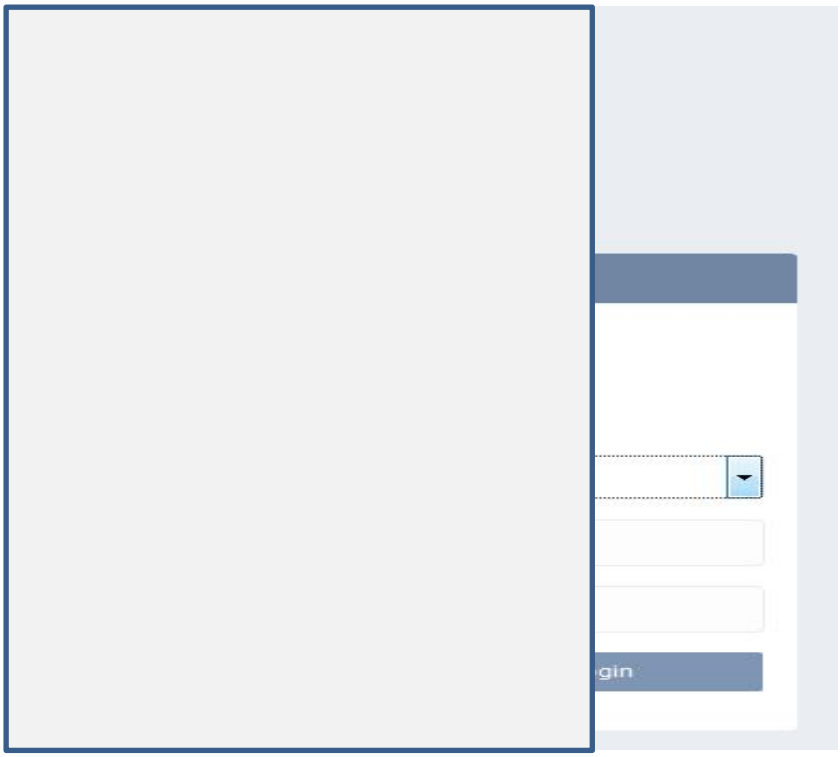

Figure 4.28: Login interface of the traffic police officer

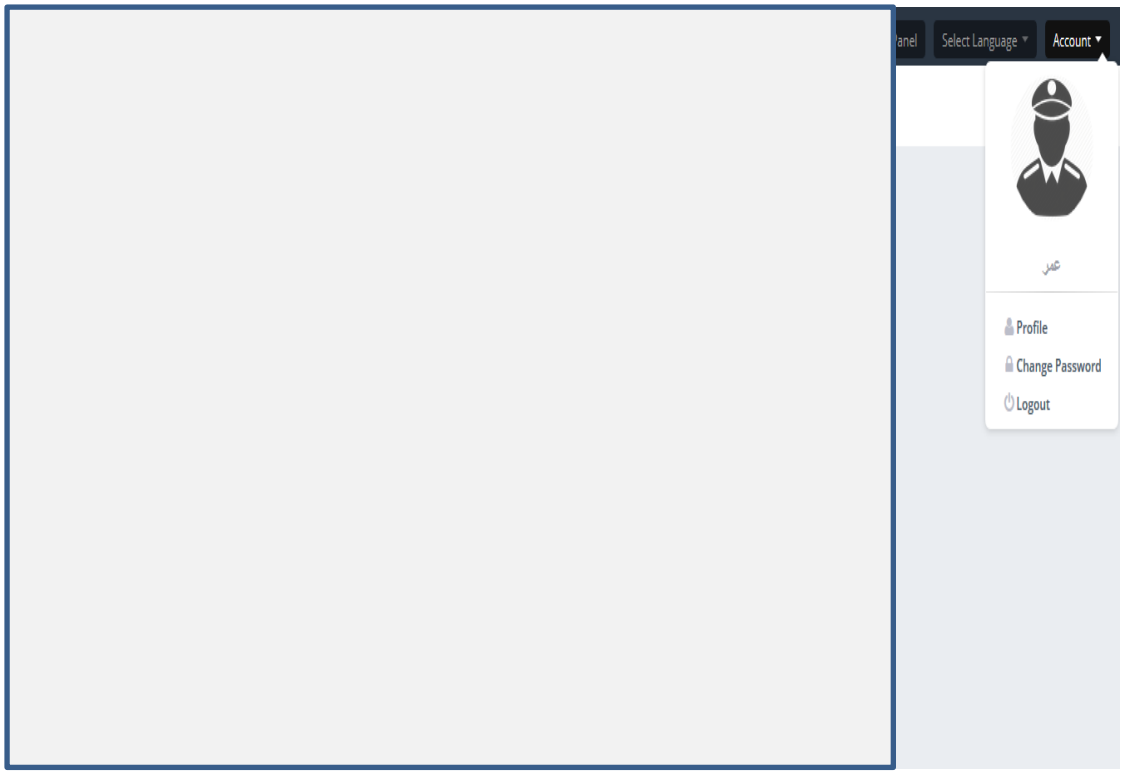

Figure 4.29: Dashboard of a police officer

Moreover, the first step for a police officer as a user in the system to start reporting the data of accident is to insert vehicle driver information as shown in Figure 4.30. The information needed to add in this step is:

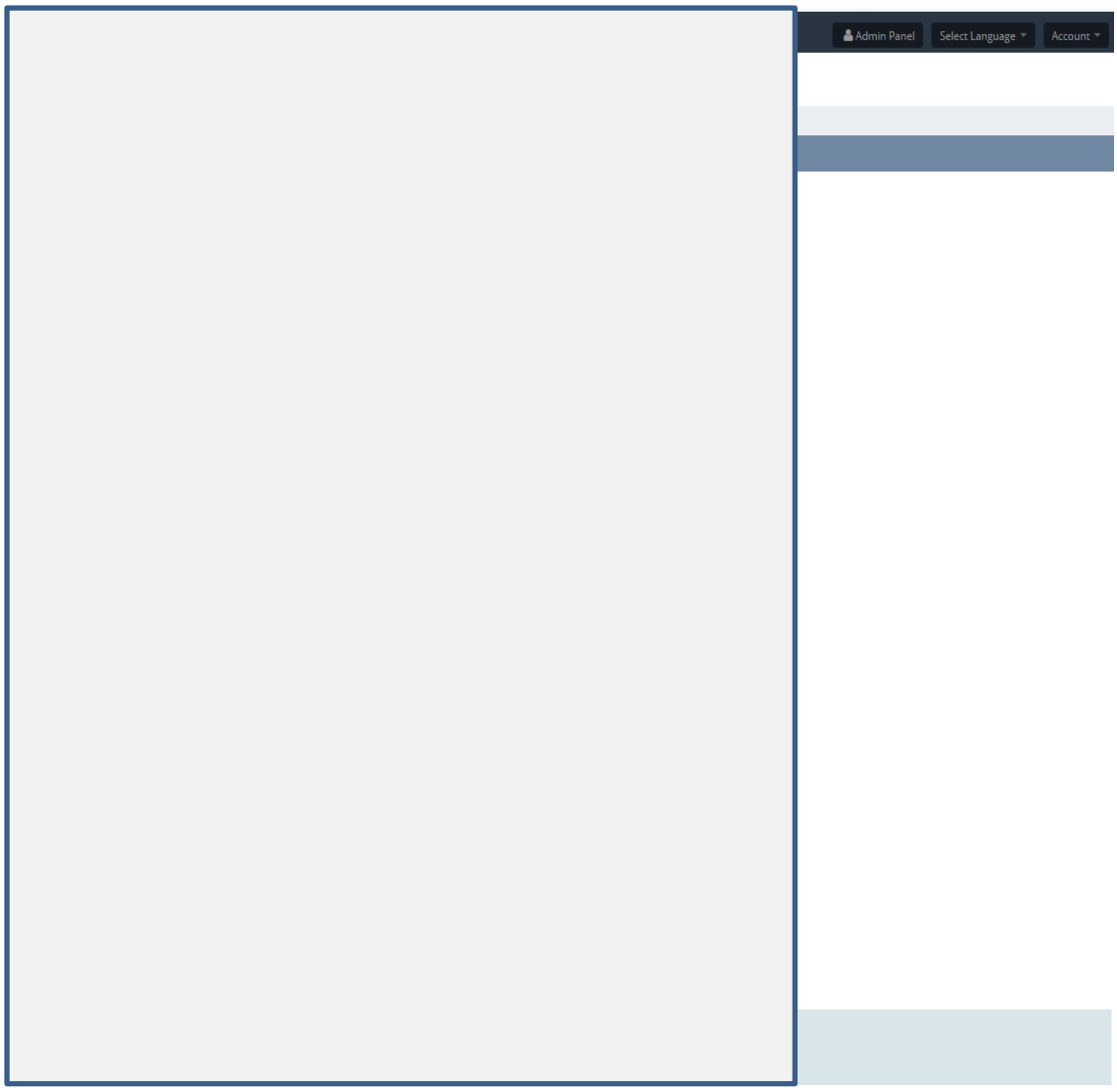

Figure 4.30: Driver information interface

Moreover, The Second step to start reporting is to provide vehicle owner information Figure 4.31. The information required is as following:

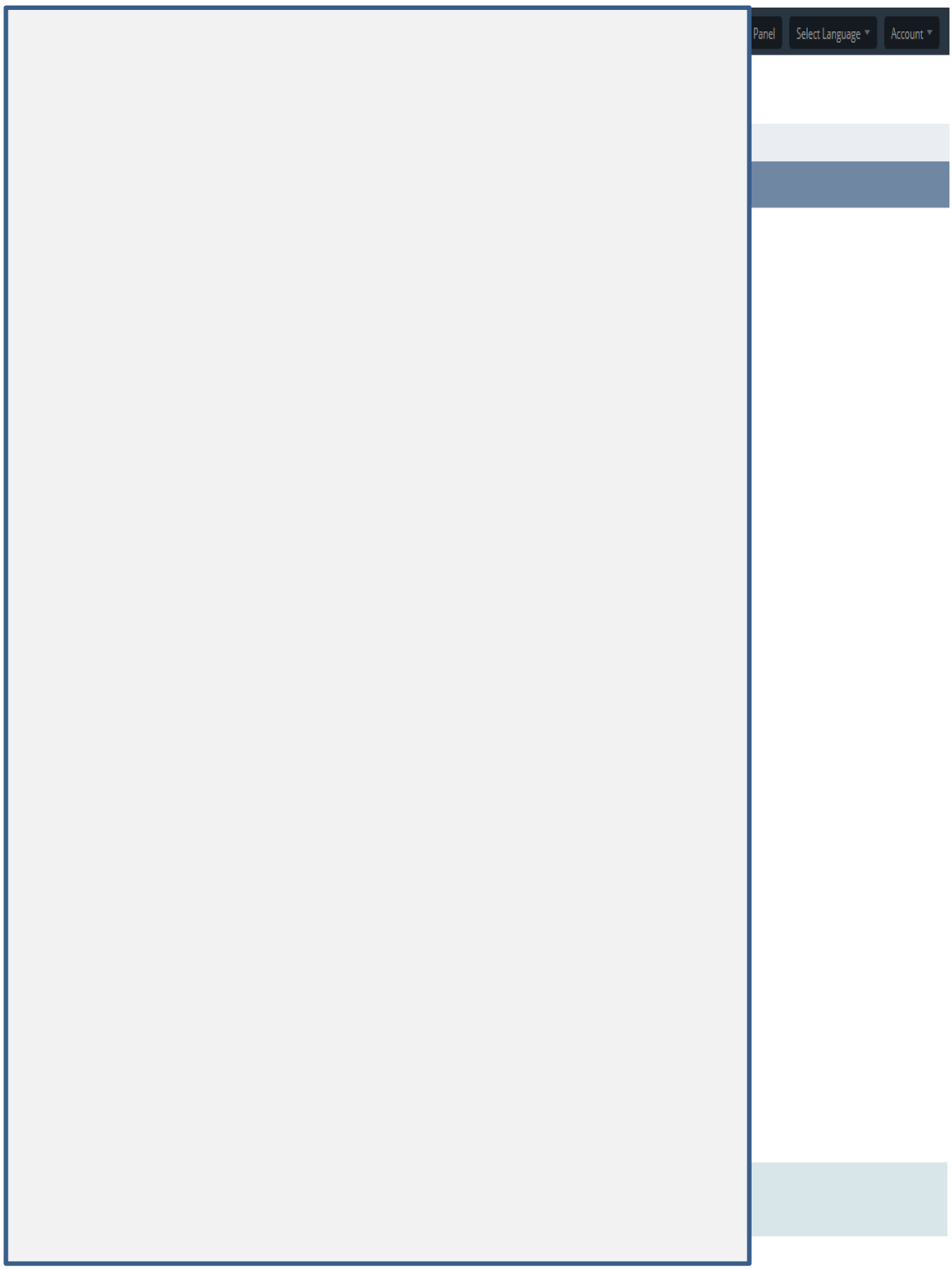

Figure 4.31: Vehicle owner information

The third step in reporting is to provide passenger information as shown in Figure 4.32. This is a critical step in data reporting as it requires to have an idea about all passengers in the vehicles involved in the accident and the following information is provided:

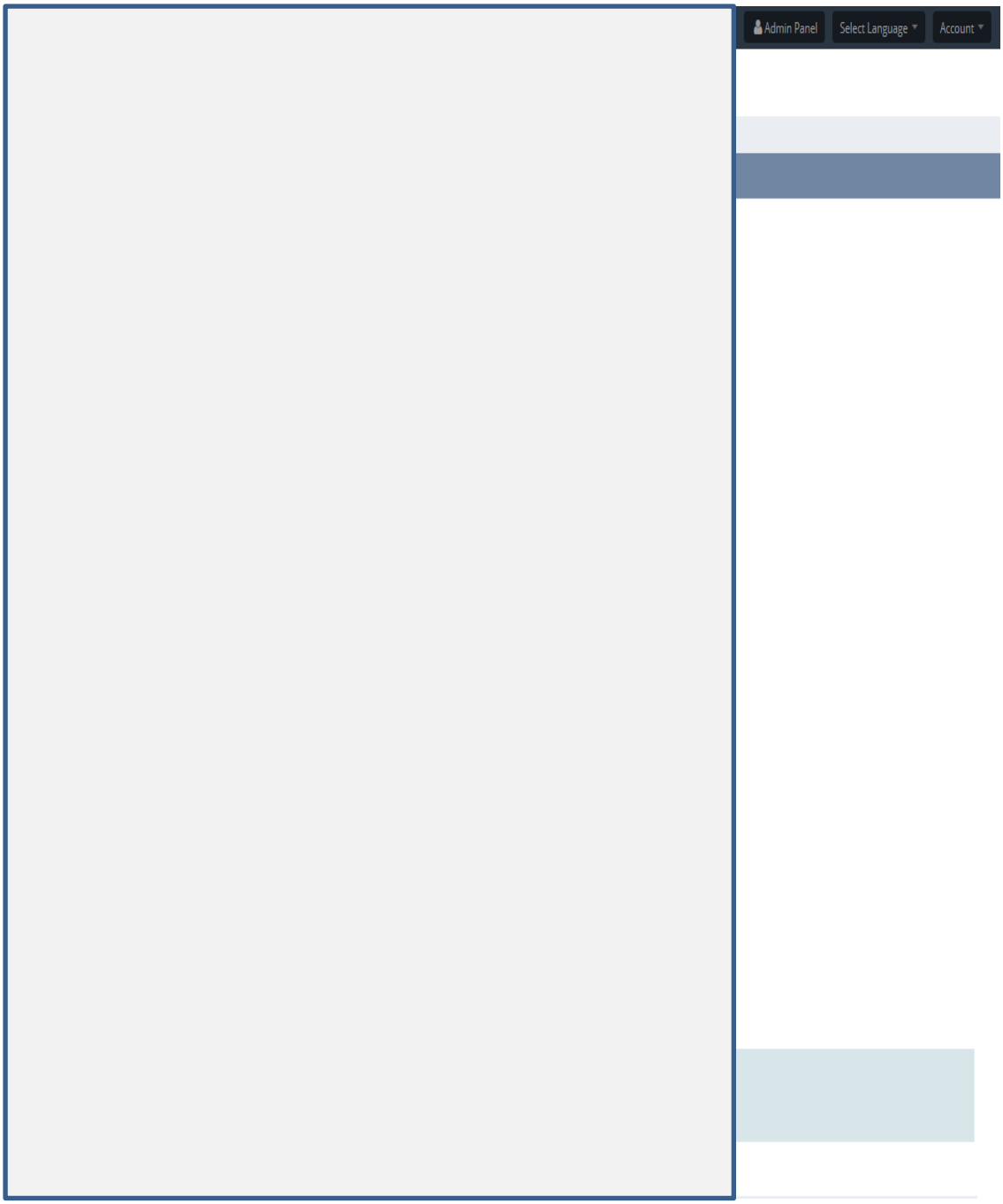

Figure 4.32: Passenger information interface

The fourth data interface for a police officer is accident information. This option also is fundamental to collect the information about the accidents. Figure 4.33 display the required information in this section are:

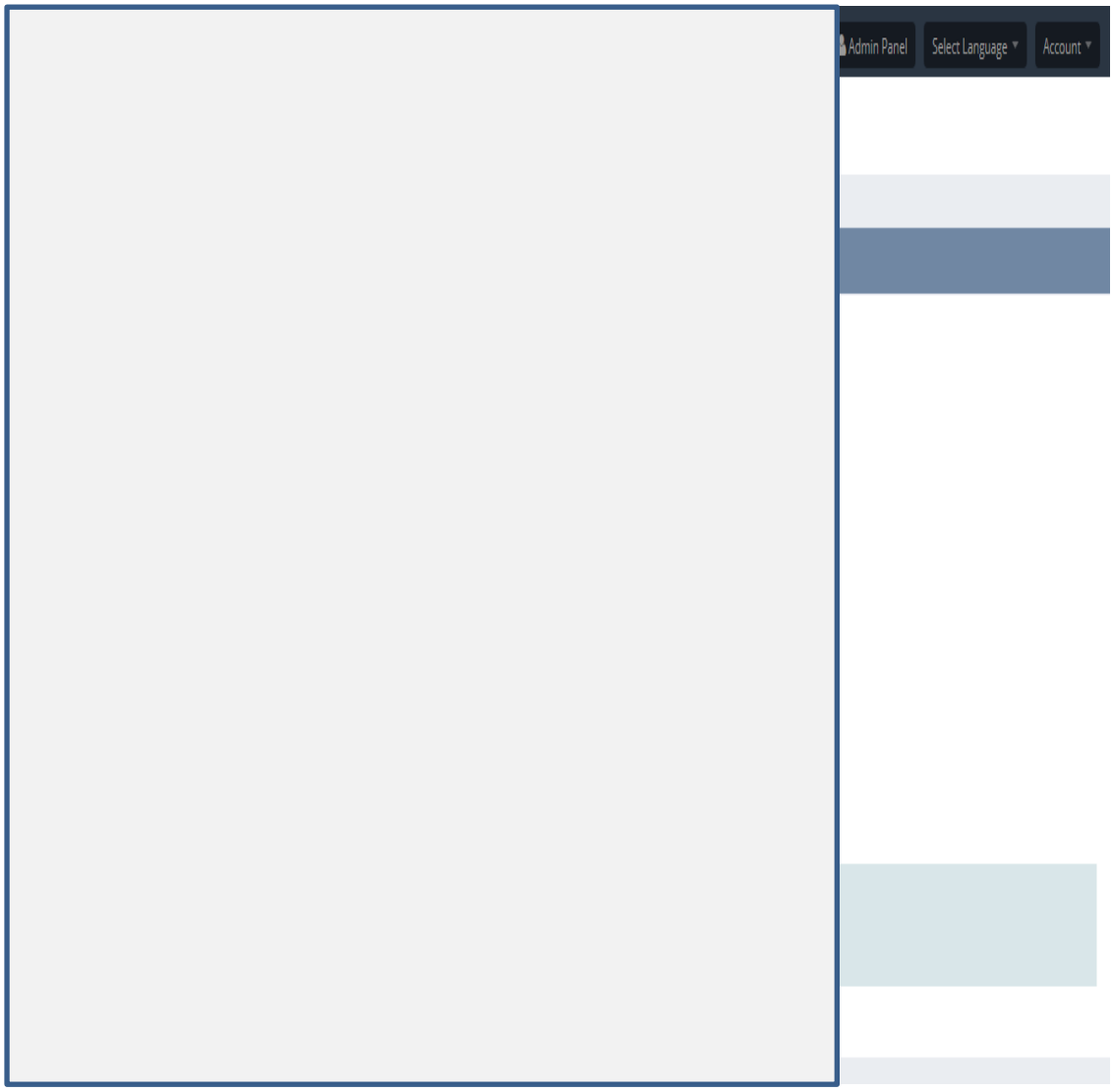

Figure 4.33: Accident information interface

The fifth step to finish the accident report is causes of the accident, in this step Figure 4.34, the police officer will report the cause of the crash. In other words, it shows the factor that leads to traffic accident as it was mentioned that there are four main categories causes RTAs which are Human factors, vehicle factors, road factors and environmental factors. The required information is as follows:

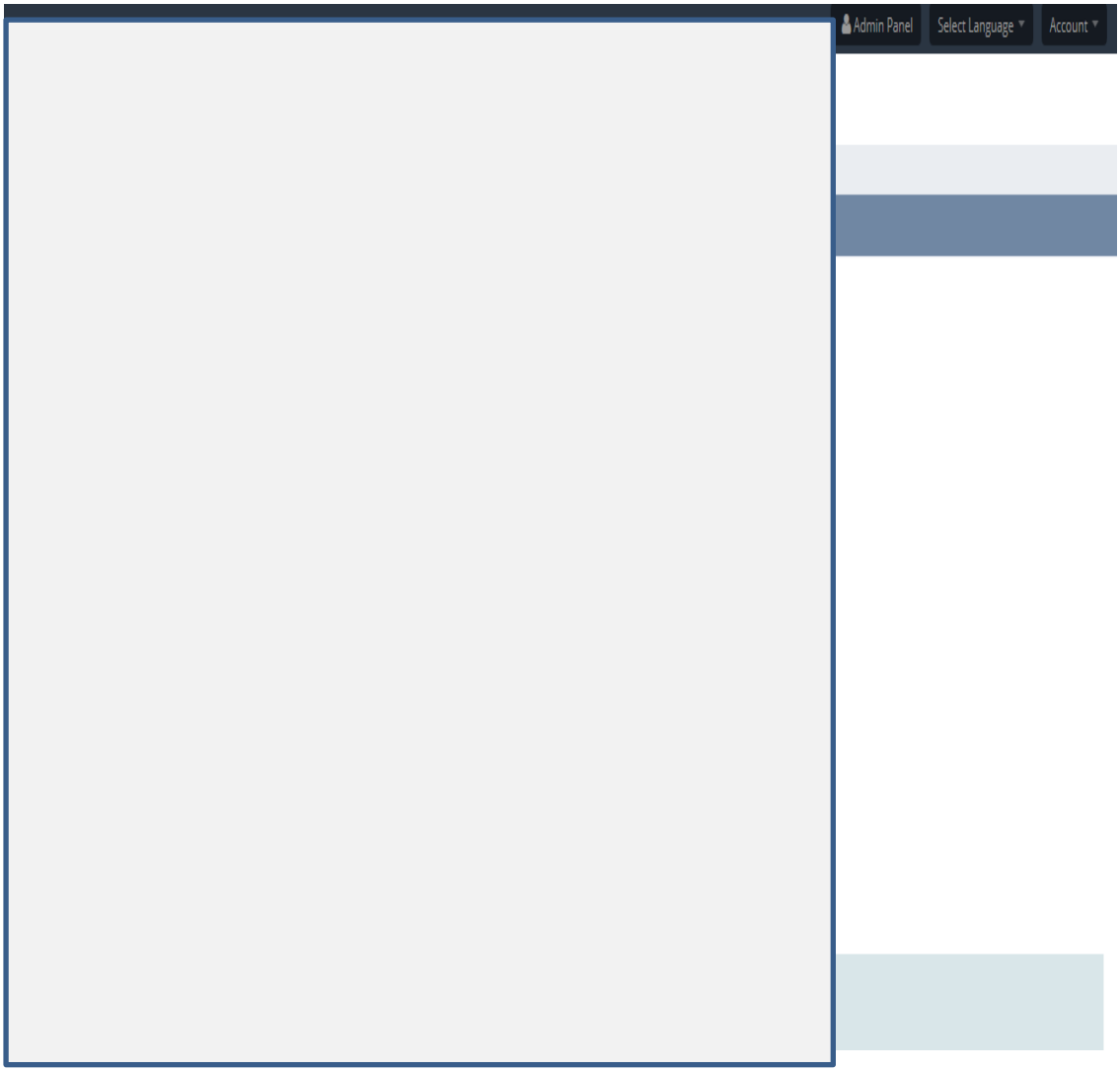

Figure 4.34: Causes of accident interface

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Highway and traffic engineers are working with the law implementation official and instructors in a group effort, to make sure that traffic regulations are imposed and motorists having been educated about their responsibility to drive carefully and to recognise and obey traffic regulations. Highway and traffic engineers also continually involved in functioning to guarantee that the streets and highways system is designed and operated in a way that highway accidents rates might be declined. This includes identifying effective traffic safety countermeasures, developing methodologies for accurately collecting and analysing the data, and determining the effects of safety programs. RTAs in Libya are deliberated as one of the most causes of death and disabilities. Also, the increase in the accidents leads to the exhaustion of the Libyan economy. There are a lot of factors which affect RTAs, where these factors are classified according to four categories the importance of each, these factors are:

- Driver or operator action (human).
- The Vehicle condition.
- Roadway condition.
- The Environmental.

Also, the study included 400 participants, 314 were males, and 86 were females. The response was approximately 100%. Most of the participants were observed to be young. This research performed to classify the factors affecting RTAs in Libya. And develop a system to asses in collecting the data and ensure that all information saved in advance methods. Moreover, it will help the decision makers in Libya to address this issue to minimise or element the RTAs in the city of Tripoli if results are taken into account by stakeholders.

5.2 Conclusion

The results show that the factors differ in their impact on RTAs from one factor to another. Each factor has a specific effect on RTAs, some of them have high effects and lead to increase RTAs, and others have moderate effects while there are some factors with slight impact or without impact on RTAs. Also, the major contributing cause of many crashes as observed in the results is driver error. The human errors leading to highway crashes are related to the complex interaction for the driver's psychological and physiological condition, the system design, and the existing environmental condition. The driver's actions that lead to errors include driving at an inappropriate speed or over speeding which ranked as first among all factors (85%) for existing physical and/or environmental condition, driver inattentiveness, failure to yield the right-of-way, wrongly negotiating curves, the use of mobile phones. Moreover, driver's disobedience to driving code with 84% has significant impacts on the RTAs. The main aim of the traffic engineer regarding human factors in Tripoli networks to ensure the safety is to understand how those factors influence the drivers so that probability of occurrence of these associated safety consequences of these factors is reduced. For examples, in the city of Tripoli rumple strips are placed at side and medians of high-speed roads in rural areas to alert inattentive or sleepy drivers when they are leaving the travel lane.

The mechanical situation of an automobile might be involved in highway crashes which known as vehicle factors group. Faulty breaks in vehicles were the 1st-factor affecting RTAs with more than 80% compared to other factors; this indicates a higher influence on the RTAs. The 2nd influencing was Faulty light with approximately 73% affecting the RTAs followed by other factors such as worn tiers. However, many vehicle manufacturers are now installing in-vehicle equipment that helps to reduce the potential of the vehicle being involved in crashes and/or the severity of a collision when the vehicle is involved in one. These include seat belt reminders, antilock braking systems (ABS), collision avoidance sensor and speed limiter/intelligent speed adaption. In Libyan, due to the political issues and lacking in control the importing of vehicles the condition was not in good condition, which was prohibited before the current situation. In this case, the government should take action to reduce this issues and importing the vehicles which installing all safety equipment. Furthermore, the

quality and the condition of the roads is one of the factors involve the RTAs. As results, the highway needs to be designed to afford adequate stopping sight distance (SSD) at the design speed. Otherwise, the drivers will be incompetent to take remedial actions to evade the accidents. One of the solutions, traffic signs should afford sufficient SSD when the signs go from green to yellow and then to red. In Libya, the pavement surface is in a critical situation and most of the roads need to be reconstructed at the time of maintenance is over. Moreover, the signs should be placed on the importance of the information contained in them and avoiding placing it at the location where they are not necessary or essential. Also, in situations where the required information cannot be placed on one sign or several signs at signs at a single location, the information should be given in portions along the road to reduce the information load. The physical and climatic environment surrounding an automobile are factors occurrence of highway accidents; the most common environmental factor is the weather. Weather conditions are the primary roads accidents contribution the highway, but as shown from the results in the city of Tripoli, it has a slight impact on RTAs. Fog has been caused many sever accidents because vehicles travelling at high speeds are not capable of realising other automobiles have been ahead that may have slowed down or stopped.

5.3 Recommendations for stakeholders

Stakeholders recommendations section will talk about some recommendations that should be taken into consideration for the government, to reduce road traffic accidents in Tripoli, to achieve the objective of this research.

5.3.1 Overspeeding

Over Speed is the most critical factor affecting RTAs in Tripoli, where the majority of respondents considered that speeding has a massive impact on the increase in accidents. Recently, it has also been noted that the rate of accidents has been increased as a result of extreme speed and this has resulted in increased casualties. Hence, the government should increase awareness of the dangers of speed by giving specialists to lectures in high schools and universities to increase awareness of accidents as a result of excessive speed. Moreover, the government should also install speed-monitoring cameras in all places, as well as

increase traffic campaigns and punish those who exceed the speed limit with high fines that may reach to high penalties and withdrawal of license**.**

5.3.2 Using a mobile phone

The handling of mobile phones during driving is one of the reasons for the increase in RTAs. Hence, awareness campaigns should be conducted regarding the dangers of using phones while driving, also not being lenient in performing traffic violations. Additionally, use of a mobile phone for pedestrians while crossing the roads leads to increased accidents; pedestrians must be alerted and warned not to use the phones while crossing the roads.

5.3.3 Drinking /Taking drugs while driving

Drinking alcohol or taking drugs is a factor that affects road accidents. The Libyan society does not accept such acts because alcohol and drugs are highly prohibited, so the driver becomes abnormal, and this affects his behaviour on the roads and how he is driving. It is not safe to drive under the effect of alcohol and drugs. Also, the police should ask drivers to carry a breath analysis while driving to make sure the drivers are not drunk.

5.3.4 Getting the license in Libya

Obtaining a driver's license in Libya has become very easy so that it reached the stage where the driver's license can be obtained without a driving test. Either paying a bribe to a traffic man or knowing someone in the traffic department that leads to many crimes regarding increasing accident rates thus increasing the proportion of casualties. Hence, the emphasis should be on the issue of obtaining driving licenses. So the traffic man participatory in giving the license without an exam should be expelled.

5.3.5 Vehicle maintenance

The government should consider the emphasis on the technical inspection of vehicles periodically. So the drivers should pay attention to the maintenance of cars regularly because neglecting the maintenance of the car increases the rate of accidents due to the sudden failure of one of the components of the vehicle. Causing the lack of control of the vehicle, for example, the explosion of tires or disable the gear axis or brake failure.

5.3.6 The road network in Libya needs to be improved

Most of the participants considered that the roads in Libya are terrible and need many improvements. The government should pay attention to these roads regarding providing functional lighting. The government should also ensure a good quality of the road surfaces and make the periodic maintenance of these roads. Also, providing road signs and especially roads linking cities.

5.3.7 Public transportation

The public transport system in Libya is inadequate and almost is non-exist, which leads to an increase in the percentage of vehicles, resulting in increased traffic congestion and increased accidents. The government should concern to public transport, establish trains and an excellent public transport system to reduce RTAs.

5.3.8 Provide pedestrian footpaths and pedestrian signals

It is essential for the government to offer pedestrian footpaths and pedestrian signals that will cause reducing in the RTAs.

5.3.9 Raising the fines would reduce driver violations

The emphasis on increasing financial penalties leads to a reduction of the driver violation, therefore minimising the RTAs causing driver violations.

5.3.10 Road safety education

It is essential to have road safety education courses for drivers, passengers, or pedestrian at the school level.

5.4 Recommendations for Future work

- It is recommended to carry out a study of road traffic accidents in the whole country after the LRTARS installed.
- The ministry of transportation should review all roads network in the country regarding geometric design, Sight distance and illumination.
- It's recommended to review all procedures that followed to issue the driver licenses.

REFERENCES

Abuhamoud, M. A. A., & Rahmat, R. A. O. K. (2010). Influencing modal shift to public transport for sustainable urban development in Tripoli (Libya). In *Computer and Automation Engineering (ICCAE), 2010 The 2nd International Conference on* (Vol. 4, pp. 72–75). IEEE.

Af Wåhlberg, A. E. (2008). Driver celeration behaviour and accidents–an analysis. *Theoretical Issues in Ergonomics Science*, *9*(5), 383–403.

Ahmed, I. (2013). Road infrastructure and road safety. *Transport and Communications Bulletin for Asia and the Pacific*, *83*, 19–25.

Alexander, J., Barham, P., & Black, I. (2002). Factors influencing the probability of an incident at a junction: results from an interactive driving simulator. *Accident Analysis & Prevention*, *34*(6), 779–792.

Ameratunga, S., Hijar, M., & Norton, R. (2006). Road-traffic injuries: confronting disparities to address a global-health problem. *The Lancet*, *367*(9521), 1533–1540.

Bener, A., Hussain, S. J., Al Malki, M. A., Shotar, M. M., Al Said, M. F., & Jadaan, K. S. (2010). Road traffic fatalities in Qatar, Jordan and the UAE: estimates using regression analysis and the relationship with economic growth.

Chen, G. (2010). Road traffic safety in African countries–status, trend, contributing factors, countermeasures and challenges. *International Journal of Injury Control and Safety Promotion*, *17*(4), 247–255.

Cornelissen, M., Salmon, P. M., McClure, R., & Stanton, N. A. (2013). Using cognitive work analysis and the strategies analysis diagram to understand variability in road user behaviour at intersections. *Ergonomics*, *56*(5), 764–780.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

De Oña, J., Mujalli, R. O., & Calvo, F. J. (2011). Analysis of traffic accident injury severity on Spanish rural highways using Bayesian networks. *Accident Analysis & Prevention*, *43*(1), 402–411.

EUROPA. (2006). The European Road Safety Observatory.

Fernando, D., Vadysinghe, A., Sudasinghe, N., & Premasinghe, K. (2012). Use of seat belts: prior to the legal requirement. *Sri Lanka Journal of Forensic Medicine, Science & Law*, *2*(2).

George, D., & Mallery, P. (2003). Frequencies. *SPSS for Windows Step by Step: A Simple Guide and Reference*, *11*, 20–52.

Gogtay, N. J. (2010). Principles of sample size calculation. *Indian Journal of Ophthalmology*, *58*(6), 517.

Hammoudi, A. Al. (2014). Causes and strategies to reduce road traffic accidents in Abu Dhabi. Cardiff Metropolitan University.

Harper, S., Strumpf, E., Burris, S., Davey Smith, G., & Lynch, J. (2012). Do Mandatory Seat Belt Laws Affect Socioeconomic Inequalities in Seat Belt Use?

Híjar, M., Arredondo, A., Carrillo, C., & Solórzano, L. (2004). Road traffic injuries in an urban area in Mexico: An epidemiological and cost analysis. *Accident Analysis & Prevention*, *36*(1), 37–42.

Hokoma, R., & Bindra, S. (2010). Libyan Railway: A Gateway to Europe. In *Libyan International Railways Exhibition & Conference, LIREX, Tripoli, Libya*.

Ismail, A., & Yahia, H. A. M. (2011). *Causes and effects of road traffic accidents in tripoli–Libya*. ISBN 978-602-8605-08-3.

ISMEIK, M., JREW, B., & ABBAS, N. (2010). Development of Driver Behavior's Accident Prediction Models. *International Journal of Natural & Engineering Sciences*, *4*(3).

James Mearkle, P. E. (2009). Road safety fundamentals. *Cornell Local Roads Program*.

Jegede, F. J. (1988). Spatio-temporal analysis of road traffic accidents in Oyo State, Nigeria. *Accident Analysis & Prevention*, *20*(3), 227–243.

Jorgensen, S. H., & Abane, A. M. (1999). A comparative study of urban traffic accidents in developing and developed countries: Empirical observations from Trondheim (Norway) and Accra (Ghana). *Bulletin of the Ghana GeographicalAssociation*, *21*(1), 121–137.

Kashani, A. T., Shariat-Mohaymany, A., & Ranjbari, A. (2012). Analysis of factors associated with traffic injury severity on rural roads in Iran. *Journal of Injury and Violence Research*, *4*(1), 36.

Kong, L. B., Lekawa, M., Navarro, R. A., McGrath, J., Cohen, M., Margulies, D. R., & Hiatt, J. R. (1996). Pedestrian-motor vehicle trauma: an analysis of injury profiles by age. *Journal of the American College of Surgeons*, *182*(1), 17–23.

Koushki, P. A., Ali, S. Y., & Al-Saleh, O. (1998). Road traffic violations and seat belt use in Kuwait: Study of driver behavior in motion. *Transportation Research Record: Journal of the Transportation Research Board*, (1640), 17–22.

Lankarani, K. B., Heydari, S. T., Aghabeigi, M. R., Moafian, G., Hoseinzadeh, A., & Vossoughi, M. (2014). The impact of environmental factors on traffic accidents in Iran. *Journal of Injury and Violence Research*, *6*(2), 64.

Li, Y., Xie, D., Nie, G., & Zhang, J. (2012). The drink driving situation in China. *Traffic Injury Prevention*, *13*(2), 101–108.

Mackenbach, J. P., Kunst, A. E., Cavelaars, A. E. J. M., Groenhof, F., Geurts, J. J. M., & Health, E. U. W. G. on S. I. in. (1997). Socioeconomic inequalities in morbidity and mortality in western Europe. *The Lancet*, *349*(9066), 1655–1659.

Makinde, O. O., & Opeyemi, D. A. (2012). Understanding of traffic signs by drivers–A case of Akure city, Ondo State, Nigeria. *ARPN Journal of Science and Technology*,*2*(7), 608–612.

McSweeney, C., Lizcano, G., New, M., & Lu, X. (2010). The UNDP Climate Change Country Profiles: Improving the accessibility of observed and projected climate information for studies of climate change in developing countries. *Bulletin of the American Meteorological Society*, *91*(2), 157–166.

Mekky, A. (1984). Road traffic accidents in rich developing countries: the case of Libya. *Accident Analysis & Prevention*, *16*(4), 263–277.

Moen, B.-E., & Rundmo, T. (2006). Perception of transport risk in the Norwegian public. *Risk Management*, *8*(1), 43–60.

Muijs, D. (2010). *Doing quantitative research in education with SPSS*. Sage.

Nellthorp, J., Bristow, A., & Mackie, P. (2005). Developing guidance on the valuation of transport-related noise for inclusion in WebTAG. In *seminar "Valuing Transport Related Noise"(May 17th 2005), Department for Transport, London*.

Nellthorp, J., Mackie, P. J., & Bristow, A. L. (2003). Measurement and Valuation of the Impacts of Transport Initiatives, Deliverable D9, EUNET Project, EI Fourth Framework RTD Programme. *ITS, University of Leeds, Leeds, UK*.

Odugbemi, O. O. (2015). Road Transportation and Tourism in Nigeria. Joja Press, Lagos.

Ogundele, O. J., Ifesanya, A. O., Adeyanju, S. A., & Ogunlade, S. O. (2013). The impact of seat-belts in limiting the severity of injuries in patients presenting to a university hospital in the developing world. *Nigerian Medical Journal: Journal of the Nigeria Medical Association*, *54*(1), 17.

World Health Organization. (2004). Global status report on road safety. *Injury Prevention*, August),18.https://doi.org/http://www.who.int/violence_injury_prevention/road_safety_status/2013/en/index.html

World Health Organization. (2009). *Global status report on road safety: time for action*. World Health Organization.

Paine, M. G. M., & Magedara, N. (2007). The role of tyre pressure in vehicle safety, injury and environment. *Road Safety Solutions*.

Pucher, J., & Dijkstra, L. (2003). Promoting safe walking and cycling to improve public health: lessons from the Netherlands and Germany. *American Journal of Public Health*, *93*(9), 1509–1516.

Qhtani, A. M., & Al Fassam, A. N. (2011). Ar Riyadh Geospatial urban information system and metropolitan development strategy for Ar Riyadh. In *ESRI international user conference* (pp. 1–26).

Rimola, J., Ordás, I., Rodriguez, S., García-Bosch, O., Aceituno, M., Llach, J., … Panés, J. (2011). Magnetic resonance imaging for evaluation of Crohn's disease: validation of parameters of severity and quantitative index of activity. *Inflammatory Bowel Diseases*, *17*(8), 1759–1768.

Rumar, K. (1999). Transport safety visions, targets and strategies: beyond 2000. *1st European Transport Safety Lecture. European Transport Safety Council, Brussels, Tech. Rep*.

Sabbour, S. M., & Ibrahim, J. M. (2010). Driving behaviour, driver style and road traffic accidents among young medical group. *Injury Prevention*, *16*(1), A33.

Shankar, V., Mannering, F., & Barfield, W. (1995). Effect of roadway geometrics and environmental factors on rural freeway accident frequencies. *Accident Analysis & Prevention*, *27*(3), 371–389.

Shen, X., Yan, Y., Li, X., Xie, C., & Wang, L. (2014). Analysis on tank truck accidents involved in road hazardous materials transportation in China. *Traffic Injury Prevention*, *15*(7), 762–768.

Shibata, A., & Fukuda, K. (1994). Risk factors of fatality in motor vehicle traffic accidents. *Accident Analysis & Prevention*, *26*(3), 391–397.

Shinar, D., Schechtman, E., & Compton, R. (2001). Self-reports of safe driving behaviors in relationship to sex, age, education and income in the US adult driving population. *Accident Analysis & Prevention*, *33*(1), 111–116.

Stanojević, P., Jovanović, D., & Lajunen, T. (2013). Influence of traffic enforcement on the attitudes and behavior of drivers. *Accident Analysis & Prevention*, *52*, 29–38.

Transport, D. of I. and. (2009). *International Road Safety Comparisons*. Canberra, Australia.

Violence, W. H. O., Prevention, I., & Organization, W. H. (2015). *Global status report on road safety 2015: supporting a decade of action*. World Health Organization.

Vlahogianni, E. I. (2013). Modeling duration of overtaking in two lane highways. *Transportation Research Part F: Traffic Psychology and Behaviour*, *20*, 135–146.

WHO. (2009). *European status report on road safety*. WHO Regional Office for Europe.

Yahia, H. A. M., Ismail, A., Albrka, S. I., Almselati, A. S., & Ladin, M. A. (2014). Attitudes and awareness of traffic safety among drivers in Tripoli-Libya. *Research Journal of Applied Sciences, Engineering and Technology*, *7*(24), 5297–5303.

Yan, X., Radwan, E., & Guo, D. (2007). Effects of major-road vehicle speed and driver age and gender on left-turn gap acceptance. *Accident Analysis & Prevention*, *39*(4), 843–852.

Yitmen, I., Sevay, H., Taneri, C., & Yalçıner, H. (2006). An expert system for quantifying the impact of change orders on project performance.

Zeng, X. H., & Gao, Y. (2013). An Optimized Algorithm for Advanced Vehicle Anti-Lock Braking System. In *Advanced Materials Research* (Vol. 791, pp. 1489–1492). Trans Tech Publ.

Zimmerman, K., Mzige, A. A., Kibatala, P. L., Museru, L. M., & Guerrero, A. (2012). Road traffic injury incidence and crash characteristics in Dar es Salaam: a population based study. *Accident Analysis & Prevention*, *45*, 204–210.

APPENDICES

APPENDIX 1

DRIVERS, PASSENGERS AND PEDESTRIANS QUESTIONNAIRE

Invitation Letter

I am Faris Ahmed Abdulfatah Elturki, a master student at Near East University, Currently conducting research entitled“Investigation of Factors affecting road traffic accidents (Case study Tripoli, Libya)”.This study is investigating the factors that affect the road traffic accidents in Tripoli, Libya. These findings can contribute to reducing traffic accidents and improving road safety. Understanding these factors might enable the authorities to take countermeasures to refine driver attitudes and enhance traffic safety.

In order to to achieve the aim of the study successfully, an empirical work should be carried out in the context of Libya using a research questionnaire as a data collection tool. Therefore, your cooperation is required to enable the researcher to obtain adequate and proper data needed for the research. You are kindly requested to complete all sections of the questionnaire, and if you have any further comment, you are welcome to include them.

I can also assure you that all the answers and information given will be treated confidentially and complete and that it will be used only to serve the aims of the research.For further clarification and to inquire about any item included in the questionnaire, please do not hesitate to contact Scholar at the address indicated at the bottom of the page.

Name student **Supervisor**

Faris Ahmed Abdulfatah Elturki **Dr. Shaban Ismael Albrka**

Please accept my thanks and high appreciation.

Part (1): Respondents' Profile

This section intends to get information about the respondents' demographic background.

1. Gender

☐ Male ☐Female

2. Age

☐18 - 25 years ☐ 26 - 35 years

☐36 – 45 years ☐ More than 45 years

3. Nationality

☐ Libyan ☐ Other _____

4. Marital status

☐Single ☐Married

☐ Other _____

5. What is your occupation?

☐ Full-time employment ☐ Part-time employment

☐ Unemployment ☐Student.

6. Education level

☐ No qualification ☐Less than high school

☐High school ☐Undergraduate degree

☐Post-graduate degree

7. Monthly income

☐ Less than 600 LYD ☐600 to 1,000 LYD

☐1001 to 1,500 LYD ☐ 1,501 to 2,000 LYD

☐More than 2,000 LYD

8. Where is your work /study place location?

☐ City centre ☐Suburb

☐Countryside ☐Another place.

Part (2): Trip Characteristics

9. How many days do a week you usually go to your work/study?

☐ Twice A Week ☐Four Times

☐Five Times ☐ More Than Five Times

10. Please can you estimate the distance of your work /Study trip

☐ Less than 15 minutes ☐15 – 30 minutes

☐ 31 – 60 minutes ☐More than 60 minutes

11. How long is your experience in driving including obtaining a license?

☐1-3 years ☐4-7 years

☐8-12 years ☐More than 12 years

Part (3): Factors affecting the road traffic accidents RTAs

Below are numbers of factors affecting the road traffic accidents RTAs in Tripoli – Libya, related to your experience, please express your opinion on the importance and the impact of following factors as key performance indicators of road traffic accidents.

1	2	3	4	5
No opinion	**No impact**	**Slight impact**	**Considerable impact**	**Great impact**

A. Human Factors	**1**	**2**	**3**	**4**	**5**
Decision-making ability (overtaking, breaking etc.)					
Disobedience to driving code such as children who are playing with the car on the road					
Drinking /Taking drugs and driving					
Following the vehicle in front too closely					
Inexperienced drivers					
Overspeeding					
Passenger's attitude (fighting, quarrelling etc.)					
Sleepiness and fatigue					
Using a mobile phone (hands – held) and driving					

Note: give a sequential number to all tables (Factors**)**

B. Vehicle Factors	**1**	**2**	**3**	**4**	**5**
The absence of rear view					
Bad tyres					
Breakdown of engine					
Defective horns					
Defective steering					
Faulty gearbox					
Faulty light					
Poor brakes/brake failure					
Windshield(break, not clean)					
Other mechanical failures					

C. Road factors	**1**	**2**	**3**	**4**	**5**
Poor road surface					
Poor/no street lighting					
Insufficient signing					
Road humps					
Regularly roadworks					
Road surroundings (e.g. buildings, fences, vegetation)					
Animals out of control(e.g. camel, dogs,)					
Road site details (e.g. steep hill, narrow road, bend/winding road, slippery road)					
Roadway geometrics					

D. Environmental factors	**1**	**2**	**3**	**4**	**5**
Slick roads					
Glare (difficulty seeing in the presence of bright light)					
View obstructions					
Other highway-related conditions					
Weather conditions (e.g. Fog, rain and/or snow)					

Part4: remedial measures: your opinions

(In your opinion which is the most suitable answer, please choose only one)

1	2	3	4	5
I don't know	**agree**	**Strongly agree**	**disagree**	**Strongly disagree**

	1	2	3	4	5
The road network in Tripoli, Libya needs to be improved.					
There are some hazardous locations (or black spots) on Tripoli, Libya roads that need to be dealt with (treated).					
It is important for the government to provide public transportation.					
It is important for the government to provide pedestrian footpaths and pedestrian signals					
Speed humps are important in reducing speed.					
Raising the fines would reduce driver violations.					
Having more police patrols on the roads would reduce driver violations.					
There is enough road safety awareness programmers in Libyan either at school or for the general public or in the media.					
It is important to have road safety education courses for drivers, passengers, or pedestrian at the school level.					
It is necessary (or relevant) to have proper practical training by a Driving Instructor.					
A retest driving license for drivers who have caused a serious accident in their first two years.					
A suspension for drivers who commit several serious offences cases it is proved that neglect is the main cause of the accident.					

Suggestions and Comments:

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Thank you for your participation

Arabic version of drivers, pedestrians and passengers questionnaire

تحديد وتقييم العوامل المؤثرة علي حوادث الطرق في ليبيا

خطاب دعوة

أنا فارس أحمد عبد الفتاح التركي، طالب ماجستير في جامعة الشرق الأدنى,اجري حاليا بحثا بعنوان "تحقيق العوامل التي تؤثر على حوادث المرور على الطرق طرابلس، ليبيا)"، وهذه الدراسة تدرس العوامل التي تؤثر على حوادث السير في طرابلس، ليبيا. ويمكن أن تساهم هذه النتائج في الحد من الحوادث المرورية وتحسين السلامة على الطرق. وقد يساعد فهم هذه العوامل السلطات على اتخاذ تدابير مضادة لصقل مواقف السائقين وتحسين السلامة المرورية ولتحقيق هدف الدراسة بنجاح، ينبغي القيام بعمل تجريبي في سياق ليبيا باستخدام استبيان بحثي كأداة لجمع البيانات. ولذلك، فإن تعاونكم مطلوب لتمكين الباحث من الحصول على البيانات الكافية والسليمة اللازمة للبحث. يرجى التكرم بإكمال جميع أقسام الاستبيان، وإذا كان لديك أي تعليق آخر، فأنت مدعو لوضعه ويمكنني أيضا أن أؤكد لكم أن جميع الإجابات والمعلومات المقدمة سيتم التعامل معها بشكل سري وكامل، وأنها سوف تستخدم فقط لخدمة أهداف البحث. لمزيد من التوضيح والاستفسار عن أي بند المدرجة في الاستبيان، يرجى عدم تتردد في الاتصال الباحث العلمي على العنوان المشار إليه في أسفل الصفحة.

اسم الطالب **اسم المشرف**

فارس احمد عبدالفتاح التركي **د.شعبان اسماعيل البركة**

تقبلو شكري وتحياتي لتجاوبكم

يرجي وضع اشارة علي كل المربعات المناسبة:

الجزء1 : المعلومات الشخصية

1. الجنس

☐ ذكر ☐ أنثي

2.العمر

☐ 25-18 سنة ☐ 35-26 سنة

☐ 45-36 سنة ☐ اكبر من 45 سن

3.الجنسية

☐ الليبية ☐ غير ذلك _____

4. الحالة الاجتماعية

☐ متزوج ☐ عازب

☐ غير ذلك _____

5. ماهي مهنتك ؟

☐ موظف بدوام كامل ☐ موظف بدوام جزئي

☐ عاطل ☐ طالب

6. المستوي التعليمي

☐ بلا مؤهل ☐ اقل من الشهادة الثانوية

☐ الشهادة الثانوية ☐ دراسات جامعية

☐ دراسات عليا

7. الراتب الشهري

☐ اقل من 600 دينار ليبي ☐ من 600 - 1000 دينار ليبي

☐ من 1001 - 1500 دينار ليبي ☐ من 1501 – 2000 دينار ليبي

☐ أكثر من 2000 دينار ليبي

8. اين يقع مكان عملك/ دراستك ؟

☐ وسط المدينة ☐ ضاحية

☐ الريف ☐ غير ذلك

الجزء 2: خصائص الرحلة

9. كم عدد الايام التي تذهب فيها الي العمل/ الدراسة اسبوعيا ؟

☐ يومان ☐ اربعة ايام

☐ خمسة ايام ☐ اكثر من خمسة ايام

10. من فضلك هل تستطيع تقدير المدة التي تستغرقها للذهاب الي العمل / الدراسة؟

☐ اقل من 15 دقيقة ☐ من 15-30 دقيقة

☐ من 31- 45 دقيقة ☐ اكثر من 45 دقيقة

11. كم تملك من الخبرة في القيادة بما في ذلك حصولك علي رخصة القيادة؟

☐1-3 سنوات ☐ 4-7 سنوات

☐ 8-12 سنة ☐ اكثر من 12 سنة

الجزء 3: العوامل المؤثرة علي حوادث الطرق

هناك عديد من العوامل المؤثر علي الطرق في طرابلس_ليبيا كما هي موضحة فالاسفل , من فضلك عبر عن رأيك عن اهمية وتأثير هذه العوامل المذكورة فالاسفل علي حوادث الطرق

1	2	3	4	5
لايوجد رأي	**لايوجد تأثير**	**تأثير بسيط**	**تأثير كبير**	**تأثير عالي جدا**

أ. عوامل بشرية	**1**	**2**	**3**	**4**	**5**
القدرة علي اتخاذ القرار (الاجتياز, الفرامل ..الخ).					
عدم اتباع قوانين الطريق , استهتار الاطفال بالسيارات علي الطرق علي سبيل المثال .					
القيادة تحت تأثير الخمور/ المخدرات .					
عدم ترك مسافة كافية للمركبة الامامية (الاقتراب الشديد بالسيارة الامامية).					
نقص خبرة السائق .					
القيادة بسرعة عالية .					
سلوك الركاب (مشاجرة ,ضجيج).					
الاجهاد والنوم اثناء القيادة .					
استخدام الهاتف النقال اثناء القيادة.					

ب. عوامل المركبات	1	2	3	4	5
غياب الرؤية الخلفية .					
اطارات سيئة .					
عطل محرك المركبة .					
ضجيج المنبهات (الابواق).					
عيوب مقود القيادة .					
عطل محرك التروس.					
عطل/ ضعف انارة المركبة .					
فرامل سيئة / عطل الفرامل .					
الزجاج الامامي (شقوق,كسر,غير نظيف).					
أعطال ميكانيكية اخري .					

ج . عوامل الطرق	1	2	3	4	5
سوء سطح الطرق .					
سوء / عدم وجود اضاءة في الطريق .					
عدم وجود اشارات توجيه كافية على الطرقات.					
مطبات الطرق .					
اعمال صيانة الطرق بانتظام .					
محيط الطرق (المباني, الأسوار, الاشجار..الخ).					
دخول الحيوانات للطرق(الجمال, الابقار , الكلاب..الخ).					
تفاصيل الطرق(التل الشديد,الطريق الضيق,الانحناء, الطريق المتعرج, الطريق الزلق).					
التصميم الهندسي للطرق .					

د. عوامل البيئة	1	2	3	4	5
حواجز الرؤية					
وهج (عدم الرؤية في وجود الضوء الساطع)					
الطريق الزلقة(بقع الزيت,الثلوج....الخ)					
ظروف اخري لها علاقة بالطرق السريعة					
حالة الطقس(ضباب, أمطار, ثلوج..الخ)					

الجزء 4: التدابير العلاجية :ارائكم

في رأيك أي من الخيارات مناسب اكثر والرجاء اختيار خيار واحد فقط

1	2	3	4	5
لاأعلم	موافق	موافق بشدة	غير موافق	غير موافق بشدة

	1	2	3	4	5
شبكة الطرق في ليبيا تحتاج الي تحسين.					
هل هناك بعض الطرقات الخطره و التي تحتاج لمعالجة سريعة .في طرابلس.					
انه من المهم للدولة ان توفر نظام نقل عام.					
من المهم أن توفر الحكومة ممرات المشاة وإشارات المشاة.					
مطبات السرعة مهمة لتقليل السرعة .					
ارتفاع تكلفة الغرامات يؤدي الي تقليل انتهاك قوانين المرور.					
زيادة الدوريات المرورية ع الطرقات تؤدي الى تقليل انتهاكات قوانين المرور.					
هناك مايكفي من مبرمجي التوعية بالسلامة في الطرقات اما في المدارس او في وسائل الاعلام.					
من المهم ان يكون هناك مواد تعليمية للسلامة في الطرق للسائقين,الركاب,المشاة في مختلف المدارس والجامعات.					
من الضروري ان يكون مدربي القيادة ذو جودة تدريبية عالية.					
اعادة اختبار القيادة للمتسببين في حوادث خطيرة خلال العامين الاولين في قيادتهم المركبة.					
معاقبة وحرمان السائقين المتسببين في حوادث خطيرة في حالة ثبوت ان الاهمال هو السبب الرئيسي في الحادث.					

الاقتراحات والتعليقات

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شكرا لتعاونكم

APPENDIX 2

HUMAN FACTORS RESULTS

Table 2.1: Decision-making ability (overtaking, breaking etc.)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	16	4.0	4.0	4.0
	No impact	32	8.0	8.1	12.1
	Slight impact	80	20.1	20.2	32.2
	Considerable impact	159	39.8	40.1	72.3
	Great impact	110	27.6	27.7	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

Table 2.2: Disobedience to driving code such as children who are playing with the car on the road

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	24	6.0	6.0	6.0
	No impact	14	3.5	3.5	9.6
	Slight impact	33	8.3	8.3	17.9
	Considerable impact	98	24.6	24.7	42.6
	Great impact	228	57.1	57.4	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

Table 2.3: Drinking /Taking drugs and driving.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	35	8.8	8.8	8.8
	No impact	52	13.0	13.1	22.0
	Slight impact	70	17.5	17.7	39.6
	Considerable impact	75	18.8	18.9	58.6
	Great impact	164	41.1	41.4	100.0
	Total	396	99.2	100.0	
Missing	System	3	.8		
Total		399	100.0		

Table 2.4: Following the vehicle in front too closely

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	15	3.8	3.8	3.8
	No impact	31	7.8	7.8	11.6
	Slight impact	99	24.8	24.9	36.5
	Considerable impact	133	33.3	33.5	70.0
	Great impact	119	29.8	30.0	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

Table 2.5: Inexperienced drivers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	14	3.5	3.5	3.5
	No impact	38	9.5	9.6	13.1
	Slight impact	129	32.3	32.5	45.6
	Considerable impact	116	29.1	29.2	74.8
	Great impact	100	25.1	25.2	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

Table 2.5: Inexperienced drivers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	14	3.5	3.5	3.5
	No impact	38	9.5	9.6	13.1
	Slight impact	129	32.3	32.5	45.6
	Considerable impact	116	29.1	29.2	74.8
	Great impact	100	25.1	25.2	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		

Table 2.6: Over speeding

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	12	3.0	3.0	3.0
	No impact	16	4.0	4.0	7.1
	Slight impact	33	8.3	8.3	15.4
	Considerable impact	112	28.1	28.3	43.7
	Great impact	223	55.9	56.3	100.0
	Total	396	99.2	100.0	
Missing	System	3	.8		
Total		399	100.0		

Table 2.7: Passenger's attitude (fighting, quarrelling etc.)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	24	6.0	6.0	6.0
	No impact	49	12.3	12.3	18.4
	Slight impact	106	26.6	26.7	45.1
	Considerable impact	121	30.3	30.5	75.6
	Great impact	97	24.3	24.4	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

Table 2.8: Sleepiness and fatigue

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	27	6.8	6.8	6.8
	No impact	36	9.0	9.1	15.9
	Slight impact	99	24.8	25.1	41.0
	Considerable impact	108	27.1	27.3	68.4
	Great impact	125	31.3	31.6	100.0
	Total	395	99.0	100.0	
Missing	System	4	1.0		
Total		399	100.0		

Table 2.9: Using a mobile phone (hands – held) and driving

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	12	3.0	3.0	3.0
	No impact	11	2.8	2.8	5.8
	Slight impact	74	18.5	18.7	24.5
	Considerable impact	132	33.1	33.3	57.8
	Great impact	167	41.9	42.2	100.0
	Total	396	99.2	100.0	
Missing	System	3	.8		
Total		399	100.0		

APPENDIX 3

VEHICLE FACTORS RESULTS

Table 3.1: Absence of rear view

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	17	4.3	4.3	4.3
	No impact	43	10.8	10.8	15.1
	Slight impact	133	33.3	33.5	48.6
	Considerable impact	134	33.6	33.8	82.4
	Great impact	70	17.5	17.6	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

Table 3.2: Bad tyres

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	11	2.8	2.8	2.8
	No impact	36	9.0	9.1	11.9
	Slight impact	123	30.8	31.2	43.1
	Considerable impact	124	31.1	31.5	74.6
	Great impact	100	25.1	25.4	100.0
	Total	394	98.7	100.0	
Missing	System	5	1.3		
Total		399	100.0		

Table 3.3: Breakdown of engine

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	34	8.5	8.6	8.6
	No impact	120	30.1	30.3	38.9
	Slight impact	140	35.1	35.4	74.2
	Considerable impact	56	14.0	14.1	88.4
	Great impact	46	11.5	11.6	100.0
	Total	396	99.2	100.0	
Missing	System	3	.8		
Total		399	100.0		

Table 3.4: Defective horns

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	57	14.3	14.4	14.4
	No impact	137	34.3	34.7	49.1
	Slight impact	125	31.3	31.6	80.8
	Considerable impact	51	12.8	12.9	93.7
	Great impact	25	6.3	6.3	100.0
	Total	395	99.0	100.0	
Missing	System	4	1.0		
Total		399	100.0		

Table 3.5: Defective steering

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	62	15.5	15.7	15.7
	No impact	92	23.1	23.2	38.9
	Slight impact	137	34.3	34.6	73.5
	Considerable impact	65	16.3	16.4	89.9
	Great impact	40	10.0	10.1	100.0
	Total	396	99.2	100.0	
Missing	System	3	.8		
Total		399	100.0		

Table 3.6: Faulty gearbox

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	61	15.3	15.5	15.5
	No impact	118	29.6	30.0	45.5
	Slight impact	116	29.1	29.5	75.1
	Considerable impact	58	14.5	14.8	89.8
	Great impact	40	10.0	10.2	100.0
	Total	393	98.5	100.0	
Missing	System	6	1.5		
Total		399	100.0		

Table 3.7: Faulty light

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	13	3.3	3.3	3.3
	No impact	36	9.0	9.1	12.3
	Slight impact	105	26.3	26.4	38.8
	Considerable impact	159	39.8	40.1	78.8
	Great impact	84	21.1	21.2	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

Table 3.8: Poor brakes/brake failure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	10	2.5	2.5	2.5
	No impact	20	5.0	5.1	7.6
	Slight impact	66	16.5	16.7	24.2
	Considerable impact	137	34.3	34.6	58.8
	Great impact	163	40.9	41.2	100.0
	Total	396	99.2	100.0	
Missing	System	3	.8		
Total		399	100.0		

Table 3.9: Windshield (break, not clean)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	28	7.0	7.1	7.1
	No impact	86	21.6	21.7	28.7
	Slight impact	150	37.6	37.8	66.5
	Considerable impact	90	22.6	22.7	89.2
	Great impact	43	10.8	10.8	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

Table 3.10: Other mechanical failures

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	50	12.5	12.6	12.6
	No impact	75	18.8	18.9	31.5
	Slight impact	169	42.4	42.6	74.1
	Considerable impact	53	13.3	13.4	87.4
	Great impact	50	12.5	12.6	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

APPENDIX 4

ROAD FACTORS RESULTS

Table 4.1: Poor road surface

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	10	2.5	2.5	2.5
	No impact	22	5.5	5.6	8.1
	Slight impact	72	18.0	18.3	26.5
	Considerable impact	148	37.1	37.7	64.1
	Great impact	141	35.3	35.9	100.0
	Total	393	98.5	100.0	
Missing	System	6	1.5		
Total		399	100.0		

Table 4.2: Poor/no street lighting

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	12	3.0	3.0	3.0
	No impact	18	4.5	4.5	7.6
	Slight impact	49	12.3	12.3	19.9
	Considerable impact	135	33.8	34.0	53.9
	Great impact	183	45.9	46.1	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

Table 4.3: Insufficient signing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	8	2.0	2.0	2.0
	No impact	19	4.8	4.8	6.9
	Slight impact	93	23.3	23.6	30.5
	Considerable impact	125	31.3	31.7	62.2
	Great impact	149	37.3	37.8	100.0
	Total	394	98.7	100.0	
Missing	System	5	1.3		
Total		399	100.0		

Table 4.5: Road humps

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	14	3.5	3.5	3.5
	No impact	33	8.3	8.3	11.8
	Slight impact	86	21.6	21.7	33.5
	Considerable impact	138	34.6	34.8	68.3
	Great impact	126	31.6	31.7	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

Table 4.6: Regularly roadworks

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	46	11.5	11.8	11.8
	No impact	71	17.8	18.2	29.9
	Slight impact	101	25.3	25.8	55.8
	Considerable impact	92	23.1	23.5	79.3
	Great impact	81	20.3	20.7	100.0
	Total	391	98.0	100.0	
Missing	System	8	2.0		
Total		399	100.0		

Table 4.7: Road surroundings (e.g. buildings, fences, vegetation)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	29	7.3	7.4	7.4
	No impact	85	21.3	21.7	29.2
	Slight impact	144	36.1	36.8	66.0
	Considerable impact	79	19.8	20.2	86.2
	Great impact	54	13.5	13.8	100.0
	Total	391	98.0	100.0	
Missing	System	8	2.0		
Total		399	100.0		

Table 4.8: Animals out of control (e.g. camel, dogs)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	35	8.8	8.8	8.8
	No impact	50	12.5	12.6	21.5
	Slight impact	76	19.0	19.2	40.7
	Considerable impact	109	27.3	27.5	68.2
	Great impact	126	31.6	31.8	100.0
	Total	396	99.2	100.0	
Missing	System	3	.8		
Total		399	100.0		

Table 4.9: Road site details (e.g. steep hill, narrow road, bend/winding road, slippery road).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	19	4.8	4.8	4.8
	No impact	44	11.0	11.1	15.9
	Slight impact	106	26.6	26.8	42.7
	Considerable impact	133	33.3	33.6	76.3
	Great impact	94	23.6	23.7	100.0
	Total	396	99.2	100.0	
Missing	System	3	.8		
Total		399	100.0		

Table 4.10: Roadway geometrics

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	26	6.5	6.6	6.6
	No impact	53	13.3	13.4	20.0
	Slight impact	95	23.8	24.1	44.1
	Considerable impact	93	23.3	23.5	67.6
	Great impact	128	32.1	32.4	100.0
	Total	395	99.0	100.0	
Missing	System	4	1.0		
Total		399	100.0		

APPENDIX 5

ENVIRONMENTAL FACTORS RESULTS

Table 5.1: View obstructions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	28	7.0	7.1	7.1
	No impact	60	15.0	15.2	22.2
	Slight impact	125	31.3	31.6	53.8
	Considerable impact	114	28.6	28.8	82.6
	Great impact	69	17.3	17.4	100.0
	Total	396	99.2	100.0	
Missing	System	3	.8		
Total		399	100.0		

Table 5.2: Glare (difficulty seeing in the presence of bright light)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	10	2.5	2.5	2.5
	No impact	37	9.3	9.3	11.8
	Slight impact	91	22.8	22.9	34.8
	Considerable impact	153	38.3	38.5	73.3
	Great impact	106	26.6	26.7	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		

Table 5.3: Slick roads

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	21	5.3	5.3	5.3
	No impact	38	9.5	9.6	14.9
	Slight impact	92	23.1	23.2	38.1
	Considerable impact	106	26.6	26.8	64.9
	Great impact	139	34.8	35.1	100.0
	Total	396	99.2	100.0	
Missing	System	3	.8		
Total		399	100.0		

Table 5.4: Other highway-related conditions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	54	13.5	13.8	13.8
	No impact	52	13.0	13.3	27.0
	Slight impact	99	24.8	25.3	52.3
	Considerable impact	115	28.8	29.3	81.6
	Great impact	72	18.0	18.4	100.0
	Total	392	98.2	100.0	
Missing	System	7	1.8		
Total		399	100.0		

Table 5.5: Weather conditions (e.g. Fog, rain and/or snow)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no opinion	21	5.3	5.3	5.3
	No impact	44	11.0	11.1	16.4
	Slight impact	106	26.6	26.7	43.1
	Considerable impact	130	32.6	32.7	75.8
	Great impact	96	24.1	24.2	100.0
	Total	397	99.5	100.0	
Missing	System	2	.5		
Total		399	100.0		