

Analysis of Accident Pattern of Quetta City and Suggested Strategies for Reduction in Accidents

**ASFAND YAR SAIF
(00000172427)**

A thesis submitted in partial fulfillment of the

The requirements for the degree of

Master of Science

In

Transportation Engineering



Department of Transportation Engineering

National Institute of Transportation (NIT)

School of Civil & Environmental Engineering (SCEE)

National University of Sciences and Technology (NUST)

Islamabad, Pakistan

(2018)

THESIS ACCEPTANCE CERTIFICATE

Certified that final copy of MS thesis written by **Mr. ASFAND YAR SAIF (Registration No. 00000172427)** of (NIT-SCEE), has been vetted by undersigned, found complete in all respects as per NUST Statutes / Regulations, is free of plagiarism, errors, and mistakes and is accepted as partial fulfillment for award of MS degree. It is further certified that necessary amendments as pointed out by GEC members of the scholar have also been incorporated in the said thesis.

Signature: _____

Name of Supervisor: **Dr. Muhammad Jawed Iqbal**

Date: _____

Signature (HOD): _____

Date: _____

Signature (Dean/Principal): _____

Date: _____

DEDICATED

TO

MY PARENTS, SIBLINGS, FRIENDS,

AND COLLEAGUES

ACKNOWLEDGEMENT

I am thankful to Allah Almighty, for giving me strength and patience to complete this research. I pay my earnest gratitude with sincere sense of respect to my parents. I would like to pay debt of gratitude to Dr. Muhammad Jawed Iqbal, being the supervisor of this study, whose countless inspiration and guidance made it possible to complete my research work. In addition, I am grateful to Dr. Kamran Ahmad and Dr. Arshad Hussain, for their assistance and feedback throughout the thesis process as members of thesis committee.

I would like to pay gratitude to the academic members of the National Institute of Transportation who provided a lot of knowledge during academic session in the postgraduate program. Special thanks to SSP Legal Mr Sajjad, Statistical Officer Trauma centre Mr Agha Muhammad and to Mr Babu Haider (Medico Legal ward). In the end, I pay my earnest gratitude to my siblings, my friends and colleagues for their encouragement, sincere prayers and good wishes for successful completion of my research work.

(Asfand Yar Saif)

Table of Contents

LIST OF TABLES.....	viii
LIST OF FIGURES.....	x
LIST OF ACRONYMS.....	xii
Abstract.....	xiii
Chapter no. 1	1
1. Introduction	1
1.1 Background	1
1.2 Problem Statement.....	2
1.3 Thesis Objectives.....	3
1.4 Organization of thesis	3
Chapter no 2	4
2. Literature review.....	4
2.1 Background	4
2.2 Road Traffic Accidents	4
2.2.1 Types of Road Traffic Accidents	4
2.2.2 Classification based on the severity of a Road Traffic Accident	8
2.3 Past work done related to research.....	9
2.3.1 International studies	9
2.3.2 National Studies	11
Chapter no. 3	13
3. Introduction to research Methodology	13
3.1 Research methodology	13
3.2 Data collection	15
3.2.1 Data from Police stations and CCPO office	15
3.2.2 Data from Sandeman Provincial Hospital Quetta	16
3.3 ANALYSIS OF ACCIDENT DATA OF POLICE STATION AND CCPO OFFICE.....	17
3.3.1 TEMPORAL ANALYSIS	17
3.3.2 SEVERITY WISE ANALYSIS.....	18
3.3.3 CASUALITY WISE ANALYSIS	18
3.3.4 GENDER WISE ANALYSIS	18
3.3.5 CAUSES WISE ANALYSIS	18

3.3.6 POLICE STATION WISE ANALYSIS	19
3.3.7 DEATH PLACE WISE ANALYSIS.....	20
3.3.8 COLLISION TYPE WISE ANALYSIS.....	20
3.3.9 ROAD USER GROUP.....	20
3.3.10 VEHICLE INVOLVEMENT	20
3.3.11 ACCIDENT ON MAJOR ROADS.....	21
3.3.12 ANALYSIS OF ACCIDENTS PRONE ROAD.....	23
3.4 ANALYSIS OF ACCIDENT DATA OF S.P.H QUETTA	23
3.4.1 MONTHWISE ANALYSIS.....	23
3.4.2 GENDER WISE ANALYSIS	23
3.5 Comparison	23
3.6 Conclusion and recommendation.....	23
Chapter no .4	24
4. DATA ANALYSIS AND RESULTS	24
4.1 Introduction to data analysis and results	24
4.2 Study Area.....	24
4.3 RTA data analysis	24
4.3.1 Analysis of data taken from Police Stations and CCPO office.....	24
4.3.2 SEVERITY WISE ANALYSIS.....	29
4.3.3 CASUALITY WISE ANALYSIS	30
Causality wise analysis is done to find out the number of people died or injured in the accidents during study duration.	30
4.3.4 GENDER WISE ANALYSIS	31
4.3.5 CAUSES WISE ANALYSIS	31
4.3.6 POLICE STATION WISE ANALYSIS	32
4.3.7 PLACE WISE ANALYSIS.....	34
4.3.8 COLLISION TYPE WISE ANALYSIS.....	34
4.3.9 ROAD USER GROUP.....	35
4.3.10 VEHICLE INVOLVEMENT	37
4.3.11 ACCIDENT ON MAJOR ROADS.....	38
4.3.12 Trends of Accidents on Western bypass.....	40
4.4 Analysis of data taken from Sandeman Provincial Hospital	44

4.4.1 Casualty wise analysis	44
4.4.2 Month wise analysis.....	45
4.4.3 Gender wise analysis.....	47
4.4.4 Analysis of data per day.....	48
4.5 Summary of Analysis	48
Chapter no. 5	50
5.CONCLUSIONS AND RECOMMANDATIONS	50
5.1 Conclusions	50
5.1.4 Summary of conclusions.	51
5.2 Recommendations	51
References	53
Appendix (1).....	55

LIST OF TABLES

Table 1. 1 Population projection of Quetta City (Metropolitan Corporation Quetta)	2
Table 2. 1 Difference between severity standard of WHO and Pakistan.....	8
Table 4. 1 Month wise analysis of police data.....	25
Table 4. 2 Day wise analysis of police data.....	26
Table 4. 3 Hour wise analysis of police data	27
Table 4. 4 Day and night analysis of police data	28
Table 4. 5 Severity wise analysis of police data	29
Table 4. 6 Causality wise analysis of police data	30
Table 4. 7 Gender wise analysis of police data.....	31
Table 4. 8 Causes wise analysis of police data	32
Table 4. 9 Police station wise analysis of data.....	33
Table 4. 10 Place wise analysis.....	34
Table 4. 11 Collision type wise analysis.....	35
Table 4. 12 Road user type fatalities.....	36
Table 4. 13 Road user type Injuries	36
Table 4. 14 Vehicle involvement analysis	37
Table 4. 15 Accidents on Major roads	38
Table 4. 16 Severity wise analysis of western bypass	41
Table 4. 17 Road user group wise analysis of western bypass	42
Table 4. 18 Collision type wise analysis of western bypass	43
Table 4. 19 Per day analysis of Police data	43

Table 4. 20 Causality wise analysis of Hospital data.....	44
Table 4. 21 Month wise analysis of injured of Hospital data	45
Table 4. 22 Month wise analysis of dead of Hospital data	46
Table 4. 23 Gender wise analysis of hospital data.....	47
Table 4. 24 Per day analysis of hospital data.....	48

LIST OF FIGURES

Figure 2. 1 Head on Accidents.....	4
Figure 2. 2 Nose to tail Accidents.....	5
Figure 2. 3 Side Impact collision	5
Figure 2. 4 Sideswipe collision.....	6
Figure 2. 5 Rollover accident.....	6
Figure 2. 6 Single car accident.....	7
Figure 2. 7 Multiple Vehicle Pile Up.....	7
Figure 3. 1 Flow chart shows the adopted research methodology	14
Figure 3. 2 Road traffic accident FIR	15
Figure 3. 3 MLC report from Sandeman provincial hospital.....	16
Figure 4. 1 Month wise analysis of police data	25
Figure 4. 2 Day wise analysis of police data	26
Figure 4. 3 Hour wise analysis of police data.....	28
Figure 4. 4 Day and night analysis of police data.....	29
Figure 4. 5 Severity wise analysis of police data.....	30
Figure 4. 6 Causality wise analysis of police data	30
Figure 4. 7 Gender wise analysis of police data	31
Figure 4. 8 Causes wise analysis of police data.....	32
Figure 4. 9 Police station wise analysis of data	33
Figure 4. 10 Place wise analysis	34

Figure 4. 11 Collision type wise analysis	35
Figure 4. 12 Road user type fatalities	36
Figure 4. 13 Road user type Injuries.....	37
Figure 4. 14 Vehicle involvement analysis.....	38
Figure 4. 15 Accidents on Major roads.....	40
Figure 4. 16 Severity wise analysis of western bypass.....	41
Figure 4. 17 Road user group wise analysis of western bypass.....	42
Figure 4. 18 Collision type wise analysis of western bypass.....	43
Figure 4. 19 Causality wise analysis of Hospital data	45
Figure 4. 20 Month wise analysis of injured of Hospital data	46
Figure 4. 21 Month wise analysis of dead of Hospital data.....	47
Figure 4. 22 Gender wise analysis of hospital data	48

LIST OF ACRONYMS

WHO	World Health Organization
RTAs	Road Traffic Accidents
RTC	Road Traffic Crashes
RTI	Road Traffic Injuries
RCF	Road Crash Fatalities
MUTCD	Manual on Uniform Traffic Control Devices
CCPO	Capital City Police Officer
S.P.H	Sandeman Provincial Hospital
RC	Road crash
UNESCAP	United Nations Economic and Social Commission for Asia.

Abstract

Road safety is major public health concern over the world. The threat is even bigger in developing countries like Pakistan. Urban transport infrastructures in most of the Pakistani cities are inadequate and deteriorated over years. In Quetta capital city of Balochistan roads of the city are congested and overcrowded. The public transport has not kept pace with abrupt increase in population and with safety and comfort of passengers. Thus persuading passengers to turn to personalized vehicles. This results not only in flow of traffic but also put the user life at great risk. This research attempts to analyze the road accidents in Quetta using annual data of year 2017 (January to December). Data is collected from Police department and Sandeman provincial hospital Quetta. The analysis of data is done with the help of MS Excel. And the conclusions are, total number of accidents occurred in Quetta in year 2017 are 199. In which 84 accidents are fatal accidents, 113 are non-fatal and 2 property damage accidents. Careless driving is the cause of 98% of accidents which is unrealistic. Males are prone to accidents with 88%. While most abundant type of collision is pedestrian hit 52%. (Western bypass) is the most accidents prone location in the city where around 18% of all accidents occurred during the year 2017. Motorcycles are involved by 34% in accidents. There is a big difference between the injured of police data and hospital data. Ratio of injured people of police to hospital data is 16:1. 4218 patients were brought hospital and 254 people were recorded as injured in police data. Countermeasures are complete surveillances of accidents should be done to collect complete and reliable data. Proper traffic management system should be imposed in the city. Pedestrian crosses must be provided. Road safety awareness should be provided and Strict and transparent method should apply for new as well as renewal of driving license.

1. Introduction

1.1 Background

The traffic of a city is measured to be one of the factors to gauge the extent to which a society is civilized. It imitates the attitude of the citizens, the respect and honor they have for others life and for the law of the terrestrial. Some social scientists even deduct many characteristics like care, tolerance, values and social norms through a community's traffic sense (Altaf.M, 2016). Road safety becomes major public health concern over the world. Over the last decade the number of personalized as well as goods transportation vehicles has increased to alarming numbers on our roads. For the betterment of road vehicle safety and road users comfort world has made heavy investment to improve the quality of existing as well as constructing new roads. Despite the improvement in road designs, new vehicle safety standards and new safety laws, RTA is still the 8th major cause of death in the world. It is estimate that around 1.2 million people died and up to 50 million got injured in RC every year in the world (Bliss, 2004). In 1990 RC were the 9th major cause of death in the world but calculations suggest that it will be the 6th major cause by 2020 (Jacobs et al, 2000). Without ample actions, it is suggested that RTA will jump from 9th to 3rd place in the list of 100 different causes of death by 2020 (Kopits and Copper 2005). It is reported that 3500 people died every day in road crashes (UNECE, 2008). According to the above figures of different studies road accidents are acknowledged to be a thriving global phenomenon now. In developing countries RTAs become more deadly than some historic disease that affected the population (Eduardo 1995). In the last 15 years it is been seen that the number of person killed in RTA is increasing in the developing countries and steadily decreasing in the developed (western) countries (Jacob et al, 2000). By 2020 a rise of 80% will be seen in low and middle income countries and a decline of 30% will be seen in high income countries (Peden et al. 2004). It is very alarming that (UNESCAP) secretariat estimates that, if any additional safety measures are not taken than about 610,000 deaths might occur in the region by 2020 (UNECE 2008).

In Pakistan WHO data shows that there are 30,000 fatalities occurs in road accidents every year (WHO, 2013). Further studies as also shown that about 30,000 people died in RTA every year in Pakistan (Khan, 2013). These accidents are the cause of economic loss of about Rs 116.6 billion which is 1.5% of GNP of the country (Ahmed, 2007).

Quetta, the capital city of the biggest province of Pakistan is the ninth largest city in country and largest city in the province. Quetta city is located at Latitude 30°18'N and longitude 67°00'E coordinates of Pakistan map; it stands at an elevation 1680 m (5510 ft) The city is sprawled over an area of 2,653²km. The city is surrounded by several mountains to form a

natural fort. These eye catching mountains are named as Takatoo, Zarghoon, Murdar and Chiltan,

Quetta city was designed for 100,000 citizens by the British in late 19th century (Naseebullah, 2014). According to 1998 census the total population of the Quetta city was 759,941 with an estimated growth rate 4.13% (District census report 1998). According to the Censes of 2017 the population of Quetta city is 2 million. However, these numbers are very un-realistic and do not reflect the ground reality of population growth in Quetta City (Metropolitan Corporation Quetta). The Settlement of Afghan Refugees has also increased the population of the city. A large number of people migrating from the surrounding cities such as Mastung, Pishin, Muslim Bagh and Chaman etc have also increased the population of the Quetta dramatically. Apart from all that, the arrival of afghan refugees has also increased the population of Quetta. Due to which the roads of Quetta are jammed with traffic due to poor traffic management and planning. (Naseebullah, 2014).

Table 1. 1Population projection of Quetta City (Metropolitan Corporation Quetta)

Sr #	Year	Population Projection
1	2016	2,101,875
2	2017	2,188,682
3	2018	2,279,075
4	2019	2,373,201
5	2020	2,471,214

1.2 Problem Statement

The population of Quetta city is increasing with a booming rate as discussed above, and insufficient urban transport facilities compel the people to move for personalized vehicles. Quetta city is almost devoid of any traffic system. And it is going from bad to worse. As an outcome, the citizens are free to move without taking into account any traffic norm. Furthermore, the condition of the roads in the city makes driving and traffic horrible. The abrupt increase of three wheeler auto rickshaws is another problem in traffic congestion, out of which 60% to 70% three wheelers have fake number plates, licenses and permits. The problem is at its worst when school and college students, the officers and business persons go from their educational institutions, offices and business centers for their home and large queues and traffic congestions are observed across different roads and intersections of the city (Ali.A, 2013).

As population increases, so does the flow of traffic and congestion increases, due to congestion the chances of happening of traffic accidents increased. This study is being conducted to reduce the causes and implement the traffic plans and laws to reduce the likelihood of accident

in Quetta city. This Research attempts to analyze the road accidents in Quetta using annual data of year 2017 (January to December). And remedial of this study can be used to overcome the worse situation of other cities of Pakistan as well.

1.3 Thesis Objectives

The main objectives of this research work are as follow.

- To Analyze the Accident Pattern of Quetta City.
- To Suggest Remedial Measures to Reduce RTA in Quetta City

1.4 Organization of thesis

This thesis includes five chapters. Detail of each chapter is discussed below

Chapter 1: Includes the background of the study, problem statement and research objectives.

Chapter 2: It includes the previous studies conducted locally and internationally on road traffic accidents.

Chapter 3: It discusses the collection and collation of data used in present study.

Chapter 4: It presents detailed analysis of traffic data based on various factors like time, weather, road users group, gender wise and severity etc. Causes of accidents are identified. Also accident blind spots are identified in the city.

Chapter 5: It includes the conclusion and future recommendations to reduce the RTAs in Quetta City. It also includes the previous studies conducted locally and internationally on road traffic accidents.

2. Literature review

2.1 Background

This chapter discusses the past work done to the research being carried out. It entails a discussion on different types and causes of RTAs.

2.2 Road Traffic Accidents

A Road Traffic Accident is a calamitous event that occurs when a vehicle collides with other vehicle, pedestrian and stationary object (trees, electric pole, sign board and Building) or roll over of that vehicle. RTA results in Fatality, injury and property damage.

2.2.1 Types of Road Traffic Accidents

The different types of Road Traffic Accident are as follow.

2.2.1.1 Head on Collision

Head on Collision occurs when the front of one vehicle collide with the front of another vehicle. The rate of injuries, casualties and property damage is higher in this type of accident.



Figure 2. 1 Head on Accidents

2.2.1.2 Rear End Collision

Rear End Collision happened when a car crashes in the back side of another vehicle. It happens when the rear vehicle suddenly accelerates or when the front vehicle suddenly decelerates. Rear End Collision mostly occurs on traffic signals where vehicles have to stop suddenly.

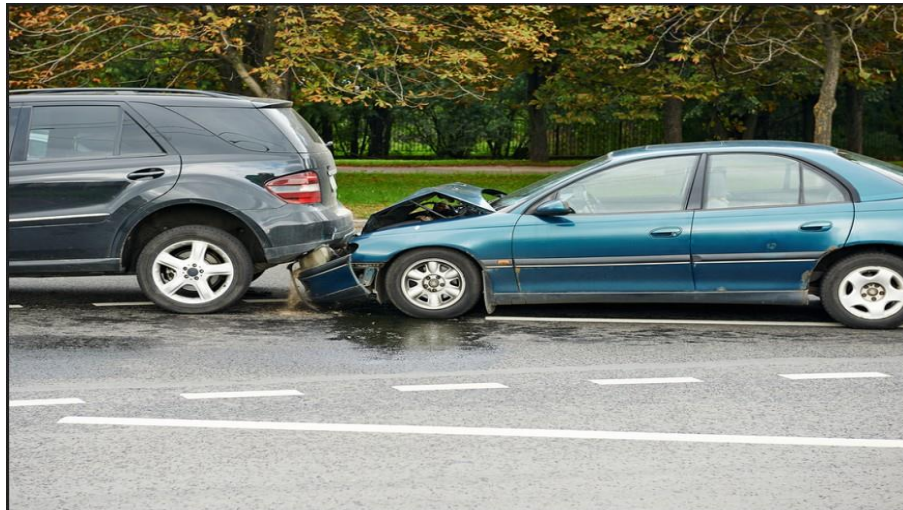


Figure 2. 2 Nose to tail Accidents

2.2.1.3 Side Impact Collision

This occurs when side of vehicle is hit by another vehicle. It is more dangerous than Rear end collision. The severity of injuries and fatalities depends on the safety features in the vehicles.



Figure 2. 3 Side Impact collision

2.2.1.4 Sideswipe Collision

Sideswipe collision occurs when two adjacent sides of vehicle collide with each other. It's not a dangerous one. Majority cosmetics of the both vehicles got damaged.



Figure 2. 4 Sideswipe collision

2.2.1.5 Roll Over

Rollover accidents occur when a vehicle due to its high speed or tire burst flips over on the side or roof. It's quite dangerous and fatalities and severe injuries occurs in this kind of accidents.



Figure 2. 5 Rollover accident

2.2.1.6 Single Car Accident

Single car accidents involve only one vehicle in collision. It happens when one vehicle collides with a pedestrian or road side furniture due to carelessness of driver, pedestrian or brake failure.



Figure 2. 6 Single car accident

2.2.1.7 Multiple Vehicle Pile Up

Multiple Vehicle pile Up involves many vehicles in a RTA. It usually occurred on motorways and express ways. It is the deadliest accident that cause many fatalities and sever injury. It occurs due to poor pavement, lack of visibilities and weather condition.



Figure 2. 7 Multiple Vehicle Pile Up

2.2.2 Classification based on the severity of a Road Traffic Accident

RTAs are divided in different categories depending upon the severity. The WHO provides the definition that which RTA is fatal, and which is non-fatal. The table below shows the comparison of Pakistan and WHO definition about the severity of the RTA.

Table 2. 1 Difference between severity standard of WHO and Pakistan.

Category	WHO	Pakistan
Fatal Crash	Any RTA leading to the death of a Person immediately or dying within 30 days as a result of Crash.	No Standard Definition Exist
Non-Fatal or Causality Crash	A person who got Physical Damage in a Crash.	No Standard Definition Exist

Each RTA category in term of severity of severity is discussed below.

2.2.2.1 Fatal Accidents

Fatal car accidents is defined as the road traffic accident in which at least one motorist died. It is not a uniform event, many factors contribute in the occurrence of fatal accidents like over speeding, improper road geometry, carelessness etc. Due to the severity associated with fatal car accidents, the litigation and the subsequent legal process surrounding the incident is quite complex and will vary based on a case by case circumstance.

2.2.2.2 Major Accidents

In traffic accident one or more person injured and detained in hospitals or detained for more than 12 hours.

2.2.2.3 Minor Accidents

In traffic accident, all persons involved either not detained in hospitals or detained for not more than 12 hours.

2.2.2.4 Property Damage Only

It is type of accident in which neither a dead, major injury nor minor injury occurs. Only a loss of property occurs like vehicle Damage or road side furniture damage.

2.3 Past work done related to research

This chapter presents various past studies regarding Road Traffic Accidents that were either carried out internationally or within Pakistan.

2.3.1 International studies

Sanjay Kumar Singh, Ashish Misra [2004] describes Patna as poor and highly dense populated city of India. The roads of the city are highly deteriorated and congested. And the public transport of the city is insufficient and unstandardized which influenced the population of the city to use their personal transport. This results in enormous amount of traffic which endangers the life of road users. The fatality rate is 45 out of 100 RTAs, The effectives are between 18 to 60 age group which 80% of All fatalities of RTAs. And 15% of RTAs occurred on (NH-38) in 2000. This is the highly inclined Road to RTAs.

In this case study of Hyderabad using GIS, Mr Bhagyaiah and B. Shrinagesh have concluded that the only source of information related to traffic crashes are newspapers and police database, which explains reasons and impacts of RTAs. The police database is authentic, but it can't provide the complete information. So they highlighted the need to strengthen the surveillance of the road crashes by the help of GIS, that it will helps to obtain a complete précised and consist. on the basis of this data, the new strategies will be implemented that will help reduce the fatality rates and the numbers o RTAs in the city. They emphasized that the good surveillance is the first stage towards reducing the deaths, injuries due to RTAs in long term.

Dr. S.K. Ghosh, Dr.M.PArida, Jay K. Uraon.[2004] This study describe that the use of GIS is unavoidable tool for the accurate analysis of traffic accidents. In Dehradun City the 72% of road accidents results in deaths or serious injuries. Mostly the accidents occurred between 2:00pm to 10:00pm and vans, jeeps and cars are frequently involved in road crashes. The study describes that to tackle the increasing numbers of accidents the adequate traffic management system is needed. J. Ohakwe, I.S. Iwueze and D.C. Chikezie (2011) have explained the behaviour of road traffic accidents in Imo State of Nigeria. The data was obtained from Nigerian Police and different available data resources. After using different statistical tools (Method of time series decomposition, chi -square test of significance, they found that there are numerous causes of RTAs. Reckless driving, (inexperience driving and mechanical faults) and road effects are the significant causes of accidents with the percentage of 30.3, 21.5 and 21.1% respectively from the total of 5921 accident cases. Out of 855 deaths recorded in the research period two motorcycles, motorcycle-vehicle and vehicle-vehicle are the major types of accidents with the percentage of 38.9, 37.5 and 14.9% respectively. And with 94.7% private vehicles, mini buses and taxi are the leading type of vehicles involved in crashes.

Hyder et al. [2006] studied traffic injuries among children in order to measure disease burden associated with road traffic accidents. Data from 1505 already published articles was

inducted into the study. Data was used to estimate characteristics and proportions of child and adolescent RTI. This research concluded that most of injuries occurred in males in the age of 0 - 9 years, constitute 40% of the total number of cases.

Rasouli et al. [2008] compared data on road crashes (involving injuries and fatalities) of Iran with other countries. The data were collected from the National health department of Iran for the years 1997 to 2006. Results of that study revealed that RCI and RCF rates increased till 2005 but decreased in 2006. The study concluded that despite the reduction in road traffic crashes in the year 2006.

Chen & Chen [2011] using mixed logit model and data from Highway Safety Information System (HSIS) for year 1991 to 2000 investigated the injury severity of single and multi-vehicle accidents on rural highways. The study concluded that snow covered road surfaces and indicator variable for light traffic were randomly distributed.

Goswami, Ajit & Sonowal, Ripunjoy. (2011) conduct analysis of Dibrugarh city, Assam India. The Data was of year 2009 which taken from case dairies and police data. And after analysis they found that main cause of accidents are careless driving which makes 95.38% of total accidents occurred in 2009. During day time (6am to 6pm) 60% of accidents occurs. 32.30% RTAs occur during rainy season (July-September). And they describe that the data present with police is insufficient. To counter the problem of RTA proper data should be collected.

JAMES WACHIRA THEURI (2008) conducts a study on causes of RTAs of Nairobi city, Kenya. In which he found that the major causes of RTA are over speeding, careless overtaking, sudden cutting in and pulling from near side. And he describes that 76.29% fatalities occurred to non-motorized road users (pedestrians and cyclists).

Katharine Bennett [December 2010] carried out a study on Johnson City. Data used for analysis was from (January 2000 to December 2009) and collected from rescue 911. Data was analyzed by ArcGIS software. And after analysis he found that accident of motorized vehicles results in injuries. Accidents occurred on commercial areas are double of residential area. 40% of accidents occur on roadway intersections and 22% occurs on signalized intersection.

Ebrahemzadih M, Giahi O, Foroginasab F. [2016] conducted a study from (2003 to 2013) on Yazd city Iran. After analysis of 1000 RTA cases using Tripod Beta Method. They found that violation of traffic rules decreased with increasing age, studies identifies the causes of RTA. Over speeding with 19.10%, defilement of traffic rules accounts for 32.6% and outdated technology of cars and deterioration of streets and Roads accounts for 20.1% are the major causes of RTA.

Shalini Rankavat, Geetam tiwari [2013] conduct a study on pedestrian accident analysis in Indian capital Delhi. And the study shows that 51% of fatalities out 8503 are of pedestrians. Using GIS and they found 4 prone location where large numbers of pedestrians died. These fatalities are clustered over the intersections of Ring Road of Delhi. Cars and buses are involved with 21% and 14% respectively.

2.3.2 National Studies

Jacobs and Sayer [1984] In developing countries such as Pakistan road user error is acknowledge as the main cause of RTAs which is 70% of total RTAs.

A study was carried out by the doctors of Agha Khan University hospital in Karachi on the studies to reduce Road Traffic Accidents. And their study emphasized on the enforcement of law and awareness among the people about RTA.(Adeel Ahmed Khan 2014).

A 40-year (1956–1996) analysis of public sector data has demonstrated a 14-fold increase in the total number of motor vehicle crashes in Pakistan (Hyder et al. 2006 Hyder, A.A. 2006. Health and road transport in Pakistan).

A study was carried out by the doctors of Allama Iqbal Medical College on Victims of Road Traffic Accidents of Quetta City. And their study emphasized that Men are highly prone to RTAs then women and most victims are from group age of 30-40 years. Head & Neck Injuries are most common in the victims. (Epidemiological Study of Road Traffic Accident Cases).

Mirza [2013] studied the demographic distribution of road traffic accident victims in Karachi using one year cross sectional data from various hospitals. The authors carried out detailed analyses of autopsy reports (examination of dead bodies) of victims from police cases still under investigation. The study concluded that out of all autopsies, 27.8% cases were victims of road traffic accidents of which 55.8% were between the ages of 19-40 years. The ratio of males to females was 7:1. Furthermore, majority of RTA victims were pedestrians while the

second highest number was of motorcyclists. The authors concluded that males ranging between 0-14 years are more vulnerable to road traffic accidents.

3. Introduction to research Methodology

This chapter presents the detail methodology of achieving goals and objectives of the research. Road Traffic Accidents (RTAs) are analyzed from broad perspective in this study. It helps in identification of variables that are the basic causes of different lose like people lives, property damaged etc. After performing analysis for the roads separately a comparative analysis is also done in this study which clearly determines changing trends of accident patterns on roads of Quetta city. Also accidents blind spots are analyzed comparing the accidents severity on different locations. It will briefly describe each step of methodology starting from data collected from various sources, Compiling or arranging data into desired format, Data analysis (Software, tools for obtaining desired results) After analysis of accidents data, accident black spots are also identified for both road sections. It also answers those questions which disturb safety on the roads. Accident analysis is actually a complex procedure and composed of many procedures. All the persons involved with traffic like Traffic Engineers, monitoring and control, planning and design relates to safety of vehicles. Understanding accident contributing factors needs high level of research. The method that is used for identification of blind spots is very simple. While the detail data of accidents provided the causes of the accidents. After knowing the causes of accidents that occur, it is easy to provide countermeasures that help in the reduction of road traffic accidents in that area.

3.1 Research methodology

For this study the capital of Balochistan province Quetta is taken as study area. The data which is used to conduct this research was collected from the reliable government departments of the city. Government departments from where the data was collected are All the Police stations that are situated in the city, and then to verify the police data of the city, data was also taken from CCPO office the city. Third and final source from where the road accident data was collected is Sandeman provincial Hospital Quetta. The duration of case study is 2017 (January to December). After the collection of data, data was treated and compiled using Microsoft Excel. Then the treated data was analyzed to achieve the required results using SPSS and MS Excel. The results are represented by pie chart, column chart and line charts to show the facts and trends of Quetta city. And finally the results are concluded and after concluding the results countermeasures are given to mitigate the reasons that are responsible for the happening of accident in Quetta city. Conclusions and recommendation are given in the later chapters of the thesis.

The methodology use for this study is shown by the following figure .

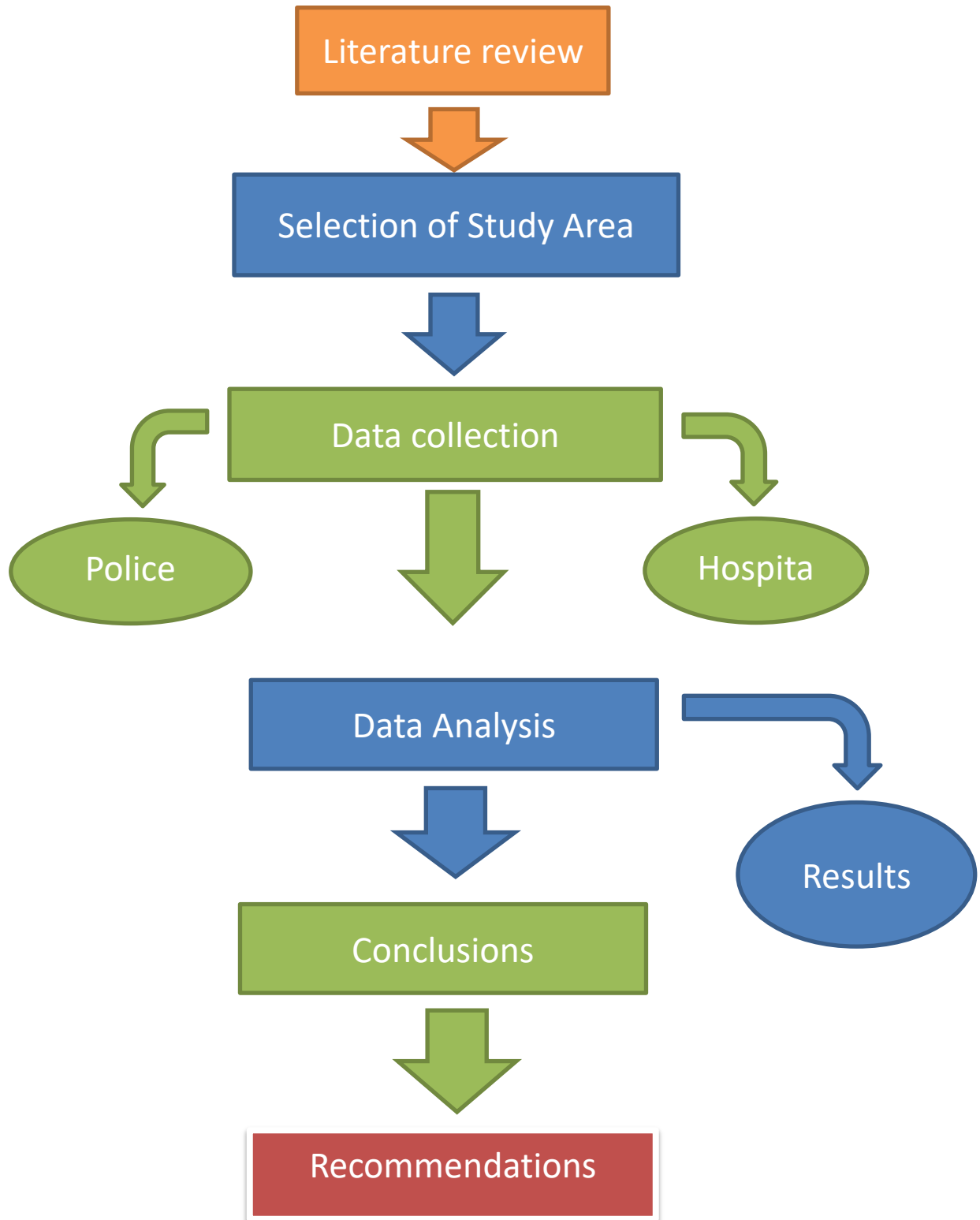


Figure 3. 1 Flow chart shows the adopted research methodology

3.3 ANALYSIS OF ACCIDENT DATA OF POLICE STATION AND CCPO OFFICE

After collecting the data from above sources analysis of the data is done. Analysis is done in order to find the pattern and causes of the accidents. Analysis will help to conclude the results and will help in finding the counter measures for results.

Analysis is done on the following area of this study.

3.3.1 TEMPORAL ANALYSIS

The data is analyzed on temporal basis. And data is analyzed monthly, day wise, hourly and analysis is also done according to day/night.

3.3.1.1 MONTH WISE ANALYSIS

Data is analyzed on monthly basis to find out accidents occur in each month of the year (January to December). After the analysis the results are shown by tables and graphs.

3.3.1.2 DAY WISE ANALYSIS

Accidents are also analyzed day wise. This analysis is done to find the number of accidents for all seven days of week and find out on which day of week most accidents occur. Results of analysis are represented by tables and graphs.

- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday
- Sunday

3.3.1.3 HOUR WISE ANALYSIS

Analysis is done on hourly basis for whole year of 2017. In this analysis we wish to find out which peak hour of accidents. Data is analyzed on one hour duration (00:00 to 00:59). Results are represented by tables and graphs.

3.3.1.4 DAY AND NIGHTS ANALYSIS

The data is analyzed to find accident occurred during day or night. Day is considered from (6:00 to 18:59) and night from (17:00 to 5:59).

- Day
- Night

3.3.2 SEVERITY WISE ANALYSIS

In this analysis the data is analyzed on the basis of severity of accident. Fatal accidents are those accidents in which at least one person die. Non-fatal are those accidents in which a person got injured. Property damage is an accident in which neither a person dies nor injured. Only property is damaged in the result of accident. Like hitting electric poles, sign boards, Traffic lights, trees and other vehicles etc. results are presented by tables and graphs.

- Fatal
- Non-fatal
- Property damage

3.3.3 CASUALITY WISE ANALYSIS

Causality wise analysis is done to find out the number of people died or injured in the accidents during study duration.

- No of people Died
- No of people Injured

3.3.4 GENDER WISE ANALYSIS

The data is been analyzed to find the number of males and females involve in the casualties happened due to the result of accidents and the results are represented by tables and graphs.

- Male
- Female

3.3.5 CAUSES WISE ANALYSIS

There are many reasons which are responsible for happening of accidents. The data is analyzed to find out the causes of accidents in Quetta city. So the counter measures can be given to reduce the reason of accidents.

Following are the causes of accidents in Quetta city.

- Careless driving
- Driving on one-way
- Intentionally
- Wrong parking

3.3.6 POLICE STATION WISE ANALYSIS

The data is analyzed to find out the number of accidents happened in area of each police station of Quetta city. so the authorities will concentrate on the prone to accidents. And will make improvement in reinforcing traffic laws. Results are presented by tables and graphs.

The Police stations of Quetta city are as follow.

- PS Airport Road
- PS Bijli Road
- PS Brewery
- PS Cantt
- PS City
- PS Civil Line
- PS Gawal mandi
- PS Industrial Area
- PS Jinnah Town
- PS Kechi Baig
- PS Khaliq Shaheed
- PS Kharotabad
- PS Kuchlak
- PS New Kuchlak
- PS New Sariab
- PS Quaid Abad
- PS Saddar
- PS Sariab Road
- PS Satellite Town
- PS Shalkot
- PS Zarghoon abad

3.3.7 DEATH PLACE WISE ANALYSIS

The data is been analyzed to find where fatalities happened after accidents. Did they die on spot or died in hospital. Results are represented by graphs and tables.

- On spot
- Hospital

3.3.8 COLLISION TYPE WISE ANALYSIS

In this analysis it is determined that what is the pattern of happening of accident. Head-on collision is a collision in which two vehicles collide face to face with each other. Nose to tail is an accident in which the front of one vehicle collides with the rear of another vehicle. Pedestrian hit is an accident in which a vehicle hit a pedestrian. In Obstacle and single car accident only one vehicle is involve in collision. It happens when a vehicle collide with any stationary object or roll over.

The Collision types of accident are as follow.

- Head on
- Nose to tail
- Pedestrian hit
- Obstacle

3.3.9 ROAD USER GROUP

This analysis is done to find out the details of involvement of road user group in accidents. And to find which road user group is more vulnerable to accidents. This analysis is done separately for deaths and injuries. The road users are as follow.

- Driver / Pillion rider
- Passengers
- Pedestrians

3.3.10 VEHICLE INVOLVEMENT

Analysis is done to find out which type of vehicle is more vulnerable to accidents. And to find out which vehicle causes more accidents in the city.

Different of type of vehicles are as follow.

- Bus
- Car (cars includes all types of cars, jeeps and pick-ups)

- Crane
- Motorcycle
- Non-motorized Vehicles
- Oil tanker
- Rickshaw
- Tractor
- Truck
- Van
- Shazore

3.3.11 ACCIDENT ON MAJOR ROADS

Analysis is been done on the data to find which major road is prone to accidents in Quetta city. The prone location will be identified on the frequency of accidents on the road. And the result will be represented by tables and graphs.

The roads on which the accidents are recorded are as follow.

- Airport Road Quetta
- Al City Scheme
- Alamdar Road
- Art School Road
- Bashir Ada Kuchlak
- Bostan Road Kuchlak
- Brewery Road
- chalo bawri road
- Double Road
- Dr. Hashmat Road
- Eastern Bypass
- Farooqia town maidani
- Gober Maidani
- Gymkhana Chowk
- Hanna Bypass
- Hazar Ganji
- Hazara town
- Jinnah Town
- Joint Road
- Kach morr
- Killi Gul Muhammad

- Killi Khilji
- Killi payand khan road
- Killi Raisani Road
- Killi shah barat
- Kirani Road
- Kuchlak Road
- Lacket Road
- Link Faisal cross
- Link Road
- Link Road Hazar Ganji
- Link Road Qda Park
- Madrasa Road
- Marri abad
- Mastung Road
- Meconghi Road
- Mehmood Ghaznavi Road
- Nau Abad
- Nawa Killi
- Pashton Bagh
- Prince Road
- Qambrani Road
- Quetta- Chaman Road
- Sabzel Road
- Samungli hosuing scheme
- Samungli Road
- Sariab Road
- Satellite town
- Sibi Road
- Sirki Road
- Spinny Road
- Teen Town
- Wahdat Colony
- Western Bypass
- White Road
- Zarghoon Road
- Zehri Town Quetta

3.3.12 ANALYSIS OF ACCIDENTS PRONE ROAD

Analysis has been done on accident prone location in the Quetta city. The location is been further analyzed on the basis of number of accidents, severity of accident, collision pattern, cause of accident, hotspot to accidents and road user group involvement.

After the analysis on police data accidents, deaths and injuries are been converted to per day calculation. This calculation will be compared with the analysis of hospital data.

3.4 ANALYSIS OF ACCIDENT DATA OF S.P.H QUETTA

Following analysis is done on S.P.H Quetta data.

3.4.1 MONTHWISE ANALYSIS

Data is analyzed on monthly basis to find out the number of people injured in road accidents in each month of the year (January to December). After the analysis the results are shown by tables and graphs.

3.4.2 GENDER WISE ANALYSIS

The data is been analyzed to find the number of males and females involve in the causalities happened due to the result of accidents and the results are represented by tables and graphs.

- Male
- Female

Number of people injured are been converted to per day calculation. This calculation will be compared with the analysis of Police data.

3.5 Comparison

Finally injured of police and hospital data are compared with each other to find the differences in the data.

3.6 Conclusion and recommendation

Conclusion is the closing of the research in which discussion is held on the obtained result and recommendations part is also included in this portion to improve the research or system. This is discussed in detail in Chapter 5 of conclusion and recommendations

4. DATA ANALYSIS AND RESULTS

4.1 Introduction to data analysis and results

This chapter describes the process of data analysis. Different types of accident occur on roads, and these accidents happened due to different causes like carelessness of driver, mechanical fault of vehicle and road way design. After analysis the causes of accidents are possibly known. And after knowing these causes suitable measures can be given to mitigate the reasons of accidents. The results are represented by tables and graphs. The main research objective is accomplished in this chapter.

4.2 Study Area

Quetta city is taken as study area for this study. Duration of research is from (January to December) 2017. And data is taken from all Police Stations, CCPO office and Sandeman Provincial Hospital Quetta.

4.3 RTA data analysis

4.3.1 Analysis of data taken from Police Stations and CCPO office

In this step of data analysis, the data collected from Police Stations and CCPO office is analyzed to find out the road accident trends and characteristics. And results will be represented by Graphs and tables.

4.3.1.1 Temporal analysis

The data is analyzed on temporal basis. And data is analyzed monthly, day wise, hourly and analysis is also done according to day/night. So we can find out that which month, day, hour or which part of the day is a more prone road traffic accident in the city. The results of the analysis are displayed with help of tables and graphs.

4.3.1.2 MONTH WISE ANALYSIS

Data is analyzed on monthly basis to find out accidents occur in each month of the year (January to December).

Table 4. 1 Month wise analysis of police data

Months	Accidents
January	9
February	5
March	15
April	14
May	24
June	20
July	32
August	12
September	15
October	15
November	23
December	15

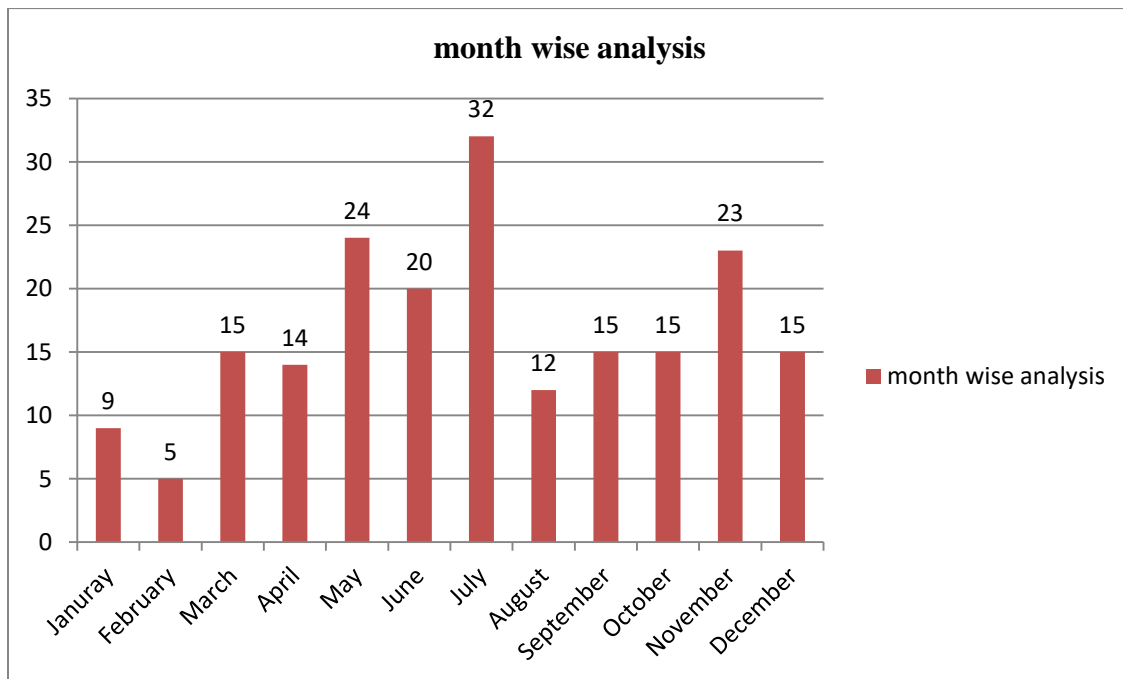


Figure 4. 1 Month wise analysis of police data

From the above table and graphs it is been clearly seen that most accidents occurs in the month of July 32 (16%) followed May with 24 (12%) accidents and least number of accidents occurred in the month of February with 5 (2.5%). Majority accidents occurred during summer season.

4.3.1.3 DAY WISE ANALYSIS

Accidents are also analyzed day wise. This analysis is done to find the number of accidents for all seven days of week and find out on which day of week most accidents occur.

Table 4. 2 Day wise analysis of police data

Day	Accidents
Monday	29
Tuesday	24
Wednesday	30
Thursday	29
Friday	37
Saturday	24
Sunday	26

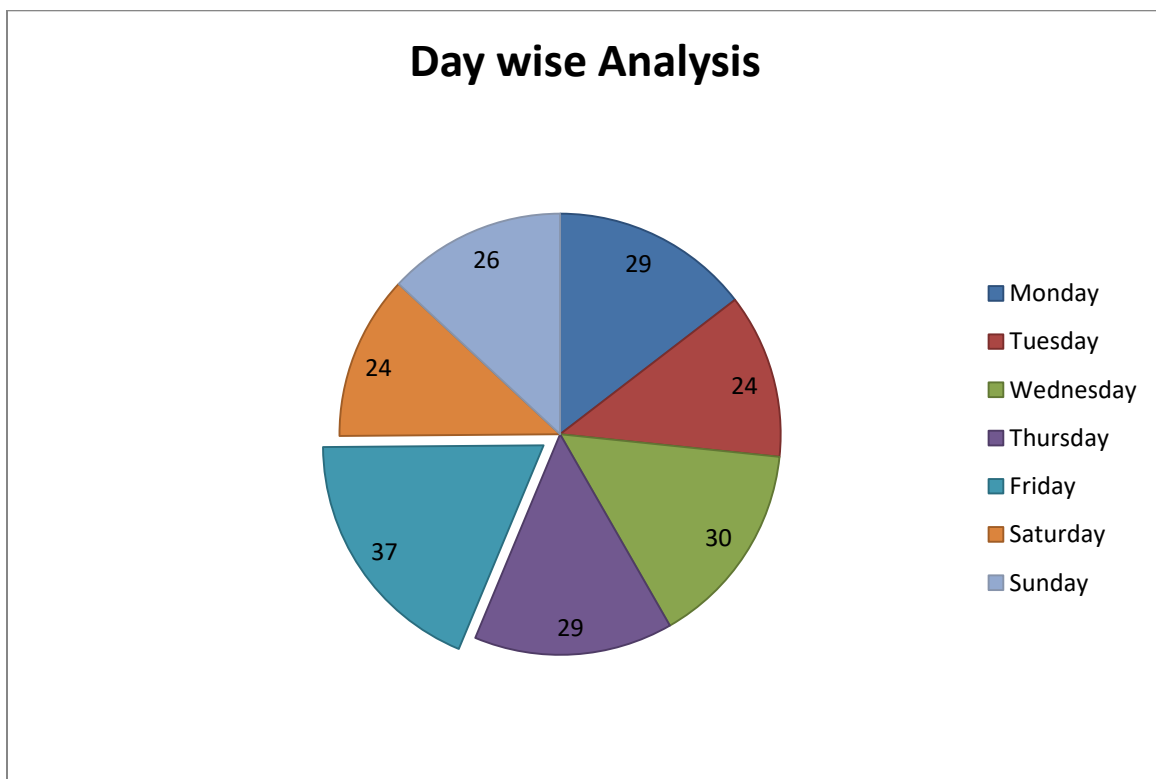


Figure 4. 2 Day wise analysis of police data

From the above graphs it is been clearly seen that most accidents happened on Friday with 37 (19%) of total accidents.

4.3.1.4 HOUR WISE ANALYSIS

Analysis is done on hourly basis for whole year of 2017. Data is analyzed on one hour duration (00:00 to 00:59) to find the Peak hour.

Table 4. 3 Hour wise analysis of police data

Hour	Accidents
1:00	3
2:00	0
3:00	0
4:00	2
5:00	1
6:00	2
7:00	8
8:00	6
9:00	4
10:00	17
11:00	12
12:00	10
13:00	10
14:00	16
15:00	12
16:00	10
17:00	22
18:00	14
19:00	17
20:00	15
21:00	8
22:00	1
23:00	9
0:00	0

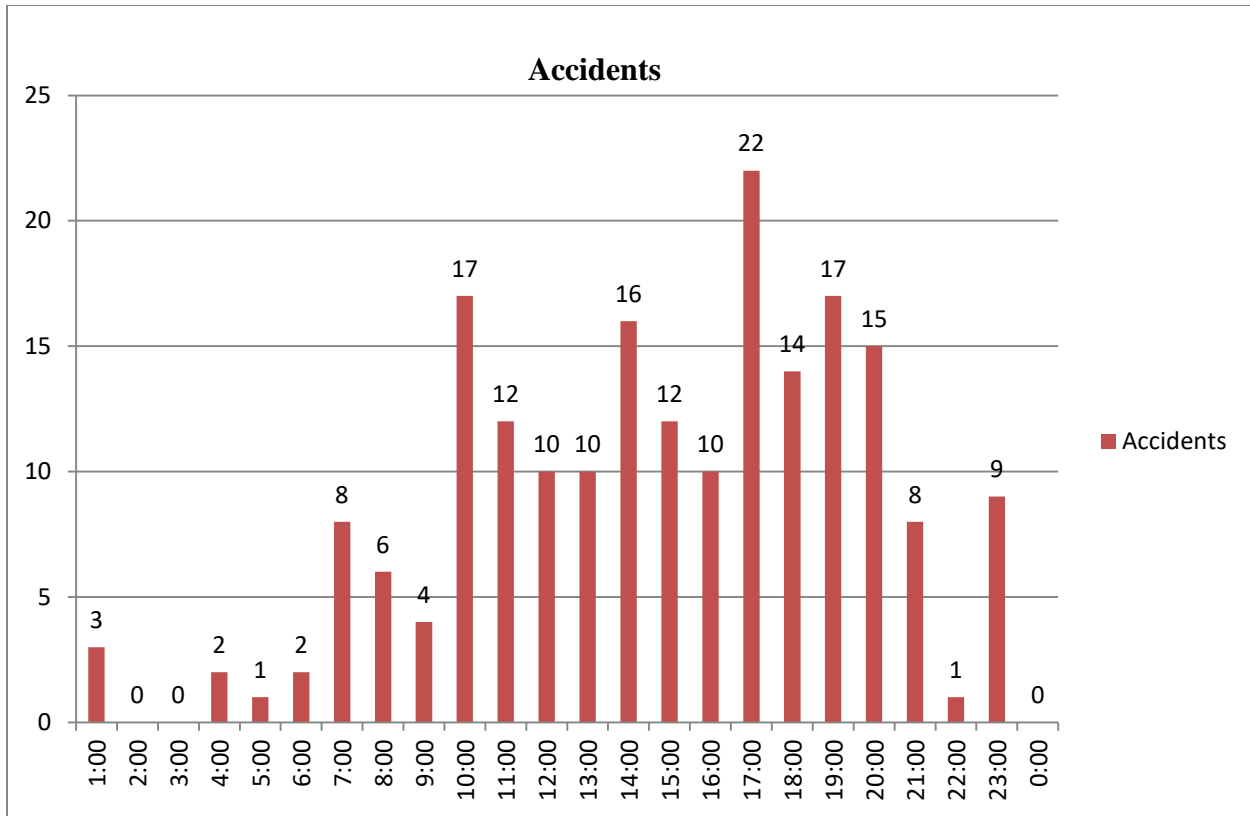


Figure 4. 3 Hour wise analysis of police data

From result it is cleared from the graphs that most number of accidents occurred from (17:00 to 17:59) 11% of total accidents. Most accidents occurred during 5pm because at this a lot of people are moving from their office, business and schools towards their home so a lot of traffic is observed during this time of the day. Due to a lot of traffic more accidents occurred during (17:00 to 17:59)

4.3.1.5 DAY AND NIGHTS ANALYSIS

The data is analyzed to find accident occurred during day or night. Day is considered from (6:00 to 18:59) and night from (17:00 to 5:59).

Table 4. 4 Day and night analysis of police data

Light Condition	No of Accidents
Day	144
Night	55

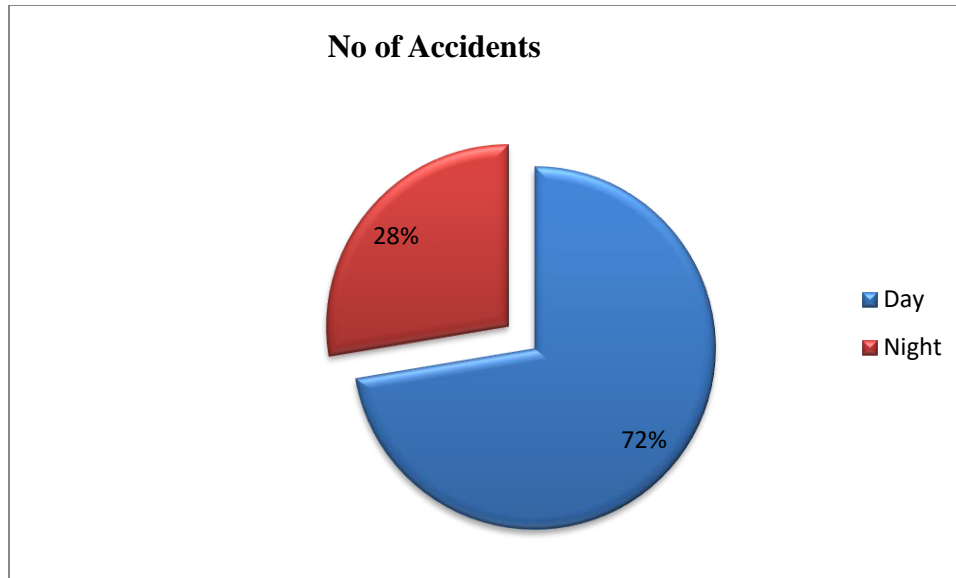


Figure 4. 4 Day and night analysis of police data

It can be clearly seen from the above graphs and tables that most accidents occur during Day which are 144 (72%). Large number of accidents occurred during because there is a lot of traffic during day time because people are moving from their houses to office, business places and schools. So due to more traffic more accidents occurred during time. And there is less traffic during night time, so the number of accidents at night is (28%)

4.3.2 SEVERITY WISE ANALYSIS

In this analysis the data is analyzed on the basis of severity of accident. Fatal accidents are those accidents in which at least one person die. Non-fatal are those accidents in which a person got injured. Property damage is an accident in which neither a person dies nor injured. Only property is damaged in the result of accident. Like hitting electric poles, sign boards, Traffic lights, trees and other vehicles etc.

It is clearly seen from the tables and graphs that during 2017 the number of Fatal accidents are 84, number of Non-Fatal accidents are 113 and 2 property damage accidents happened. From the analysis it is clear that (42%) of accidents are fatal accidents while other (58%) are non-fatal accidents. Fatal accidents constitutes large number of total accidents occurred in Quetta during 2017.

Table 4. 5 Severity wise analysis of police data

Severity	No of Accidents
Fatal	84
Non-Fatal	113
Property Damage	2

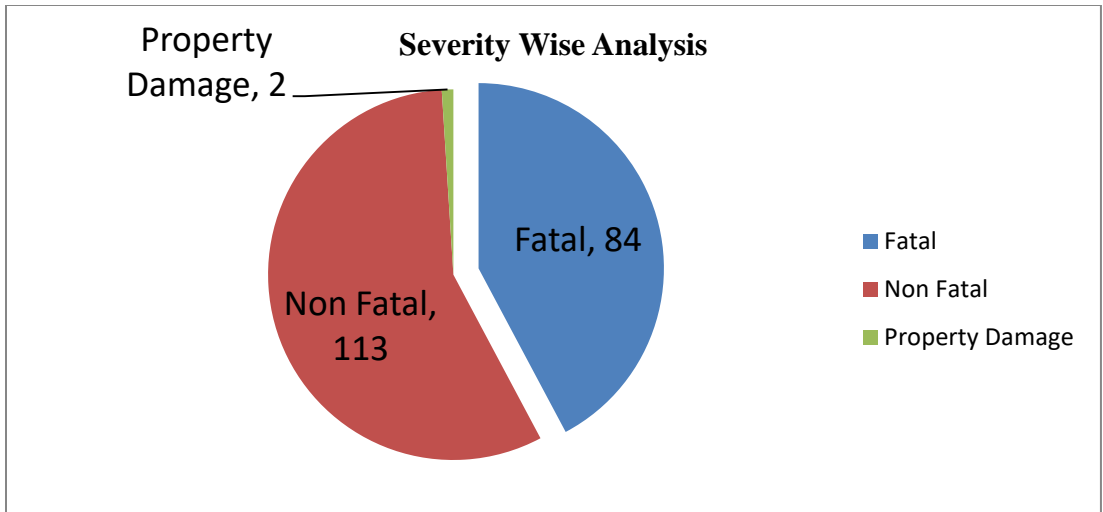


Figure 4. 5 Severity wise analysis of police data

4.3.3 CASUALTY WISE ANALYSIS

Causality wise analysis is done to find out the number of people died or injured in the accidents during study duration.

Table 4. 6 Causality wise analysis of police data

Causality	No of people
People Dead	93
people injured	254

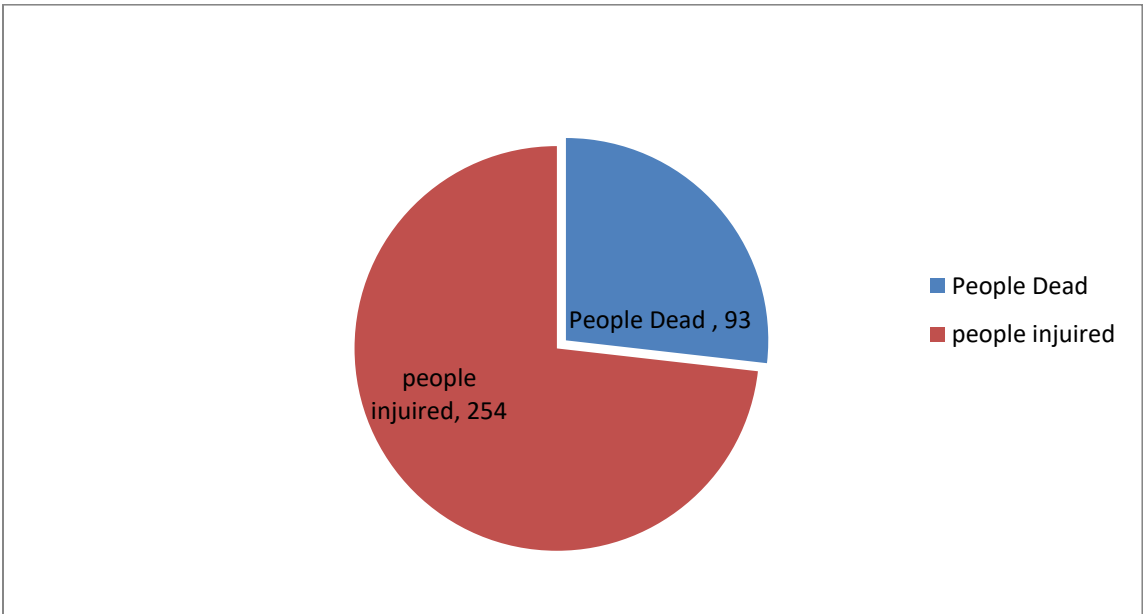


Figure 4. 6 Causality wise analysis of police data

The result is clearly seen from the table and graphs that 93 people died and 254 injured in RTA in 2017.

4.3.4 GENDER WISE ANALYSIS

The data is been analyzed to find the number of males and females involve in the causalities happened due to the result of accident.

Table 4. 7 Gender wise analysis of police data

Gender	Causalities
Male	306
Female	41

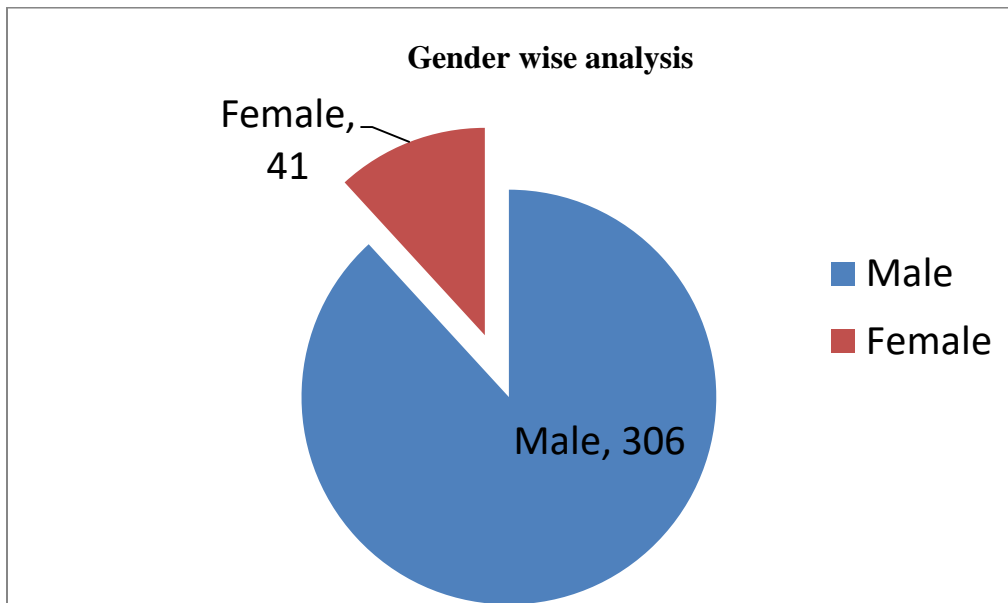


Figure 4. 7 Gender wise analysis of police data

From the above graphs it is clear that 306 (88%) Male casualties and 41 (12%) Female casualties happened in the result of RTC. Large number of accidents are pedistrain hit and most victimized vehicle to accidents are motorcycle. So due to cultural and social constraints female motorcyle drivers or pedistrains are very few in Quetta. That why males (88%) of males are involved in accidents and (12%) of females are victimized in accidents.

4.3.5 CAUSES WISE ANALYSIS

There are many reasons which are responsible for happening of accidents. The data is analyzed to find out the causes of accidents in Quetta city. So the counter measures can be given to reduce the reason of accidents

Table 4. 8 Causes wise analysis of police data

Causes of Accidents	No of accidents
Careless Driving	195
Driving on one-way	1
intentionally	2
Wrong Parking	1

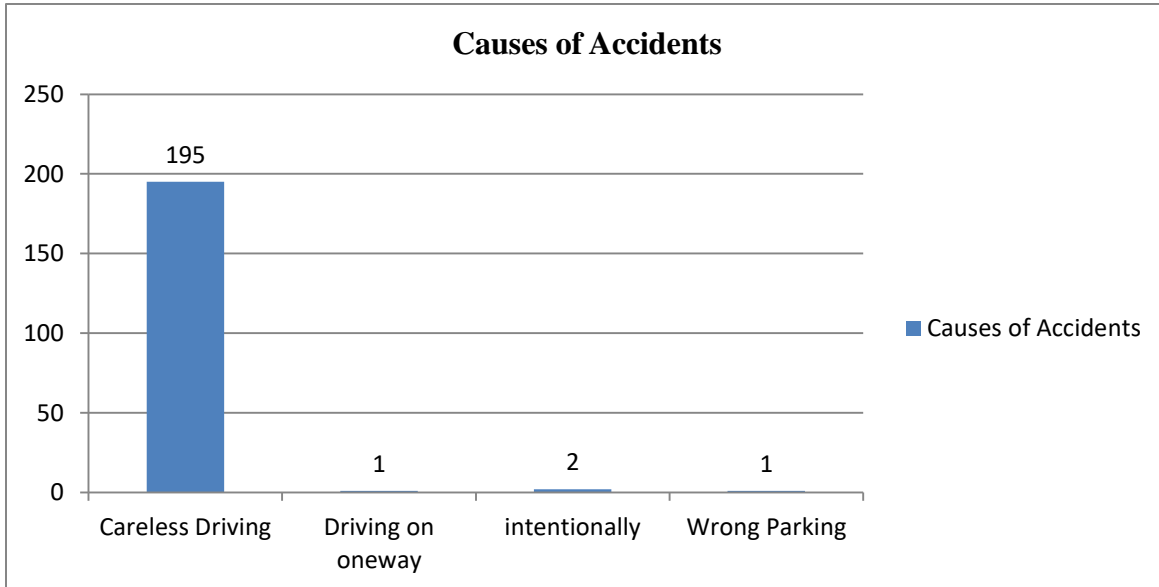


Figure 4. 8 Causes wise analysis of police data

Results obtained after analysis are careless driving 195 (97.9%) is the leading cause of accidents, which is clearly seen from graph and table. Due to the lack of reliable and incomplete data careless driving counts for the cause of (98%) accidents. So proper surveillance of accidents are required to record reliable and complete data.

4.3.6 POLICE STATION WISE ANALYSIS

The data is analyzed to find out the number of accidents happened in area of each police station of Quetta city. The analysis will show the real image of road traffic accidents happening in the city and it will help the authorities that they will concentrate on the hotspots and draw backs and provide safe and comfort passage to passenger on the road of the city.

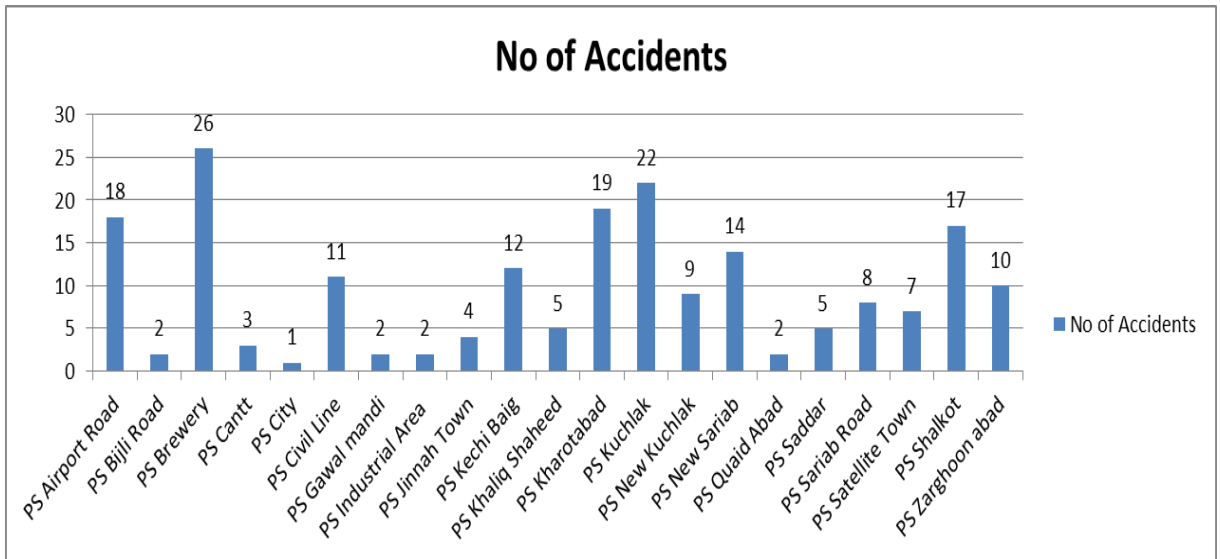


Figure 4. 9 Police station wise analysis of data

Table 4. 9 Police station wise analysis of data

Police Stations	No of Accidents
PS Airport Road	18
PS Bijli Road	2
PS Brewery	26
PS Cantt	3
PS City	1
PS Civil Line	11
PS Gawal mandi	2
PS Industrial Area	2
PS Jinnah Town	4
PS Kechi Baig	12
PS Khaliq Shaheed	5
PS Kharotabad	19
PS Kuchlak	22
PS New Kuchlak	9
PS New Sariab	14
PS Quaid Abad	2
PS Saddar	5
PS Sariab Road	8
PS Satellite Town	7
PS Shalkot	17
PS Zarghoon abad	10

It is clear from the results that most number of accidents occurred in the permisses of PS Brewery 26 (13%), and least number of accidents occurred in the area of PS City 1. Because wertern bypass Which is the most accident prone road in city is situated in the permisses of PS Brewery.

4.3.7 PLACE WISE ANALYSIS

The data is been analyzed to find where fatalities happened after accidents. Did they die on spot or died in hospital.

Table 4. 10 Place wise analysis

Place of deaths	No of People
On spot	73
Hospital	20

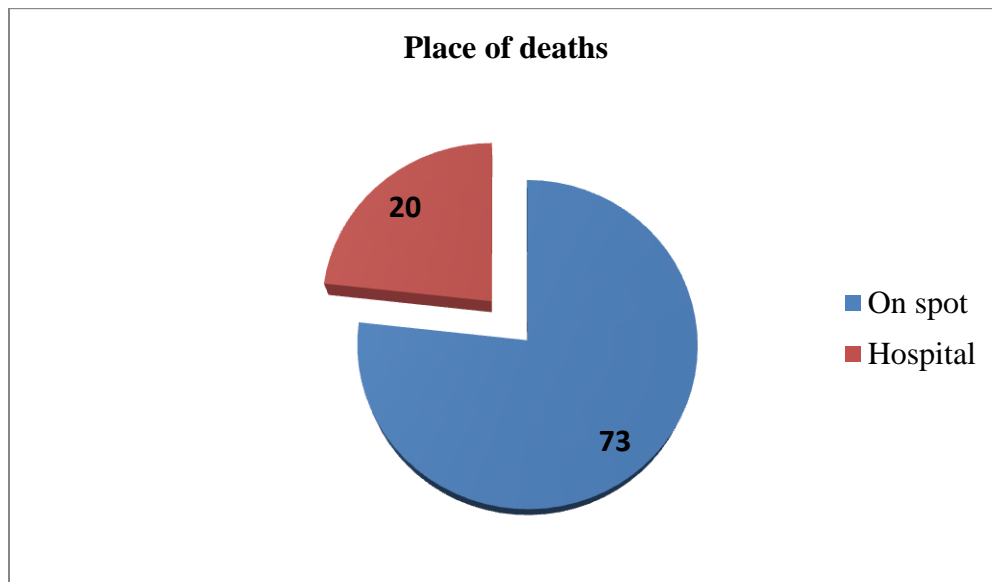


Figure 4. 10 Place wise analysis

The results show that 73 (78%) people die On spot in the results of accidents and 20 (22%) people die in Hospital. Its shows that the accidents occurred are very sever that (77%) of people at spot. This results also verify the analysis of collision type in which pedestrain hit are 104 accdients which is (52%) of total accidents.

4.3.8 COLLISION TYPE WISE ANALYSIS

In this analysis it is determined that what is the pattern of happening of accident. Head-on collision is a collision in which two vehicles collide face to face with each other. Nose to tail is

an accident in which the front of one vehicle collides with the rear of another vehicle. Pedestrian hit is an accident in which a vehicle hit a pedestrian. In Obstacle and single car accident only one vehicle is involve in collision. It happens when a vehicle collide with any stationary objector or roll over.

Table 4. 11 Collision type wise analysis

Type of Collision	No of accidents
Head On	46
Nose to Tail	48
Obstacle	1
Pedestrian hit	104

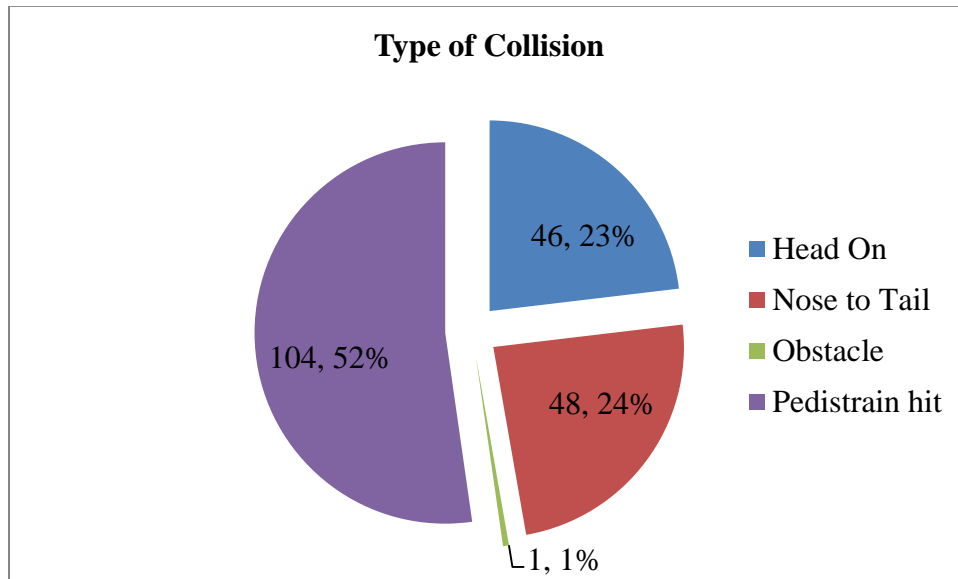


Figure 4. 11 Collision type wise analysis

It is clear from results that most type occurred are Pedestrian hit with 104 (52%), Nose to tail with 48 (24%), Head on with 46 (23%) and obstacle with 1 accident through out the year.

4.3.9 ROAD USER GROUP

This analysis is done to find out the details of involvement of road user group in accidents. And to find which road user group is more vulnerable to accidents. This analysis is done separately for deaths and injuries. The road users are as follow. It is analyzed that number

of drivers killed and injured are 34 and 64. Number of passengers killed and injured is 18 and 114. And finally number of pedestrians killed and injured is 40 and 77.

Table 4. 12 Road user type fatalities

Road User Group	No of Fatalities
No of Drivers Killed	34
No of Passengers Killed	18
No of Pedestrian killed	40

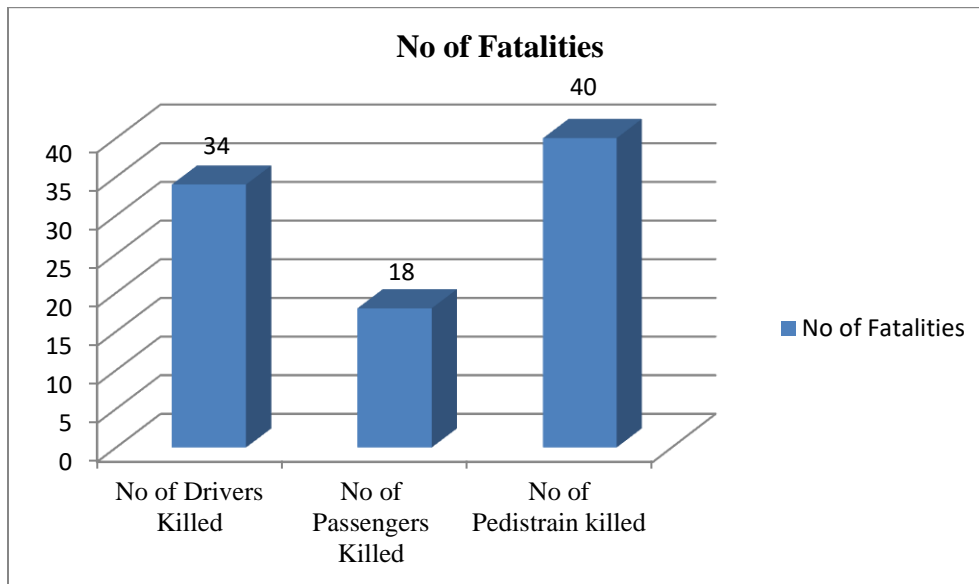


Figure 4. 12 Road user type fatalities

Table 4. 13 Road user type Injuries

Road User Group	No of Injured
No of Drivers Injured	64
No of Passengers injured	114
No of Pedestrian Injured	77

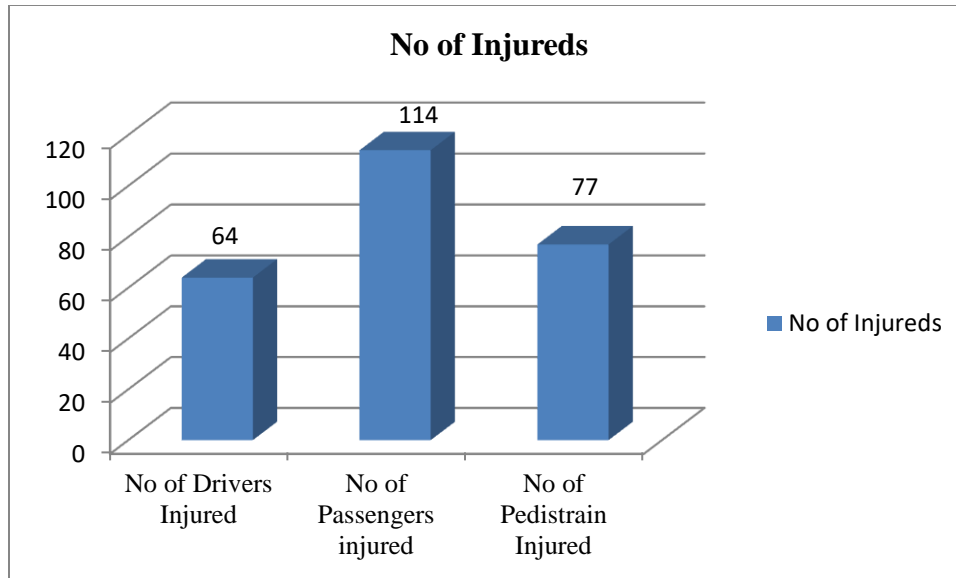


Figure 4. 13 Road user type Injuries

4.3.10 VEHICLE INVOLVEMENT

Analysis is done to find out which type of vehicle is more vulnerable to accidents. And to find out which vehicle causes more accidents in the city.

Table 4. 14 Vehicle involvement analysis

Vehicle type	No of involvement	percentage of involvement
Bus	12	4%
Car	87	30%
Crane	2	1%
Motorcycle	98	34%
Non-motorized Vehicles	4	1%
Oil tanker	4	1%
Rickshaw	12	4%
Tractor	30	10%
Truck	31	11%
Van	12	4%
Shazore	1	0%

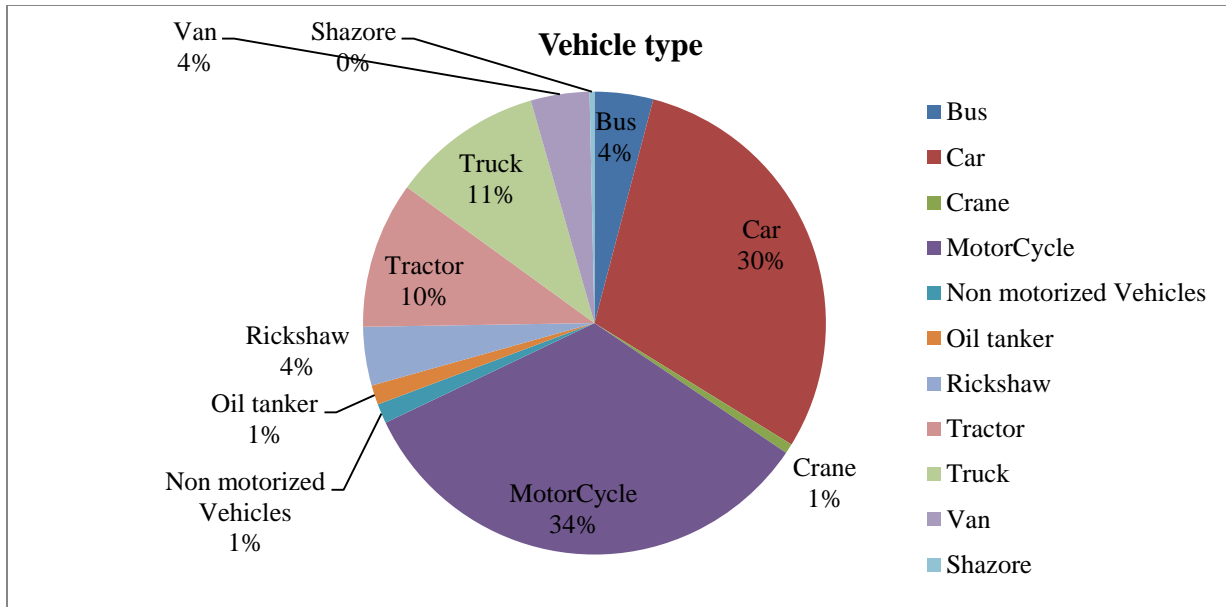


Figure 4. 14 Vehicle involvement analysis

It is clear from result that MotorCycle are most prone to accidents with 98 (34%) and car are second on the table with 87 (30%) accidents

4.3.11 ACCIDENT ON MAJOR ROADS

Analysis is been done on the data to find which major road is prone to accidents in Quetta city. The prone location will be identified on the frequency of accidents on the road.

Table 4. 15 Accidents on Major roads

Name of Road	number of accidents
Airport Road Quetta	11
Al City Scheme	1
Alamdar Road	1
Art School Road	1
Bashir Ada Kuchlak	1
Bostan Road Kuchlak	7
Brewery Road	11
chalo bawri road	1
Double Road	1
Dr. Hashmat Road	1
Eastern Bypass	4
Farooqia town maidani	1
Gober Maidani	1

Gymkhana Chowk	2
Hanna Bypass	1
Hazar Ganji	3
Hazara town	2
Jinnah Town	1
Joint Road	2
Kach morr	1
Killi Gul Muhammad	1
Killi Khilji	1
Killi payand khan road	1
Killi Raisani Road	1
Killi shah barat	1
Kirani Road	3
Kuchlak Road	1
Lacket Road	1
Link Faisal cross	1
Link Road	3
Link Road Hazar Ganji	1
Link Road Qda Park	1
Madrasa Road	1
Marri abad	1
Mastung Road	6
Meconghi Road	1
Mehmood Ghaznavi Road	1
Nau Abad	1
Nawa Killi	3
Pashtun Bagh	1
Prince Road	1
Qambrani Road	6
Quetta- Chaman Road	23
Sabzel Road	3
Samungli housing scheme	1
Samungli Road	5
Sariab Road	13
Satellite town	2
Sibi Road	7
Sirki Road	2
Spinny Road	6
Teen Town	1
Wahdat Colony	1

Western Bypass	36
White Road	1
Zarghoon Road	5
Zehri Town Quetta	1

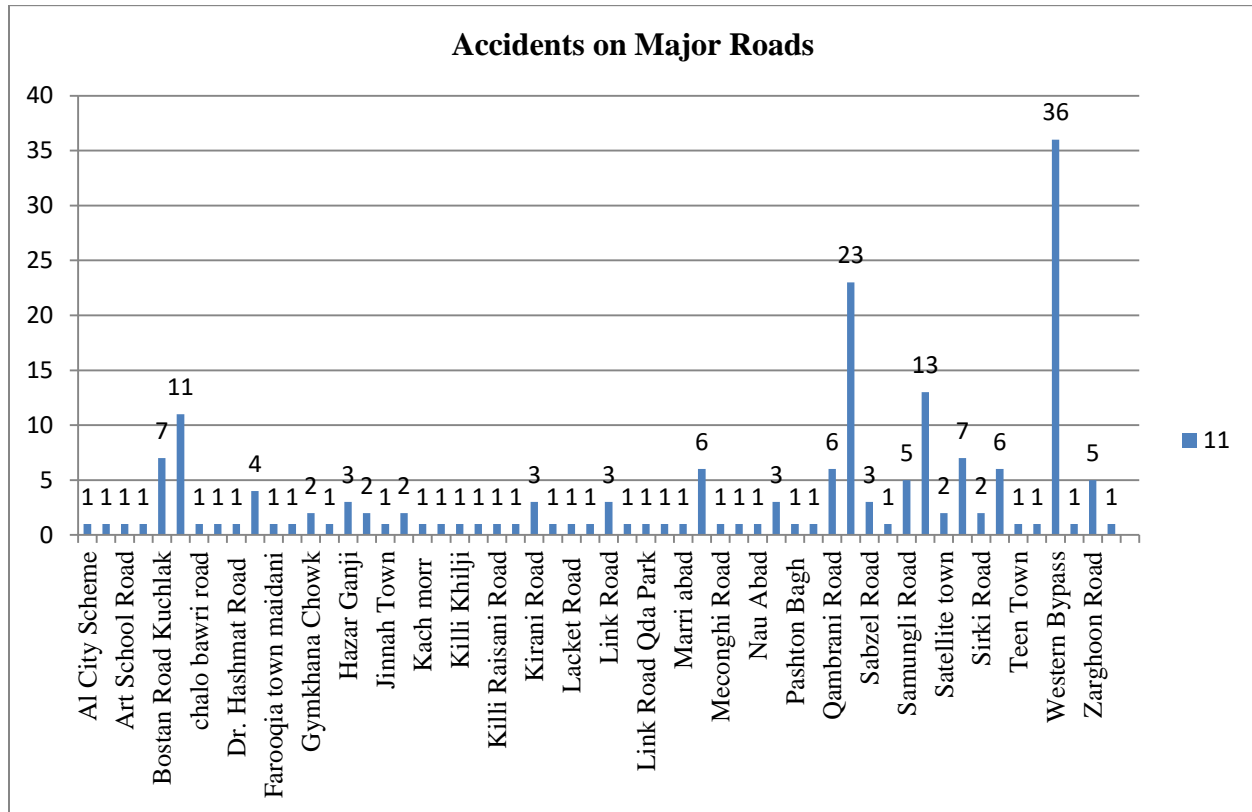


Figure 4. 15 Accidents on Major roads

It is clear from analysis that western bypass is accident prone road in Quetta city with 36 accident which is (18%) of total accients. Quetta Chaman road is second with 23 accident.

4.3.12 Trends of Accidents on Western bypass.

Following analysis is done on the accidents data of western bypass to the find trends of accidents happening on western bypass.

- Severity wise
- Road User Group
- Collision type
- Cause of accidents

➤ **Severity wise analysis**

In this analysis the data of western bypass is analyzed on the basis of severity of accident.

Table 4. 16 Severity wise analysis of western bypass

types of accidents	
fatal accidents	15
injuries	20
property damage	1

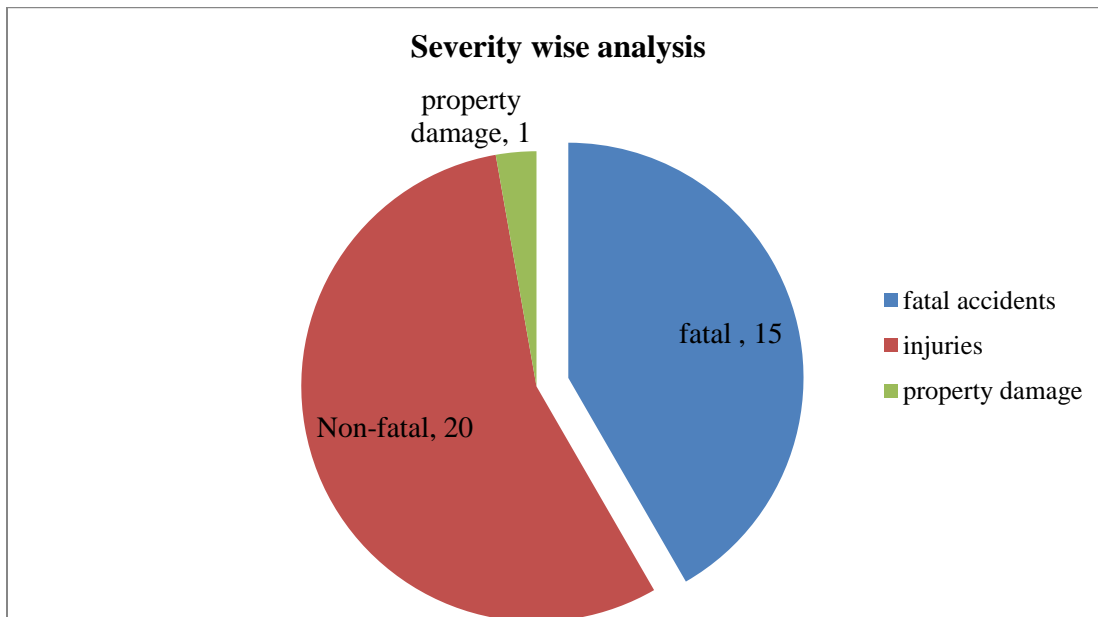


Figure 4. 16 Severity wise analysis of western bypass

From the result it is clear that 20 Non-fatal, 15 Fatal and 1 property damage accident occur on western bypass. The severity of accidents on western bypass whci is the most accident prone location is very

➤ **Road User Group**

This analysis is done to find out the details of involvement of road user group in accidents. And to find which road user group is more vulnerable to accidents on Western Bypass

Table 4. 17 Road user group wise analysis of western bypass

road user group	No of accidents
No Driver Killed	8
No Driver Injured	13
No Passenger Killed	12
No Passenger Injured	40
No Pedestrian Killed	2
No Pedestrian Injured	12

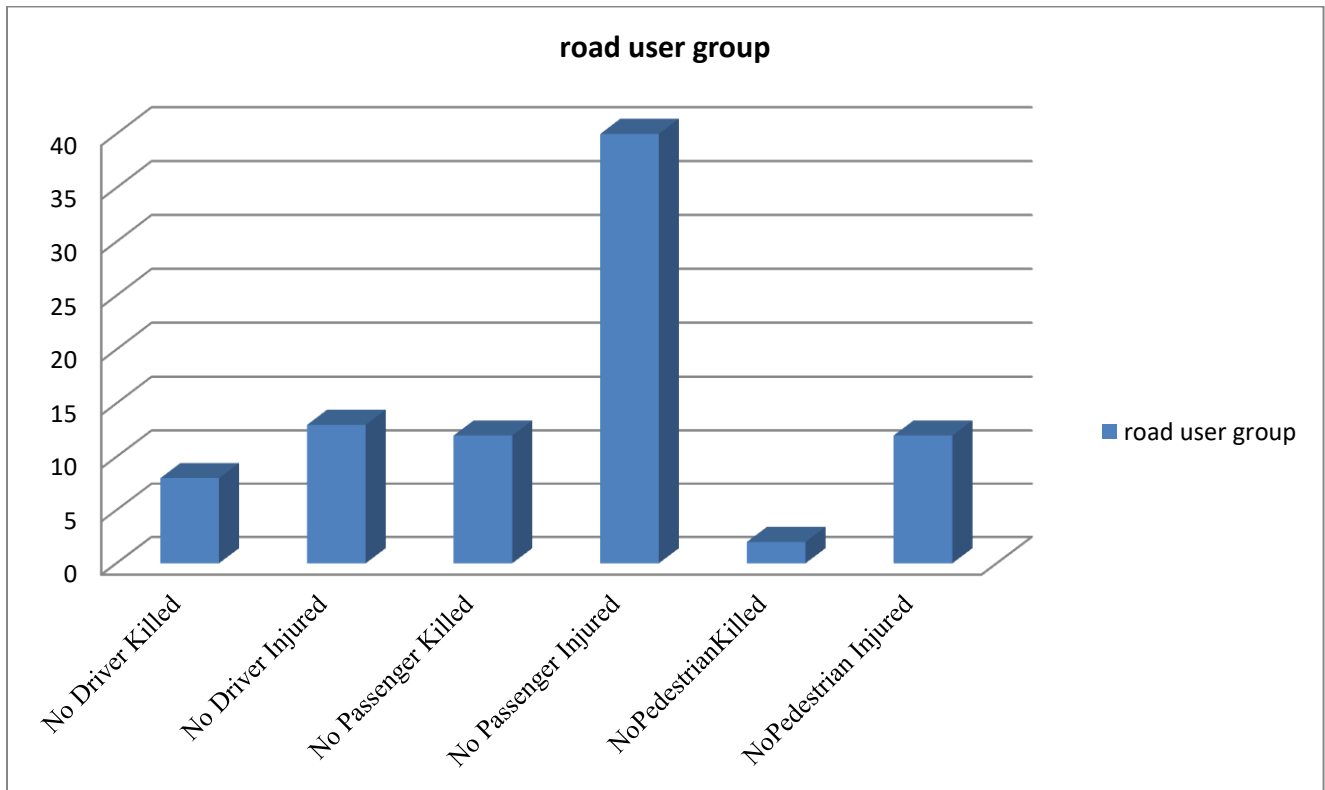


Figure 4. 17 Road user group wise analysis of western bypass

Results show that number of drivers killed are 8, passengers killed 12 and pedestrians killed are 2. And number of drivers injured are 13, passengers injured are 40 and pedestrians are 12 on western bypass.

Collision type

In this analysis it is determined that what is the pattern of happening of accident on western bypass.

Table 4. 18 Collision type wise analysis of western bypass

Collision Type	
Nose to Tail	16
Head on	6
Pedestrian hit	13
Obstacle	1

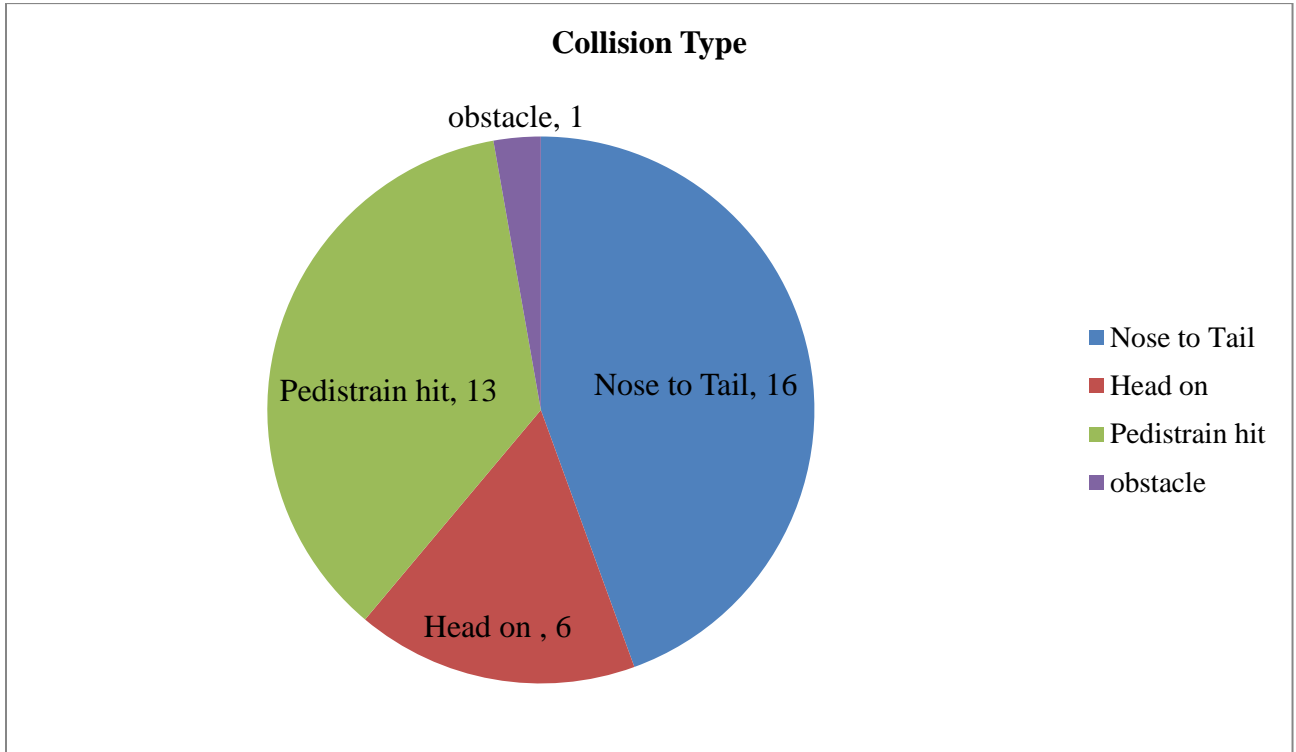


Figure 4. 18 Collision type wise analysis of western bypass

From the results it is found that the type of collision on western bypass are 16 Nose to tail, 6 head on, 13 Pedestrian hit and 1 obstacle accident.

Analysis of data per day

Accidents, deaths and injuries are been converted to per day calculation.

Table 4. 19 Per day analysis of Police data

Per day Analysis	
No of accidents per day	0.545
no fatalities per day	0.254
No injured per day	0.695

4.4 Analysis of data taken from Sandeman Provincial Hospital

In this step of data analysis, the data collected from Sandeman Provincial Hospital Quetta is analyzed to find out the accident trends and characteristics. Number of people injured, number of people died all are analyzed here in this chapter. And results are represented by tables and graphs.

Analysis is done on the following basis.

- Casualty wise analysis
- Month wise analysis
- Gender wise analysis
- Analysis of data per day

4.4.1 Casualty wise analysis

Casualty wise analysis is done to find out the number of people died or injured in the accidents during study duration. It is clearly seen from the analysis that total number of people died and brought to S.P.H is 40. And number of people brought injured to hospital during the same study duration is 4218.

Table 4. 20 Casualty wise analysis of Hospital data

Casualty wise analysis	Frequency
Total number of injured people	4218
Total number of Dead people	40

From the analysis of the data it is found that the total number of casualties which the Sandeman Provincial Hospital Quetta treated during the year 2017 is 40 Dead bodies of people who were died in road traffic accidents were brought to hospital and the number of people who were brought injured to hospital in the results of road traffic accidents are 4218. It is clearly seen from the result and graphs of both analyses that people brought to hospital are 16 times more than people injured in the police data. It explains that collateral teams from both departments should work and share data with each other to gives the data which shows the real scenario of accidents in Quetta city.

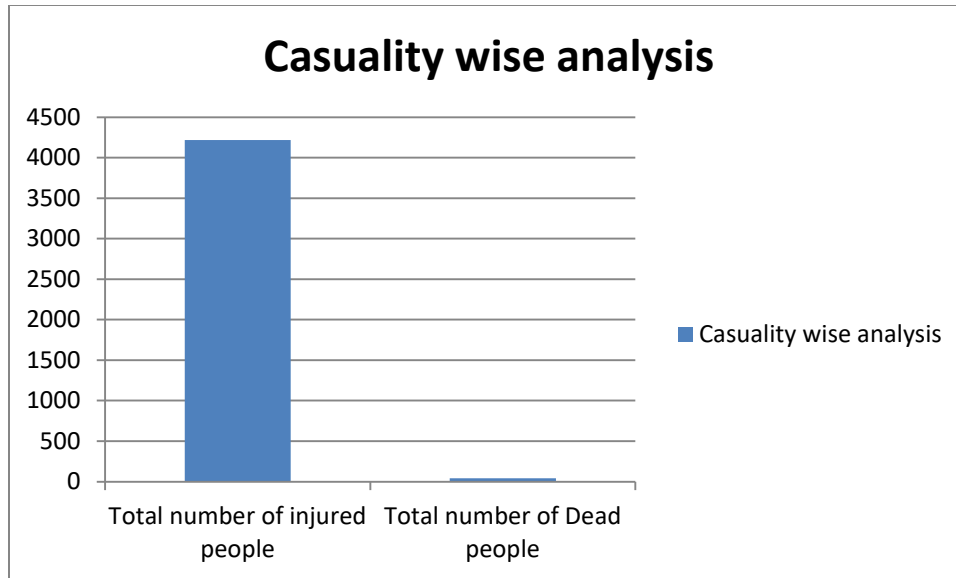


Figure 4. 19 Casualty wise analysis of Hospital data

4.4.2 Month wise analysis

Data is analyzed on monthly basis to find out accidents occur in each month of the year (January to December). Injured and dead are shown separately by tables and graphs.

Table 4. 21 Month wise analysis of injured of Hospital data

Months	No of injured
January	204
February	207
March	262
April	316
May	369
June	399
July	389
August	461
September	451
October	492
November	335
December	333

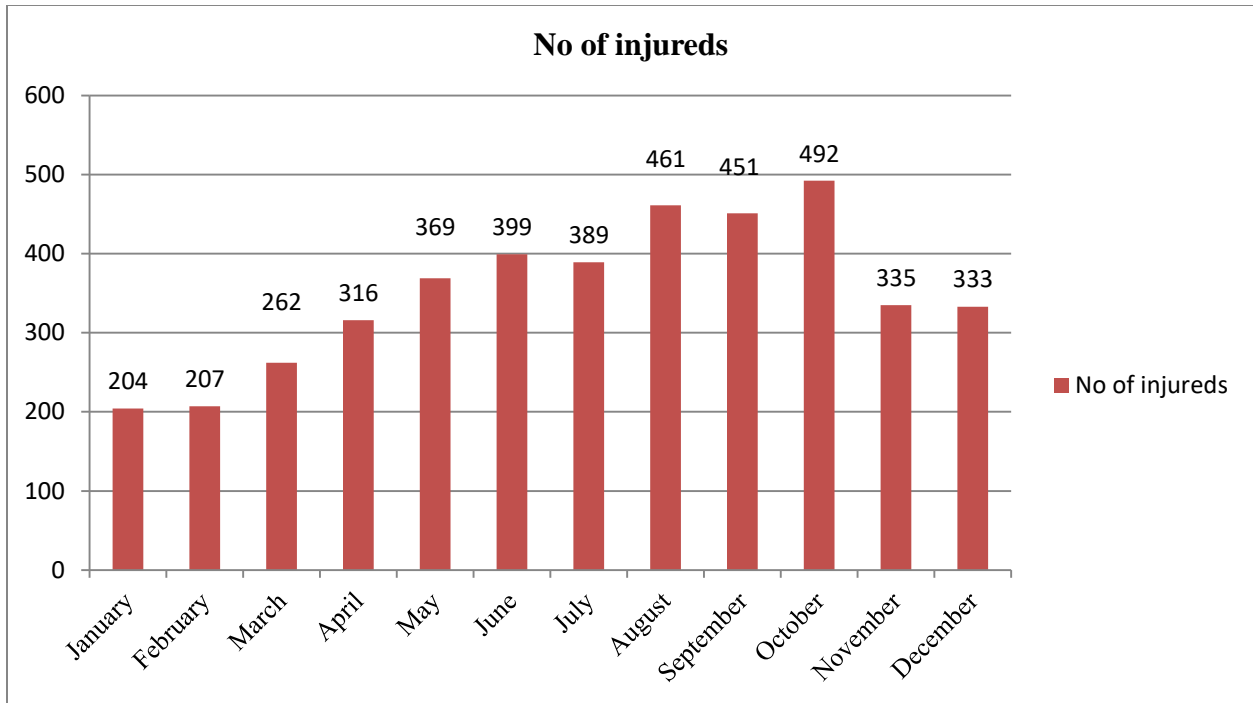


Figure 4. 20 Month wise analysis of injured of Hospital data

Table 4. 22 Month wise analysis of dead of Hospital data

Months	No of people dead
January	6
February	0
March	6
April	3
May	3
June	1
July	4
August	3
September	1
October	6
November	6
December	1

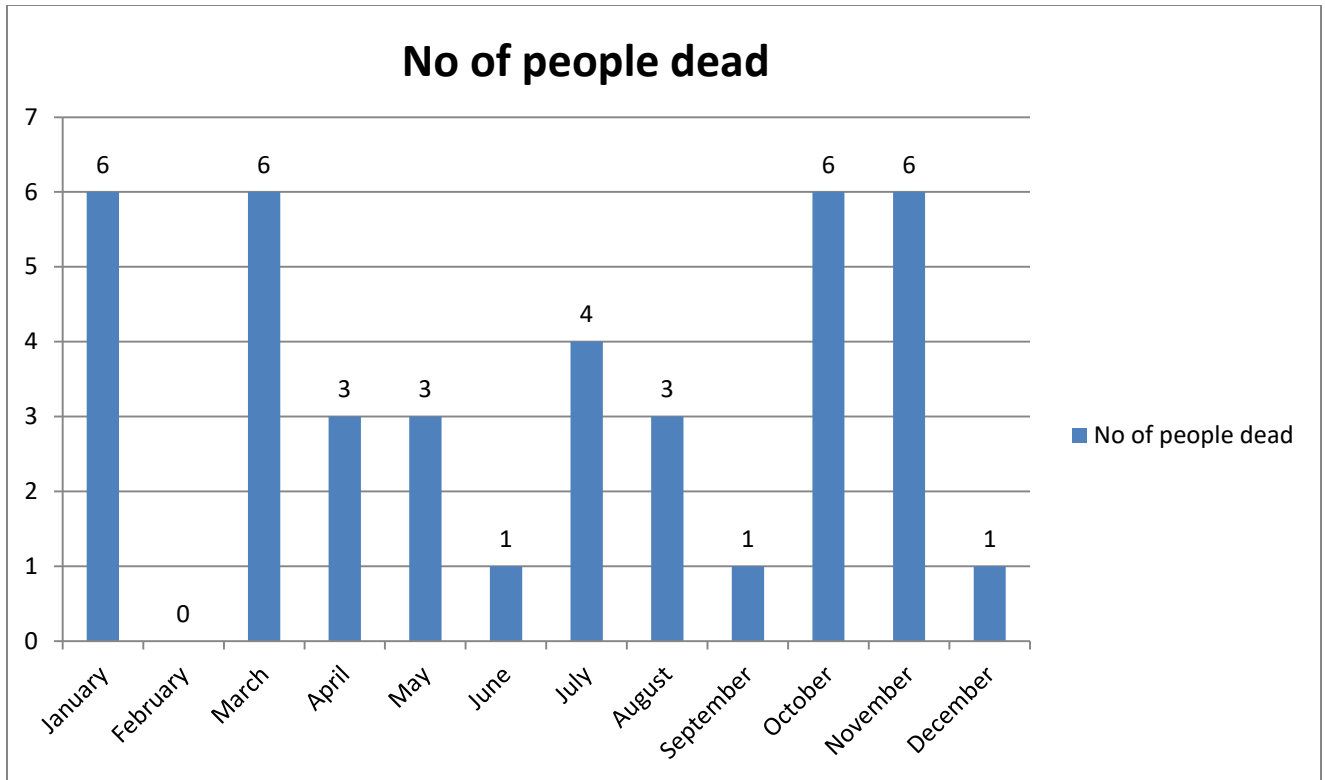


Figure 4. 21 Month wise analysis of dead of Hospital data

From the tables and graphs is clear that most number of people died in month of January, March, October and November where 6 dead bodies are brought to hospital, and most number of people injured in the month of october where number of people brought injured to S.H.P are 492.

4.4.3 Gender wise analysis

The data is been analyzed to find the number of males and females involve in the causalities happened due to the result of accident. The results are by tables and graphs.

Table 4. 23 Gender wise analysis of hospital data

Gender wise	Frequency
Male	3638
Female	620

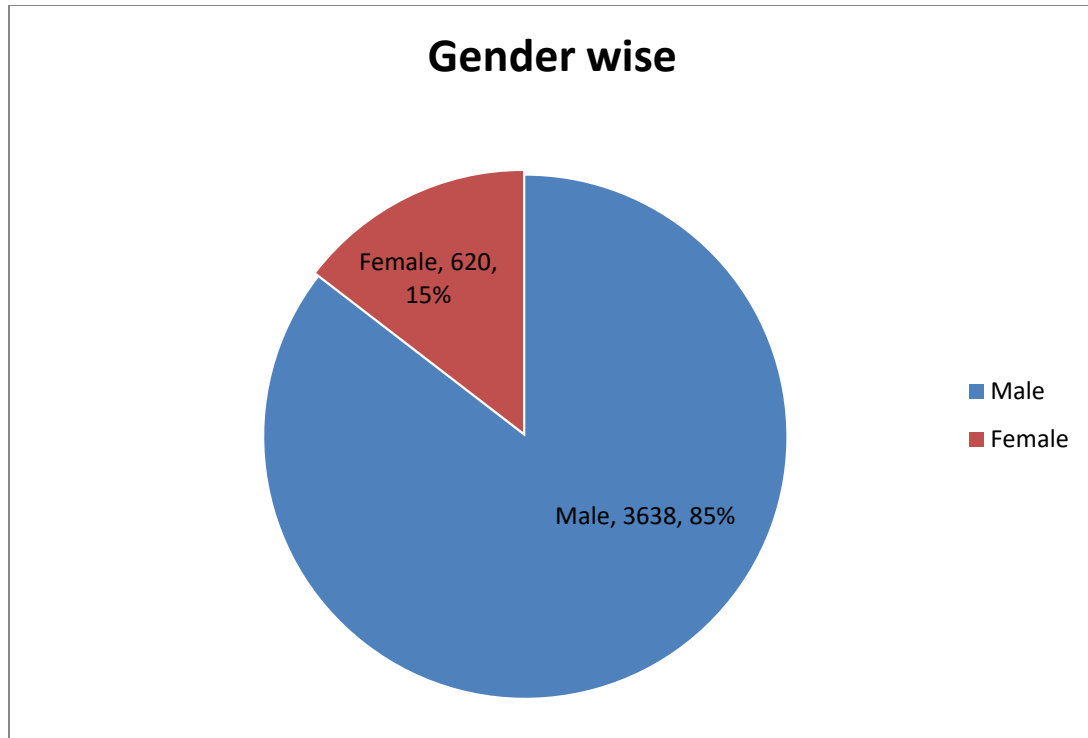


Figure 4. 22 Gender wise analysis of hospital data

From result it is clear that males are more involved in accidents with 3638 than females with 620.

4.4.4 Analysis of data per day

Accidents, deaths and injuries are been converted to per day calculation.

Table 4. 24 Per day analysis of hospital data

Per Day analysis	Frequency
No of people injured per day	11.56
No of people brought Dead to hospital per day	0.109

4.5 Summary of Analysis

Road safety is a major concern. For achieveing your goals there are many step required. This chapter has discussed the road traffic accident analysis of Quetta city. to find the pattern and

causes of RTAs. And to suggest the counter measures for mitigating the reason of RTAs. Quetta as a capital and economic hub of Balochistan province is facing a big problem of road safety because all the goodsport transport and Afghan transit trade is moving via Quetta. The roads of the city are deteriorated and the city is almost devoid of any traffic norm. So after these circumstances of increasing safety issues this study is conducted. The data is taken from two sources: All Police Stations, CCPO office and Sandeman Provincial Hospital Quetta. After the analysis of Police data it is concluded that total 199 accidents occurred in 2017. In which 84 accidents are fatal, 113 are non-fatal and 2 property damage accidents. Total of 347 casualties occurred in which 93 people died and 254 injured. Out of these 93, 73 people died on spot while 20 died in hospital. Most accidents occurred in the month of July with 32 accidents, peak hour is 17:00 to 18:00. Accidents frequently occurred on Friday with 37 accidents and 72% accidents occurred in Day light. Careless driving is the biggest cause of accidents with 195 accidents out of 199 accidents. The most frequent type of collision is Pedestrian hit with 104 accidents. Pedestrians are more victimized with 40 people died and 77 people injured. Males are more prone to accidents with (88%). Western bypass is identified as most accident prone road in the city where 36 accidents out of 199. 26 accidents occurred in the premises of PS Brewery which is (13%) of total accident. Motorcycles are most involved in 98 accidents with (34%). And car are second on table with (30%) of total vehicle involvement.

From the analysis of data of S.P.H Quetta. Results after the analysis obtained are, total 4258 casualties are treated at the hospital in which 40 are brought died to hospital and 4218 are injured during 2017. Most people brought in hospital in the month of October with 492 patients. 3638 males were brought to hospital and 620 females. After calculation it is found that 12 injured were brought to hospital every day.

Counter measures for this chapter are discussed in chapter 5.

5.CONCLUSIONS AND RECOMMANDATIONS

5.1 Conclusions

Following are the various conclusions that are drawn for this research after analysis of data.

- More accidents occurs are 32 (16%) in the month of July of year 2017 in Quetta.
- More accidents occurs on Friday throughout the year 37 accidents which is (19%) of total of 199 accidents.
- Most accident occurs from (17:00 to 17:59) 11% of total accidents in year 2017.
- Most accidents occurs during Day time which are 144 (72%) of total accident.
- Severity wise it is concluded that 84 accidents Fatal, 113 accidents are Non-fatal and 2 accidents are property damage accidents with 42.2%, 56.7% and 1% respectively.
- Total number of casualties in accidents is 347 in which 93 people died and 254 people are injured.
- 306 (88%) Male casualties and 41 (12%) Female casualties happened in the result of RTAs in Quetta.
- Leading cause of accidents are Careless driving 195 accidents which is (97.9%) of total accidents happened in 2017.
- It is concluded that 73 (78%) people die On spot in the results of accidents and 20 (22%) people die in Hospital.
- most type occurred are Pedistrain hit with 104 (52%), Nose to tail with 48 (24%), Head on with 46 (23%) and obstacle with 1 accident through out the year.
- It is concluded that most numbers of people killed are pedestrians 40. And most numbers of people injured are passengers 114.
- It is concluded that Motorcycles are prone to accidents. Which are involve in 98 accidents (34%) of all vehicles involved in accidents.
- Most accidents occur in the premises of PS brewery 26 which is (13%) of total accidents.
- Western bypass is accident prone in Quetta city where 36 accidents which is (18%) of total accidents occurred in year 2017
- Severity wise it is concluded that 20 Non-fatal, 15 Fatal and 1 property damage accident occur on western bypass.
- It is concluded that 8 drivers, 12 passengers and 2 pedestrans are killed on western bypass. While number of injured are 13, 40 and 12 respectively.
- It is concluded that the type of collision on western bypass are as, 16 Nose to tail , 6head on ,13 Pedistrain hit and 1 obstacle accident.
- It is concluded that total number of people died and brought to S.P.H is 40. And number of people brought injured to hospital during the same study duration is 4218.

- It is concluded that most number of people died in month of January, March, October and November where 6 dead bodies are brought to hospital. most number of people injured in the month of october, where number of people brought injured to S.H.P are 492.
- After analysis it is concluded that males are more involved in accidents with 3638 than females with 620.
- If the average is to be taken for each month 352 patients are brought monthly whereas from police data total number of people injured in complete year is 254 which is very unrealistic.
- Number of people injured in police data is 0.7 per day while from hospital data people brought injured to hospital is 12 person per day.
- 4218 is 16 times more than 254.

5.1.4 Summary of conclusions.

So it is clear from the analysis that the data present in Quetta city is unrealistic and incomplete. Population of the city is increasing, number of vehicles are increasing but according Pakisatn beurue of statistics accidents are decreasing without any ample action take by government or concerned departments. There is no central data base system in Pakistan or Balochistan. Data is in the pockets of Individuals. Available data is insufficient for the research purpose. Traffic in city is lacking any traffic norm. Single of traffic light is not working in the city. As major cause of RTAs is “Over Speeding” so there is no speed management plan for the city. Road markers and sign boards are rarely seen in the city. Main Arterial of the city is blocked with barriers due to VIP culture and law and order. There are a lot of geometric deficiencies in cities which need to be addressed. Half of the city is using HID lights which are also a major cause of accidents. Almost 90% of bike riders are not wearing helmets. And worse case for seat belts. The most accident prone road western bypass is undivided two lane National highway. And carriage way and shoulder of road are deteriorated and in very worse condition, more than 50% of overtakes are taken on the wrong side of the road. Heavy vehicles and passengers are moving too fast with the average speed of 70 km/hour. To ensure road safety government and concerned departments must take action.

5.2 Recommendations

- **Reliable and Accurate Data:** A proper surveillance of Road crashes is required. Major causes of the accidents are carelessness (98%), other factors like bad weather, bad road, mechanical failure, and pedestrians’ fault account zero percent of all road accidents in Quetta. These figures are definitely far from the realistic ones. There is no doubt that drivers’ fault could be a major cause of road accidents, but above mentioned figures

reveal that there is a need for improvement in data collection process to get a more realistic picture of causes of road accidents in Quetta city.

- **Safety awareness Education:** it is recommended that road safety awareness campaign should be started via seminar through festivals and media is one of the most reliable sources to promote safety awareness in the society. Road safety seminar must be conducted in Schools to aware student about road safety.
- **Traffic Management:** To ensure the safety of road users, traffic control and work personals in construction zones around the state, it is vital to maintain effective traffic management training, registration procedures and specifications
- **Road Design and characteristics:** Road design should address the deficiencies such as carriage way design, traffic signs, road markings, bumps, pedestrian ways and crossings, and animal crossings etc.
- **Motorcyclist's Accidents:** Separate lane should be provided for Motorcycles and wearing helmets and other safety measures should be must be reinforced by Traffic Police.
- **Pedestrian Crossing:** it is concluded that pedestrians constitutes large number of accidents in the city, so it is recommended that proper pedestrian way and crossing on roads must be provided.
- **Carelessness of Drivers:** Proper fines should be imposed by traffic police on the accomplice. Drivers should avoid the distraction like using of mobile phones, eating and putting on makeup etc. and aggressive driving should be avoided by the drivers.
- **License policy:** Proper license policy should be implemented in which proper driving learning courses, strict and transparent policy for issuing or renewal of license. And points system on license like in other developed countries should be imposed.

References

Goswami, Ajit & Sonowal, Ripunjoy. (2011). A STATISTICAL ANALYSIS OF ROAD TRAFFIC ACCIDENTS IN DIBRUGARH CITY, ASSAM, INDIA. Interstat.

Ebrahemzadieh M, Giah O, Foroginasab F. Analysis of Traffic Accidents Leading to Death Using Tripod Beta Method in Yazd, Iran. *Promet - Traffic & Transportation* [Internet]. 28Jun.2016 [cited 27Aug.2018];28(3):291-7

Jacobs, G. D. and I.A. Sayer (1984). Road accidents in developing countries- urban problems and remedial measures. TRRL Supplementary Report 839: Crowthorne., Transport and Road Research Laboratory Crowthorne., Transport and Road Research Laboratory.

Singh, Sanjay & Misra, Ashish. (2004). Road Accident Analysis: A Case Study of Patna City.

Heydari, S. T., Sarikhani, Y., Lankarani, K. B., & Shirazi, M. K. (2014). Burden of transportation injuries among children and adolescents of Fars province: analysis of Iran's 20-year trends. *Epidemiology and Health*, 36, e2014032. <http://doi.org/10.4178/epih/e2014032>

Shavaleh R, Motevalian SA, Mahdavi N, Haddadi M, Mohaghegh MR, Hamed Z. Epidemiological study of hospitalized road traffic injuries in Iran 2011. *Medical Journal of the Islamic Republic of Iran*. 2018;32:50. doi:10.14196/mjiri.32.50.

Chen, Feng & Chen, Suren. (2011). Injury severities of truck drivers in single- and multi-vehicle accidents on rural highways. *Accident; analysis and prevention*. 43. 1677-88. 10.1016/j.aap.2011.03.026.

Bhatti J., Razzak J., Lagarde E., and Salmi L. (2011). —Burden and factors associated with highway work-zone crashes, on a section of the Karachi–Hala Road, Pakistan. *Injury Prevention*, 17(2), 79-83.

Ahmed, A. (2007). "Road Safety in Pakistan." *National Road Safety Secretariat Ministry of Communications, Government of Pakistan*.

Mirza F., Hassan Q., and Jajja N. (2013). *An autopsy-based study of death due to road traffic accidents in metropolis of Karachi*, JPMA: 63, pp: 156-160.

Subhan and Ahmad (2015). Estimation of National Road Crash Injuries Using Data from Multiple Sources

WHO. (2015). WHO Global Status Report on Road Safety.

Jacobs, G. D. (1995). Costing Road Crashes in Developing Countries, Overseas Road Note. Transport Research Laboratory, Crow Thorne, Berkshire

De Blaeij A, F. R. (2003). The value of statistical life in road safety: a meta-analysis. *Accidents Analysis and Prevention*, 973-986.

Adeel Ahmad Khan, Z. (2014). Strategies for Prevention of Road Traffic Injuries (RTIs) in Pakistan. *Journal of the College of Physicians and Surgeons Pakistan*, 5(24), 356-360.

Appendix (1)

SAMPLE OF RTA DATA

Accident Date	Day Of Accident	Accident Time	Name of Police station	Accused Vehicle	Accident Severity Value	No Driver Killed	No Driver Injured	No Passenger Killed	No Passenger Injured	No Pedestrian Killed	No Pedestrian Injured	Collision Type Value	Light Condition Value	Accident Cause Value	Network Value	Victim's vehicle	place of death	Place of accident	Total Died	Total Injured	Female Died	Female Injured
1/2/2017	Monday	14:40	PS Sariab Road	Bus	Fatal	0	0	0	0	1	0	Pedestrian hit	Day light	Careless Driving	Sariab Road	BareFooted	On Spot	Sariab Road	1	0	0	0
1/3/2017	Tuesday	14:00	PS Satellite Town	Tractor	Fatal	0	0	0	0	1	2	Pedestrian hit	Day light	Careless Driving	chalo bawri road	BareFooted	On Spot	chalo bawri road	1	2	0	0
1/6/2017	Friday	21:35	PS Civil Line	Car	injury	0	1	0	0	0	0	Head on	Night	careless driving	Joint Road	Motor Cycle	0	imdad chowk	0	1	0	0
1/7/2017	Saturday	18:35	PS Airport Road	Car	Fatal	0	0	0	0	1	0	Pedestrian hit	Night	Careless Driving	Quetta-Chaman Road	BareFooted	On Spot	(Balana Resturant)	1	0	0	0
1/8/2017	Sunday	19:00	PS New Sariab	Car	Fatal	0	0	0	0	1	0	Pedestrian hit	Night	Careless Driving	Mastung Road	BareFooted	Hospital	(near Al-Asif hotel)	1	0	0	0
1/16/2017	Monday	11:40	PS Brewery	Tractor	Fatal	0	0	0	0	1	0	Pedestrian hit	Day light	Careless Driving	Brewery Road	BareFooted	On Spot	Brewery Road	1	0	0	0
1/17/2017	Tuesday	12:50	PS Civil Line	Car	injury	0	1	0	0	0	0	Nose to Tail	Day light	Careless Driving	Zarghoon Road	Motor Cycle	0	Grammer School	0	1	0	0
1/25/2017	Wednesday	10:30	PS Kechi Baig	Bus	Fatal	1	0	0	0	0	0	Nose to Tail	Day light	Careless Driving	Sariab Road	Motor Cycle	On Spot	Near Tariq Hospital	1	0	0	0
1/25/2017	Wednesday	12:00	PS Shalkot	Bus	Fatal	1	0	0	0	0	0	Nose to Tail	Day light	Careless Driving	Western Bypass	Motor Cycle	On Spot	Mengal abad	1	0	0	0
2/1/2017	Wednesday	11:30	PS Sariab Road	Tractor	Fatal	0	0	0	0	1	0	Pedestrian hit	Day light	Careless Driving	Qambrani Road	BareFooted	On Spot	At Bashir Chowk	1	0	0	0
2/16/2017	Thursday	21:15	PS Brewery	Motor Cycle	injury	0	0	0	0	0	1	Pedestrian hit	Night	Careless Driving	Kirani Road	BareFooted	0	Kirani Road	0	1	0	0
2/19/2017	Sunday	17:40	PS Khaliq Shaheed	Rickshaw	Fatal	1	0	0	0	0	0	Head on	Day light	Careless Driving	Eastern Bypass	Motor Cycle	On Spot	Alizai Road	1	0	0	0
2/22/2017	Wednesday	19:30	PS Kuchlak	Tractor	injury	0	1	0	0	0	0	Nose to Tail	Night	Wrong Parking	Quetta-Chaman Road	Shazore	0	Kuchlak	0	1	0	0
2/26/2017	Sunday	14:40	PS Kharotabad	Tractor	Fatal	0	0	0	0	1	0	Pedestrian hit	Day light	Careless Driving	Pashton Bagh	BareFooted	On Spot	Pashton Bagh	1	0	0	0