ANALYSIS OF ROAD TRAFFIC ACCIDENTS AT DIFFERENT INTERSECTIONS IN DISTRICT GUJRAT: CASE STUDY

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Submitted By

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In the name of Almighty Allah, the Most Merciful, the Beneficent. All praise is only for Allah who created us and always planned the best for us. I am grateful to the Almighty Allah for His countless blessings and mercy bestowed upon me through the difficulties of life and I seek His guidance and pray to Him for blessings and ease throughout this life and the life to come.

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ABSTRACT

Vehicular traffic is a complex flow model containing a wide range of vehicles along with pedestrians that make the road traffic accidents a severe problem. Many developing nations including Pakistan facing serious road accident problems that impose enormous economic and social losses on society. Road traffic accidents can be defined as unpremeditated events resulting in recognizable damage. The damage may be of property only, personal injury, or loss of human life. Most of the accidents are clashes that can be avoided with better road safety interventions. It is learned from various studies that one of the leading causes of road traffic accidents is human error, negligence and over speeding, followed by a mechanical fault in vehicles such as brake failure, tyre burst, axle damage. Further road parameters such as inadequate geometric design of highway, insufficient width of shoulder, design of junction also contribute towards the cause of crashes.

Elimination of road traffic accidents involving deaths, injury, and property damage from all road network is the major goal of road transport safety and this can be done by analyzing the facts influencing road traffic accidents finding measures to eliminate the causes of accidents, and strict enforcement of laws and regulations on the highway. This research work discussed and analyzed the current highway safety scenario in District Gujrat. The study also compared RTAs of different districts of Punjab province and identify the most effected district by the accidents using available data.

The research also focused on the identification of black spots and analysis of RTAs on major intersections of the District. Some of the major intersection of the district is located on the section of National Highway N-5 stretches from river Chenab to river Jhelum. Further with the increase in the number of passenger cars, two-wheelers, and heavy traffic maneuvering through this section the rate of crashes escalated very quickly. The trends in available data suggested the same. The deteriorating situation of road safety needs to be acknowledged and investigated accordingly. The present research originates from all the above considerations and it intends to analyze road traffic accidents, to develop an accurate diagnosis, proposing measures for the mitigation of a burgeoning number of accidents, and to develop a better understanding of highway safety in district Gujrat.

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CHAPTER 1

INTRODUCTION

1.1 Study Background

Transportation systems are principally designed on the provision of safe, convenient, and efficient means of transport for the mobility of people and goods. In the transportation system, the most important and basic aspect is road safety as road traffic accidents pose adverse effects not only on an individual societal level but also on an economic level resulting in loss of Gross Domestic Product (GDP) of a country. It is estimated by the National Road Safety Secretariat that in year 2006 Pakistan incurred a loss of 100 billion rupees due to Road Traffic Accidents (Ahmed, 2007). Furthermore, another study illustrates that due to injuries 31.94 healthy life years per 1000 population were lost in the year 1990 in Pakistan (Hyder and Morrow, 2000). Statistics of the World Health Organization reveal that in low- and middle-income countries such as Pakistan losses 3 percent of total GDP in road traffic crashes.

Pakistan's economy expanding and has recorded steady growth during the last 10 years. In fiscal year 2016-17 Pakistan's economy witnessed a 5.3% increase in Gross Domestic Product and officials of the Ministry of Finance predicted the same rising trend in upcoming years (MoF, 2017). In May 2017, The economy had surpassed US$300 billion as reported to the Pakistan Bureau of Statistics (MoF, 2017). It is estimated that if the rising trend continues to persist then by the year 2020 Pakistan GDP will be around $360 billion rising from $315 billion in 2018 and the estimated loss to the economy in 2020 due to RTAs will rise from $9 billion to $11 billion (MoC, 2018).

In both developed and developing countries, road accidents are now viewed as a serious public health issue. In the year 2016 more than 27,000 people were killed in road accidents in Pakistan as highlighted by statistics of the World Health Organization (WHO, 2018). Furthermore, according to international statistics, the death of about one-third of them is related to a lack of safety interventions in road design.

This indicates that the safety situation has been rapidly deteriorating and is very critical by international standards also the figures depict that the road safety is in a shambled state. Reliable crash data are still not available in Pakistan, there is information about many collisions where the road alignment, equipment, or traffic management were one of the reasons. Consequently, it is proven that a good and safety-oriented design may reduce the possibility and severity of crashes, and significant safety gains have been achieved in all countries where this approach has been implemented. Road traffic safety challenge is encountered by globally all countries. The severity is different from one country to another, Low and Middle-Income Countries (LMIC) have limited resources, whereas developed countries have much resources to invest in infrastructure, better provision of road safety, enforcement of safety rules and regulations on highway and policy-making whereas LMIC lag behind in development level infrastructure conditions and transportation safety policy.

Table 1 Causes of Deaths in Different Age Group

Rank	Causes	% of Total Deaths
1	Ischemic heart disease	16.6
2	Stroke	10.2
3	Chronic obstructive pulmonary disease	5.4
4	Lower respiratory infections	5.2
5	Alzheimer's disease and other dementia	3.5
6	Trachea, bronchus, lung cancers	3
7	Diabetes mellitus	2.8
8	Road Traffic Injuries	2.5
9	Diarrheal diseases	2.4
10	Tuberculosis	2.3

Source 2016 WHO Global Health Estimate

1.2 Problem Statement

Road traffic accident has now become a pressing issue all over the world. A report published by the World Health Organization (WHO) titled "Global Status Report on Road safety" illustrates that the number of fatalities due to RTAs raised to 1.35 million in 2016 from 1.25 million in 2013. 90% of all the road traffic fatalities occurred in low and middle-income countries and only 10% occurred in High-income Countries (WHO, 2018). A similar report showed that RTAs are currently ranked eighth among the various causes of deaths and are estimated to reach the fifth position by 2030 (WHO, 2018). It is also ranked as the first cause of death among children age between 5-14 and among young adults age between 15-29. The report further illustrates that the fatality rate due to RTAs is 14.3 deaths per 100,000 populations in Pakistan, whereas, in the United Kingdom, it is 3.1 deaths per 100,000 population. All these figures and statistics reflect the importance of the road safety issue and propose an urgent need to act in both developed and developing countries to mitigate this problem.

Numerous researches have already been carried out that evaluates road traffic accidents in different districts of Pakistan. District Gujrat is the 18th largest district population-wise and the 26th largest area wise of Punjab Province was never been analyzed before. Rapid motorization and urbanization of District Gujrat in the past few years worsen the situation of traffic in the city. Congestions on the main arteries of the city become part of daily routine and on top of that increasing number of drivers on road without acquiring proper licenses made the situation even worse. These factors stress the need to analyze road traffic accidents in District Gujrat.

1.3 Research Objectives

The main research objectives of this study are enlisted below,

- To carry out a detailed literature review of studies on road traffic accident analysis and investigation in Pakistan and elsewhere.
- To identify the reasons for traffic accidents and proposing measures for its mitigation.
- Analyzing the RTAs District wise in Punjab Province and identification of district most effected by RTA.

- Identifying the reasons for RTAs into Human, Mechanical, and Engineering Errors.
- Identifying the intersections having the majority of RTAs in District Gujrat.
- Identifying the vehicle category is mostly involved in RTA.
- Identifying the type of road user most affected by RTA.
- Categorizing the victims of RTA into different age groups and identifying the most vulnerable age group.
- Identification and analysis of blackspots in District Gujrat.
- Proposing various measures to enhance the safety of different intersections and Blackspots.

1.4 Research Significance

The study undertaken would help relevant government agencies and administration to reduce road traffic accidents at different locations and minimizing the adverse effect on the public. The findings of this study further facilitate the concerned department to concentrate on problems relating to road traffic injuries and its burden on public health. The research would directly help in reducing excessive road traffic injuries and fatalities while improving the overall road safety scenario of different district roads.

1.5 Scope of Research

The finding of this study will be utilized by law enforcement agencies to enforce strict laws and maintained traffic discipline at identified locations where most of the accidents happened. further, this study assists local administration to put extra resources on road safety to reduce the number of RTAs in District Gujrat. Road safety researchers able to access crash data about district Gujrat and further researches will be carried out to improve safety in District.

1.6 Thesis Organization

This research has been organized into five chapters. An overview of those chapters is given below.

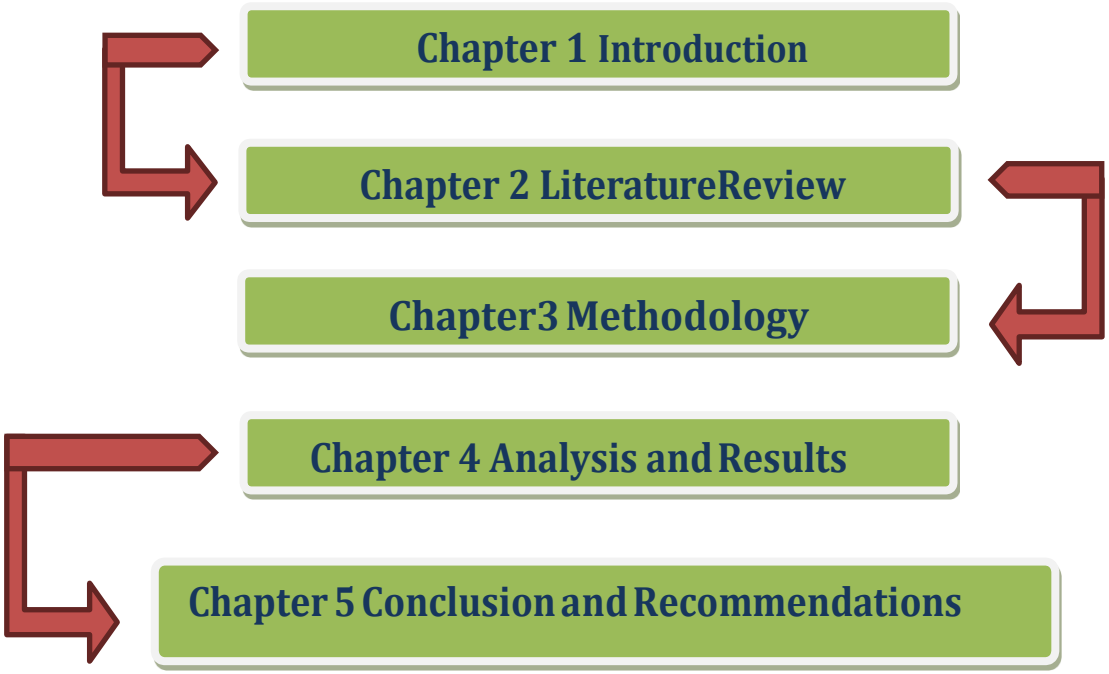


Figure 1 Process Overview Map

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents a detailed review of the research studies already carried out on road safety and its importance in the transportation sector. It further discusses in detail the literature on road traffic accidents and factors associated with it.

2.2 Road Traffic Accidents in Developing Countries

It is learned from various studies that the present and projected global burden of RTAs will be borne by the countries that can least afford to meet the health service, economic, and societal challenges posed (Ameratunga et al., 2006). Vasconcellos (1995) compared RTAs death with other epidemics and found out that the deaths in the case of RTAs were larger as compared to the deaths due to other epidemics in some of the developing countries. Assessing RTA data from the period of the year 1987 to the year 1995 it comes to know that the countries of the developing world experienced more number of people killed in a road accident as the highest death rates in terms of deaths per 10,000 registered vehicles occurred in African countries, particularly Ethiopia, Uganda and Malawi whereas in developed countries the steady decrease in the rate of death per 10,000 registered vehicle observed (Jacobs et al., 2000). It is expected that the share of death as a result of RTA in low and middle-income countries will continue to increase as much as 80% and it will decline in High-income Countries by almost 30% by the end of the year 2020 (Peden et al., 2004). In developing countries, the projected rise will be 2 deaths per 10,000 people while in high-income countries it will fall below the 1 death per 10,000 people (Kopits and Cropper, 2005). RTA ranked the sixth most common cause of death in middle-income countries (Colin et al., 2009).

A study conducting by Jacobs et al. (2000) on a regional basis showed that the Asia-Pacific region has the greatest share of road deaths which is 44%, whereas the region has only 16% of total registered vehicles. They further observed that between 1987-1995 period road deaths increased by 40% in the Asia-Pacific. Conversely, road deaths fell by about 10% in developed countries. World Health Organization published a report on Global Status on Road Safety. Comparing both

the Global Status report on Road Safety published in the years 2013 and 2018 it is observed that annual deaths from RTAs increased from 1.24 Million to 1.35 Million globally witnessing a nearly 9% increase in the annual RTA deaths. Moreover, during the period 2013 to 2018 fatality rate remained the same which is 18 death per 100,000 population. The number of vehicles increased globally from 1.9 billion to 2.1 during the same period hence death rate per registered vehicle declined and in 2016 it is reported to be around 64 deaths per 100,000 registered vehicles compared to the 70 deaths in the year 2013. Although statistics suggest that the severity of RTAs is reducing but progress varies significantly from different areas of the world. The below figure illustrate that the death rate increased in low- and middle-income Countries whereas it is reduced in High-income Countries (WHO, 2013, WHO, 2018).

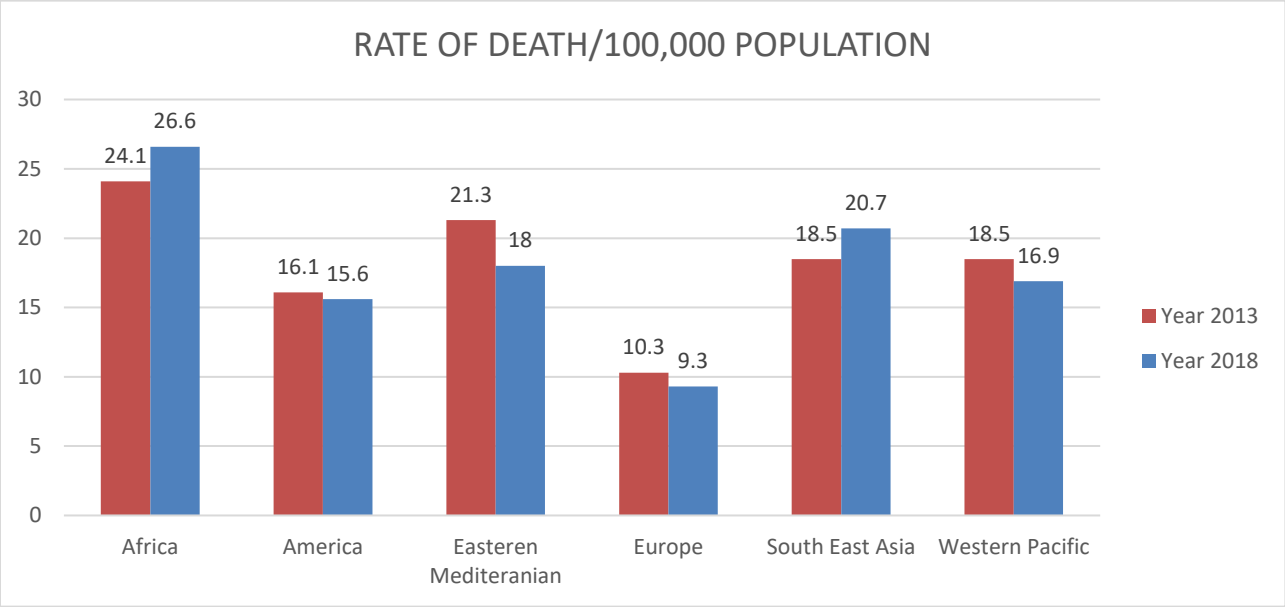


Figure 2 Death Rate per 100,000 Population

The Western Pacific Region shows a decrease of 1.6 deaths per 100,000 population followed by the European region showing a decrease of 1 death per 100,000 population contrary to this African Region witness an increase of 2.5 deaths per 100,000 population followed by South East Asia region showing an increase of 2.2 death per 100,000 population. Further, The analysis of data showed that the share of road deaths in low- and middle-income countries witness an increase of 3% from 90% to 93% during the same period whereas the share of population and registered

vehicle increases 9% and 6% respectively (WHO, 2013). Considering the above Facts and Figures it is safe to say that High-Income Countries managed to minimize the impact of RTAs resulting in fewer deaths however upwards trend observed in low and middle-income countries, suggesting that the extra steps should be taken in the right direction to reduce the impact of road traffic accident.

A study conducted by Pierce (1998) to find the reasons behind the increasing rate of accidents in developing countries and observed the following probable causes,

- Developing countries experiencing rapid urbanization process which causes more traffic on city roads.
- The growth of the population is on the rising trend.
- Developing countries have limited resources thus existing road remains in poor condition and new infrastructure could not be developed.
- Reckless driving also contribute towards the increasing number of RTAs
- In the absence of strict enforcement, the majority of the people do not adhere to the traffic regulations.
- A major portion of the population in developing countries do not own personal vehicle and they commute through public transport. However public transport vehicles do not adhere to the safety standards and are often overloaded with more passengers resulting in a higher number of deaths in case of accidents.

Mohan (2002) also highlights that one of the leading causes of the high proportion of road traffic deaths in low and middle-income countries is that people tend to construct their houses on both sides of the main highway this will increase their number of trips involving crossing of highway. Moreover, people do not use designated over and underpasses for crossing highway because they are either long or at distant locations and some are unsafe (Ameratunga et al., 2006). The study shows similar trends in Uganda, Brazil, and Mexico (Mutto et al., 2002, Forjuoh, 2003, Hijar et al., 2003).

A study conducted by Nantulya and Reich (2002) observed that rapid motorization, deteriorated highways, non-observance of traffic safety regulations, and poor access to health services these factors combine aggravate poor road safety situation in developing countries. Vanderschuren and

McKune (2015) stresses upon the need of improving post-crash conditions nearly 35% of total RTA death in south Africa occurred while the victim was en-route to the hospital. other causes observed in low and middle-income countries resulting in a high rate of injuries and death due to RTAs are congestion, mobility issues, noise, and air pollutions concerns (Gakenheimer, 1999, Gwilliam, 2003, Silcock, 2003). Downing (1991) observed that the Low- and middle-income countries are also lagging in road safety research activities. A comparison showed that 20-man years of research effort per year estimated in developing countries whereas it is over 500 in developed countries.

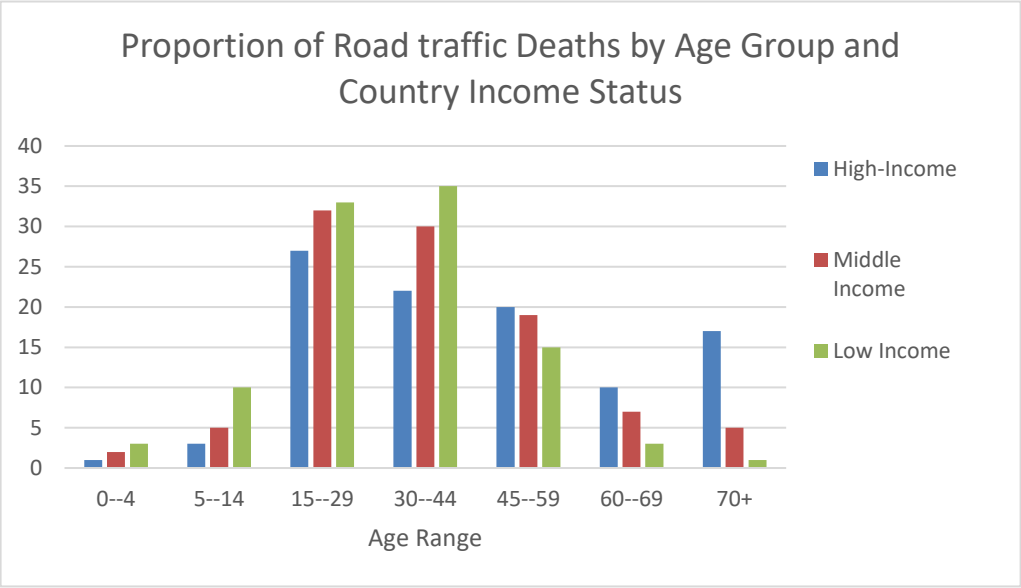


Figure 3 RTAs Death in Different Age Groups by Country Income Status

The findings of the research conducted by developed countries could not be implemented in developing countries as there are some accident characteristics which are different in both the income group of countries. Analysis reveals that there is a relatively high proportion of fatalities are pedestrians and children aged under 16 years, many fatal accidents involve a large category of vehicles including buses trucks, and other public transport vehicles (Downing et al., 1991). Moreover, there are wide differences in culture, resources, road conditions, traffic environment, road user behavior, law enforcement, and road user attitude and knowledge. These differences will further impede the transferability of research from one region of the world to another. Thus, it becomes imperative that low- and middle-income countries should focus on conducting their

research involving local characteristics of the general population to identify measures and approaches which are likely to be most successful in that specific region.

Consequently, the effectiveness of transferring some developed country solutions to developing countries is uncertain and their appropriateness needs to be considered about the problems and conditions prevailing in individual countries (Downing et al., 1991). Vulnerable road users such as pedestrians, passengers, and motorcyclists are mostly affected by road traffic injuries in developing countries in contrast to the developed countries where drivers are mostly affected by RTIs. In United States study revealed that 60% of road crash fatalities occurred in drivers as opposed to the least motorized countries such as Kenya where only 10% death in drivers is recorded due to RTAs (Nantulya and Reich, 2002)

2.2.1 RTA Socio-Economic and Health Perspective

Various studies find out that Road traffic accidents (RTA) have negative social, physical, and psychological effects (Batool, 2012). Traumatic brain injury caused by the impact of RTAs is very common and is one of the leading causes in the world. Low- and middle-income countries are adversely hit and account for 30-86% of total trauma admissions in hospitals as a result of accidents (Peden et al., 2004). A high rate of complications observed in a study on the psychosocial impact of accidents in Sweden. Fifty percent of participants experienced anxiety for two years after an accident. Findings of the study also revealed that 16% of people injured in accidents are unable to return to their normal lives and 30% of total participants reduce their leisure time activities after experiencing an accident (Peden et al., 2004). Furthermore, Batool (2012) observed that suffering becomes more aggravated if people tragedies are not treated well. It was found out that people still grief for their loss from an RTA up to 3 years. More than half of RTAs victim experience depression and one-quarter of victims tend to have suicidal feelings which hardly goes away later, almost 90% confirmed that they are unable to enjoy life as they are enjoying before the accident.

The group of populations hit by the adverse effects of RTAs in developing countries are the poorest people in society. Some cases in Bangladesh were analyzed and it was found out that 21% of people that killed due to RTA belong to the well-off families as compared to 32% victim that belong to the poor family who are mostly head of the household and sole breadwinner. 75%

of families reported a decrease in standard of living after losing head of the household in RTA. 61% of families reported that now they have no one to cover their expenses and they had to borrow money. (Peden et al., 2004).

Economies of developing countries suffered great losses due to road traffic injuries. Approximately 5% of their Gross Domestic Product (GDP) is utilized in RTAs, where it relates to health or social and economic expenditure (WHO, 2015). In low- and middle-income countries the RTIs place a heavy burden on the economic condition of a household. Most victims belong to the age group between 15 to 35. This age group is considered economically active, the workforce of a country, and has the potential to contribute to the earning of a family. The loss of breadwinner due to RTA driven families deeper into poverty (WHO, 2015).

2.3 Definition of Different Types of Accidents.

The definition of an accident according to Iqbal et al. (2017) is an event that is caused by unfavorable and unforeseen circumstances that can be termed as an accident, a bad luck unanticipated and with no evident cause. The definition of a fatal accident as described by Jacobs et al. (2000) is that the crash is considered to be fatal if a person injured in the accident dies within 30 days after the occurrence of accidents.

Personal injuries and causalities are caused by many types of traffic accidents. A head-on accident can be defined as a vehicle's front smashes to a fixed object, or with a front of another vehicle. This happens when a vehicle enters a lane from the opposite side of the avenue or when a car suddenly appears from the wrong side into a driveway, one-way street, or expressway. The other type of accident is a rollover accident which is defined as when a vehicle for any reason suddenly tips over onto its side or roof. This usually takes place because of the sharp turning of vehicle at excessive speed. Big vehicles such as trucks or buses are relatively at greater risk of turning over than a small passenger car. Another type of accident in which the driver suddenly turns a car into another path to avoid hitting an animal or car coming from another side runoff from the highway is called runoff accident. Only one vehicle is involved in this type of accident. Another reason for happening of this type of accident is when the driver is not paying full attention to the road and suddenly the vehicle skid off from its path. Other factors contribute to the causes of the above stated types of accidents.

2.4 Road Safety Profile of Pakistan

Among Asian countries, Pakistan currently ranked fourth in most populous country having a population of more than 200 Million (Census, 2017). Pakistan being the developing country experience a rapid increase in both motorization and urbanization. This leads to more traffic problems in major urban areas of big cities like Lahore, Karachi Peshawar, and Faisalabad. The cities facing congestions on major arteries of the road due to a lack of regulations. In addition to that ride-hailing service introduced in Pakistan in recent years which put an extra burden on already crowded streets of major cities. According to a mobility report (DOT, 2018) published by the New York Department of Transportation, Manhattan continuously experiencing a drop in average travel speed due to ride-hailing services. Rapid motorization in the country is regarded as the key problem responsible for harming the safe operations of traffic on roads. In Pakistan Non-motorized trips are on declining trends since 1991 due to increased motorization this means more cars on road having a greater risk of RTA. A study conducted by (Hyder et al., 2000) reveals that between the years 1956 to 1996 the number of registered vehicles increased nearly 17 times, and vehicles on road increases five times in Pakistan. With the increase in motorization, road crashes increase 14 times, and the number of deaths due to road t crashes increases 16 times.

In Pakistan, the government does not take the initiative that exclusively improves road safety in the transportation system rather road safety being made part of engineering projects. the primary objective of the engineering project is to provide a smooth flow of traffic rather than improving road safety (Batool et al., 2012).

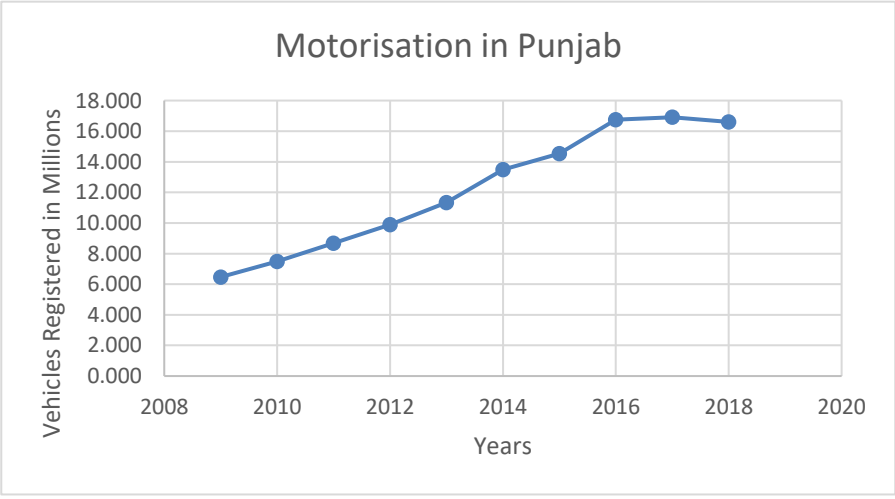


Figure 4 Motorization in Punjab

According to the global status report on road safety by WHO in Pakistan road fatalities are 14.3 deaths per 100,000 people. Pakistan has the lowest death rate comparing to its neighboring countries having an average rate of fatality around 20 deaths per 100,000 people (WHO, 2018). Acquiring reliable data related to RTAs in Pakistan is challenging. It is reported that Pakistan is facing the issue of under-reporting of accidents. The finding of a study conducted by Khan and Fatmi (2014) reveals that in Pakistan 18% of road crashes involving fatalities and 72% crashes involving injures go under-reported by police. For instance, in the year 2016, the reported death in Pakistan are 4,448 but W.H.O estimated 27,582 deaths due to RTA. The number of reported deaths is almost 5 times less than the estimated death.

Shah and Khattak (2013) concluded that among the various causes of accidents at M-2 careless driving ranked first having 25% in road crashes followed by the dozing at wheel having 23% share, tire burst become the reason of 18% accidents, brake failure becomes the reason of 9% crashes and 6% are due to pedestrians.

Traffic mix in Pakistan include more ratio of two-wheelers animals carts and pedestrian compared to the other countries traffic, thus this requires to segregate traffic accordingly but no practice of segregating slow-moving or non-motorized (animal cart) has been followed. This results in a higher risk of an incident. The death rate among the user of two-wheelers (Motorcycle), three-wheelers (Rickshaw) are 39% and for pedestrians, it is 41%, while 20% of deaths are among drivers and passengers traveling in cars. Among the miserable traffic safety issues increasing the number of unlicensed drivers on road is one of them (Hussain 2019). Pedestrian safety is often overlooked in developing countries including Pakistan. People do not use designated over and underpasses for crossing highway because they are either long or at distant locations and some are unsafe (Ameratunga et al., 2006). Khan et al. (1999) also noted this behavior of pedestrians in Karachi. The finding of research shows that sidewalks were not used by more than 82% of observed pedestrians and 33% of them are not properly using sidewalks and walking one foot away from it resulting in a change of traffic trajectory. 62% of the pedestrian is reported to be walking at the edge of the street and found to be unaware of the incoming traffic. In addition to the above observations, it was also found out that 75% of pedestrian did not use zebra crossing for crossing road, despite the availability of zebra crossing at that point.

In Pakistan driving environment is not as favorable as in other countries. Some of the factors contributing towards the poor and risky environment of driving are poor drainage system resulting in the accumulation of water everywhere, open manholes in the middle of the roads pose a high risk of getting involved in an accident, mounds of mud left after municipal service work, locals are free to construct speed humps anywhere on the road without getting approval from local administration, road dividers are no properly painted (Batool, 2012). In addition to these factors shifting of freight transport from rail to road made major highways of the country more crowded adding more discomfort in the driving environment. Imran and Low (2005) observed that the construction of new roads always gets priority in the development of the transport sector in Pakistan. Comparing the road length Pakistan has in 1947 with the existing road length it was found out that road length increased 4 times whereas the length of railway tracks remains the same.

2.5 Causes of Road Accidents

Major causes of roads accidents are enlisted below

- Road User Error: It includes Carelessness, Negligence, dozing at wheels, Rash Driving, a driver under the influence of Alcohol or Some other Drug, Over Speeding, Nonadherence to traffic Laws, not obeying traffic signals, or failure to perceive traffic situation.

- Mechanical Fault in Vehicles: it includes defects in vehicles such as malfunction of brakes, damage to the steering system, overused tire and tire burst, faulty lighting system.

- Engineering Faults: it includes Defects in Roads Condition such as Skidding road surface, potholes, ruts, and defects in the geometric design of roads such as the provision of insufficient sight distance, improper curve design, inadequate width of shoulders, and improper traffic control devices.

- Environmental factors: it includes unfavorable conditions of weather like mist, snow, smoke, and heavy rainfall which reduces normal visibility and makes driving unsafe.

- Other causes such as improper location of advertisement boards, gate of level crossing not closed when required, etc.

2.6 Risk Factors Influencing Road Traffic Accidents

During the past decade, considerable research in transport studies have focused on factors affecting road accidents. A broad range of factors can affect road accidents concluded by many studies also assumptions are made based on the evaluation of different characteristics of traffic such as traffic speed, flow, and density. Considering the characteristics of speed it can be assumed that excess speed of vehicles can cause a more severe accident resulting in more fatality (Ossiander and Cummings, 2002). Martin (2002) studied the relationship between accident rates and density and suggested that low traffic flow can induce both a higher accident rate and more severe accidents. Following traffic characteristics influencing road traffic accidents are discussed in detail.

2.6.1 Speed

The core of the road injury problem is the speed of the motor vehicle. Crash risk and crash consequences are both influenced by speed. Vehicle exceeding the relevant speed limit is defined as Excess speed whereas if a vehicle traveling at a speed that is unsuitable both for road and traffic condition is referred to as inappropriate speed. The driver of the vehicle opt for any type of speed that depends on many factors. The introduction of modern technology enables the car to reach maximum speed in a shorter distance. The geometry of the road influences the speed of the vehicle it can both encourage and discourage the speed of the vehicle.

Nilsson (1982) researched the effect of speed on traffic accident concluded that the chances of happening crash involving injury is directly proportional to the square of speed. The occurrence of a crash involving serious injury is proportional to the cube of speed. The risk of Crash involving the death of a road user is proportional to the fourth power of speed.

Evidence-based on different speed studies in various countries shown a 3% increase in the incidence of a crash involving injury and a 4% increase in the incidence of a crash involving death with the increase of only 1km/h mean traffic speed. The rate of crashes will decrease with the same percentage if the mean speed decreased by 1km/h (Finch et al., 1994). A similar result obtained in a research conducted by Taylor et al. (2000), (Taylor et al., 2002) on different types of roads in the UK showed that the highest reduction in the volume of crashes was 6% and that is achieved

through the reduction of speed by 1 mile/h (1.6Km/h). The roads selected for this research are the busiest in town and having a high level of pedestrian activity and more frequency of crashes. Another study on crashes involving injuries done in rural zones having a 60km/h speed limit found that with every increase of 5 km/h in speed above the speed limit the chances of getting involved in road crashes doubled (McLean and Kloeden, 2002).

The study revealed that there is a 90% chance of surviving a car accident by a pedestrian at a speed of 30km/h or below, but it reduces to 50% if a pedestrian hit by a car at a speed of 45km/h or more (Ashton and Mackay, 1983). The study also discussed that increasing speed from 30km/h to 50 km/h will increase the probability of getting killed by the factor of eight (Ashton and Mackay, 1979). In the case of older pedestrian, the chance the risk of getting killed by the impact of a car at the above-mentioned speed become more (Leaf, 1999). It is found out that the excess and inappropriate speed contribute 30% of crashes involving death in high-income countries (Lipovac and Nešić, 2005).

In the year of 1999, speed remains the leading cause of road traffic accidents in China (Wang et al., 2003). 44% of total road traffic accidents happened in Kenya due to over speeding, loss of control of vehicle, and misjudgment in overtaking (Odero et al., 2003). In Ghana, it was observed that half of the road crashes between 1998 to 2000 was due to over speeding (Afukaar, 2003). On the incidence of crashes, Ossiander and Cummings (2002) studied the effect of increased speed limits on freeways in Washington State. 20 years of data collected and analyzed. The findings of the study revealed that the rate of crashes involving death will increase with the increase in the speed limit of the highway.

2.6.2 Young Drivers

Global Status report on road safety revealed that the leading cause of death in the age group 15-29 years is a road traffic accident (Toroyan, 2009). This indicates that the young drivers are at greater risk of getting involved in a crash than the older driver. It is predicted that a young person as a driver will have more chances of causing an accident (Mayhew and Simpson, 1990). A study indicates that in high-income countries young men in their initial year of driving have a higher crash involvement (Cerrelli, 1998). A study on regional comparative analysis of motorcycle accidents done by McLean et al. (1990) showed that the highest injury risk was found in

motorcyclists followed by the men who are in their first year of driving. Teenage drivers are at greater crash risk than those of any other age group drivers specifically 16 years old and 17 years old pose maximum crash risk (Williams, 2003). A similar study in developed countries found out that the risk of a crash is high during 12 months after issuing a driving license (Williams, 2003). Some of the reasons enlisted below to explain the elevated risk in young drivers (Peden et al., 2004):

- Young drivers generally do not own the vehicle they are driving hence showed relatively careless behavior in driving
- Psychological characteristics, people at a young age tend to be thrill-seeking and have overconfidence for everything.
- Young drivers are comparatively less tolerating than the older drivers.
- It is found out that most of the young drivers tend to drive at excess or inappropriate speed,

Driving at nighttime is also one of the contributing factors behind serious crash among young drivers. It is found out that in 16-year-old drivers the risk factor increased 3 times of getting involved in a crash compared to the daytime.

2.7 Best Practice of Road Safety

A comprehensive study on the conceptual framework of road safety strategy by Hughes et al. (2016) stated that over the years road safety strategies continue to evolve. Earlier Road user approach opted for enhancement of road safety. The approach assumed that human error as the main cause of road accidents consequently when a crash occurred road user was designated as a sole responsible (Peden et al., 2004). Larsson et al. (2010) in their study on the systems theory approach to road safety observed that the Road User Approach was based on the research conducted by Treat et al. (1979) which suggests that human error is the cause of 95% of all accidents. This approach also assists in the legal process as every road user has a legal responsibility to prevent the occurrence of road accidents (Tingvall and Haworth, 1999). The legal system can act in case of an accident only if any road user is held responsible for the crash (Larsson

et al., 2010). Hence, major efforts are focused on correcting road user behavior through enforcement of law and education to align road users towards the such a system in which occurrence of accident due to human error can be eliminated (Mackay and Tiwari, 2001). However, humans do make mistakes and the Road user approach did not consider this fact. This limits the road user approach in tackling the occurrence of accidents. To minimize the risk of a death or serious injury the Swedish government opted a new approached called the Vision Zero Approach (VZA) that removed RUA limitation by assuming that crashes would continue to occur, but the important measures were to manage vehicles, road infrastructure, and speeds (Langford and Oxley, 2006, Larsson et al., 2010). The VZA in contrast to the RUA opt logical approach in improving road safety and consider it to be a shared responsibility between road user, administrator, Geometric design of road, and professional users of the road transport system (Johansson, 2009). Haddon (1983) developed a road safety matrix based on the system approach to prevent traffic related injury, the matrix identifies and analyzed each risk factor before and after crash in relation to person vehicle and environment.

Enforcement, Education, Engineering, and Evaluation of the 4 Es strategy opted in many countries to reduce the number of traffic accidents (Vanderschuren et al., 2017). These can be described as follows:

Enforcement: Road users need to obey the traffic laws of the country for safer roads. The laws should be consistently enforced and the agency responsible for maintaining laws should punish those road users who are not obeying laws.

Education: It is found out that untrained and unlicensed drivers cause more traffic accidents on roads. Educating the general public about road safety and creating awareness about the adverse impact of RTAs not only on the economy of the country but also on a household, educating drivers on the benefits of wearing seat limit, educating pedestrian to use pedestrian bridge whenever crossing the highway will improve the behavior of road user on roads and consequently improving overall road safety situation.

Engineering: Ensuring that the vehicles ply on roads adhered to the safety standards and geometric design of roads meet all safety criteria. Existing highways should be free from any hazard such as potholes.

Evaluation: Study will be carried out from time to time to assess the direction of preventing measures. The study should include analyzing available RTA data and identification of blackspots. Analyzing the existing trends in crashes involving both injury and fatality. Evaluating the improvement in road safety by comparing it with other researches done in the same field.

The United Nations unveils the global plan for the Decade of Action for road safety 2011-2020 to guide countries to take steps in the right direction(Nation, 2011). it identifies the five pillars of road safety that can successfully road safety in the respective country, these five pillars include:

- Road safety management
- Infrastructure
- Safe vehicles
- Road user behavior
- Post-crash care

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The research undertaken is a 'Desk and Field Research' meaning that some of the information is obtained indoors via literature while other data is collected from different Government Agencies responsible for keeping road traffic accident data.

3.2 Research Problem Statement

The intent and direction for the collection of data is very well defined by posing research questions. The following questions are the main drivers that address research issues:

1) How much the Gujrat district affected by road traffic accidents?
2) What are the negative effects of RTA on public health?
3) What are the current trends of RTAs?
4) How to improve road safety and mitigations of road traffic accidents?

Answers to the above research questions will not only help to analyze road traffic accidents but also improve road safety and further reduction in road fatalities

3.3 Research Objectives

- To identify the reasons for traffic accidents and measures for its mitigation.
- Identifying the intersections where the majority of RTA occurred.
- Identifying the vehicle category is mostly involved in RTA.
- Identifying the road user most effected by RTA.
- Identification and analysis of black spots
- Categorizing the victims of RTA into different age groups and identifying the most vulnerable age group.

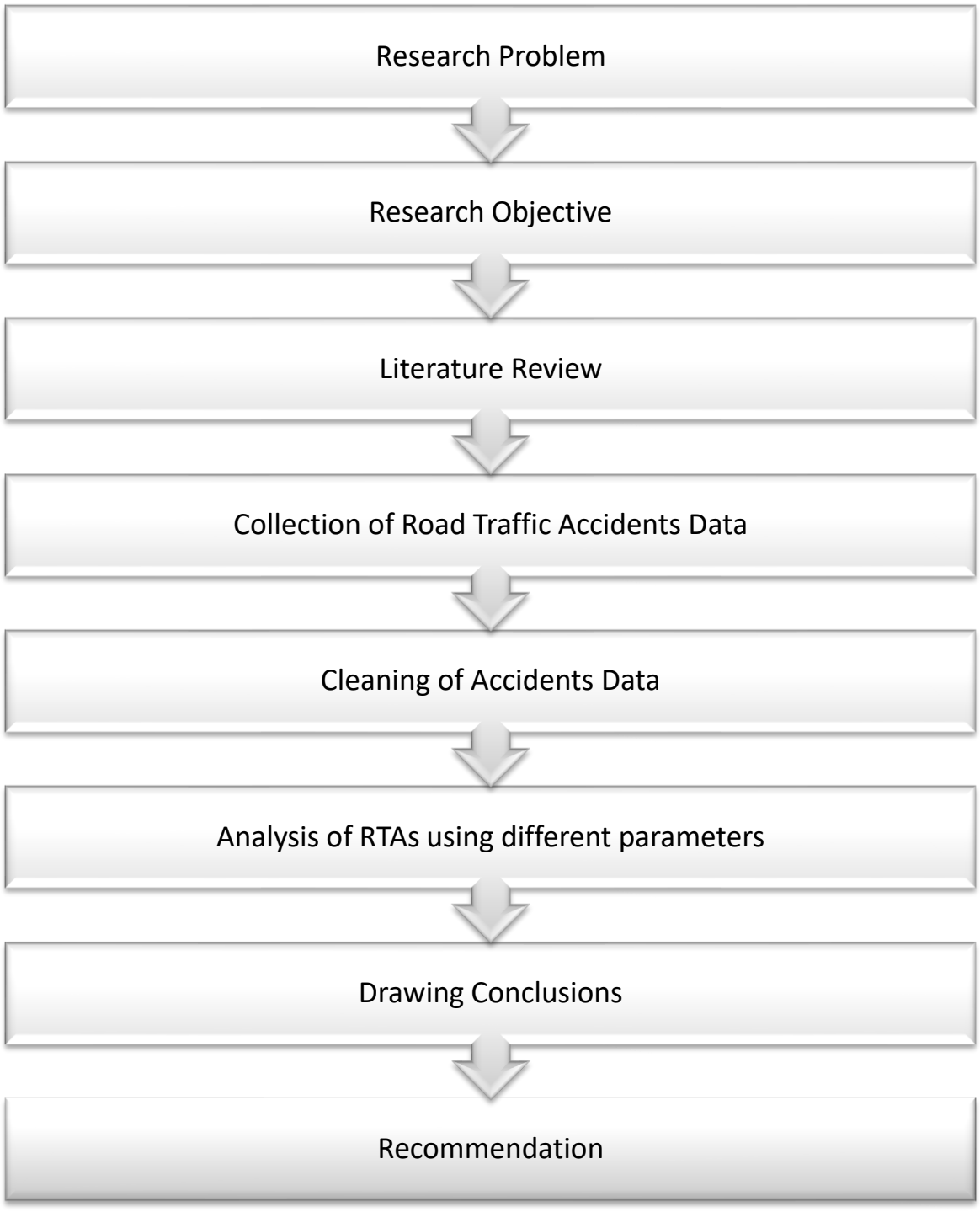


Figure 5 Schematic Representation of Research Methodology

3.4 Description of Study Area

The area chosen for this research is District Gujrat which is the 18th largest district population-wise and 26th largest area wise of Punjab Province. The current population of Gujrat is 2,756,110 out of which 1,928,714 resides in rural area and 827,396 resides in urban area. The Total Number of Households are 442,399 and the Average size of household is 7. The growth rate of the population is 1.57% annually. The District is located along G.T Road and the main railway line, coming from Peshawar to Karachi. The district is surrounded by two rivers from two sides. River Jhelum from runs on the Jhelum side and Rivers Chenab flow on the Wazirabad side of the district. The area lies within Chaj Doab. The District is well connected with Sialkot, Jhelum, Gujranwala, Sargodha, Azad Kashmir, Mandi Bahauddin, Lahore, and Islamabad through metalled roads.

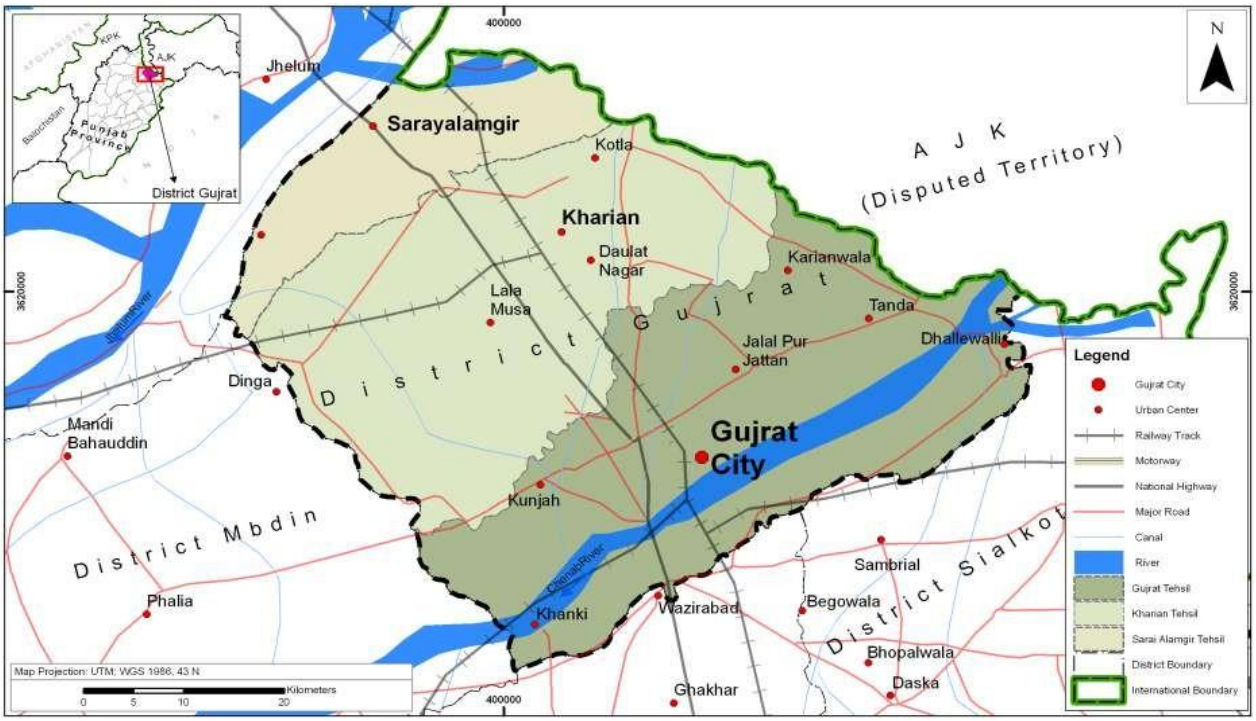


Figure 6 Map of District Gujrat

According to Punjab Development Statistics 2019 report, the total Length of Road as of 30th June 2018 in District Gujrat is 3531.85 Km out of which 61.82 is under National Highway Authority and 3443.21 Km is under Provincial Highway Department. Major roads or Gujrat and Controlling Department Enlisted Below,

Table 2 Major Roads of District Gujrat

Sr.No.	Name of Road	Controlling Department
1	GRAND TRUNK ROAD N-5	**National Highway Authority**
2	SARGODHA ROAD	**Provincial Highways Department**
3	BHIMBER ROAD	
4	OLD GRAND TRUNK ROAD	
6	KHARIAN DINGA ROAD	
7	JALALPUR JATTAN ROAD	
8	SHADIWAL ROAD	
9	LALAMUSA DINGA ROAD	
10	BHIMBER KHARIAN ROAD	

3.5 Collection of Accident Data

Accident data of District Gujrat is obtained from various government agencies Such as Rescue 1122, National Highway and Motorway Police, and Tehsil Headquarter Hospitals. Rescue 1122 started its operation in October 2004 from provincial capital Lahore city as a first professionally trained ambulance service in Pakistan offering prehospital care (Waseem et al., 2011). Anyone in need can utilize this service free of cost by calling toll free number 1122. The service is funded by the government. Initially rescue 1122 is only available to Lahore but afterward, it was extended to all 35 districts of Punjab (Tahir et al., 2012). The service also keeps a record of road traffic accidents on their prescribed proforma.

- VICTIM DETAIL
- TYPE OF ROAD USER INVOLVED IN RTA (Driver, Passenger, Pedestrian)
- TYPE OF VEHICLE INVOLVED IN RTA
- AGE OF THE VICTIM
- TYPE OF INJURY
- SEVERITY OF ACCIDENT FATAL NON-FATAL
- CAUSE OF ACCIDENT

The 62 km long portion stretches from river Jhelum to river Chenab of National Highway N-5 comes under the jurisdiction of Gujrat District. National Highway and Motorway Police

(NH&MP) is responsible for enforcement of the law, maintaining the free flow of traffic, keeping traffic in order, vehicle accident investigation, and provide help to the road users in case of any emergency (Klair and Arfan, 2017). The agency keep record on traffic accident on Micro Accident Analysis proforma (MAAP).

- Date and Time of Accident
- Location (Km Marker)
- Reason of Crash
- Vehicle Involved
- Crash Severity

Traffic Volume Data of this section of National Highway N-5 is obtained from National Highway Authority which is as follows

Table 3 Traffic Count on Portion of N-5

Direction	M.Cycle	Car/Jeep	Passenger Service Vehicles	Goods Transport Vehicles	Un-classified	Total
Gujrat to Lalamusa	4,715	4,956	1,581	2,368	1,205	14,825
Lalamusa to Gujrat	4,879	6,044	1,865	2,542	586	15,916
Lalamusa to Kharian	5,639	3,124	3,222	3,423	1,935	17,343
Kharian to Lalmusa	6,105	4,982	2,180	2,682	2,017	17,966
Kharian to Jhelum	4,068	7,182	2,662	2,315	261	16,488
Jhelum to Kharian	3,822	6,470	2,706	2,749	266	16,013

The above table shows that the busiest section of the Highway is from Kharian to Lalamusa comprising of 18.23% of total traffic.

3.6 Accident Analysis

The Analysis of Accident is conducted to determine the cause of an accident and the factors influencing its causes. It is carried out to prevent further incidents of similar kind and performed in the order of the following steps

Facts Gathering: Gathering of all the possible relevant facts that may contribute to understanding the cause of the accident after the accident happened.

Facts Analysis: date acquisition facts are summarized and put together to have a clear picture and pattern of road traffic accidents.

Conclusion Drawing: if available data is sufficiently informative conclusions can be drawn about cause and contributing factors.

Mitigation Measures: proposed measures for mitigation of further incidents.

Analysis of accident data carried out in following different ways

- Cause Wise
- Severity
- Period
- Location Wise
- Death per 100,000 Population
- Deaths per 10,000 Registered Vehicles

The data findings will be presented in graphs and tables form. Afterward, a comparative analysis of crashes involving injuries and fatalities in district Gujrat with another district will be done. Factors that were identified as contributing to road traffic injuries and fatalities were prioritized according to their influence. The locations in district Gujrat having a greater number of crashes will be identified and analyzed accordingly.

3.6.1 Analysis by Cause

This analysis enabled in quantifying the cause of accident occurrence e.g. tire burst over speeding animal appearance such analysis helps in prioritizing requirements for remedial measures.

3.6.2 Analysis by Severity

The analysis by severity helped in listing each accident occurring under one of the three severity cause

- Fatal
- Non-fatal
- Property Damage only

Fatal accidents are those that result in at least one death. Accidents that result in injuries are classified as non-fatal. Accidents that result in neither death nor injuries but involve damage to vehicles are classified as vehicle damage.

3.6.3 Analysis by Contributing Factors

Each accident occurring at a sit is listed under one of the three contributing factors to established the relationship between accident occurrence and the influence of contributing factors

- Human factor
- Environmental factory
- Vehicle-related factor

3.6.4 Analysis by period

This analysis categorizes all accidents under different periods to identify weather accident rate are significantly higher during any accident period this method of summarizing data also facilitate the identification of periods during which accident occurrences are high different period used are as under

- Day/Night
- Monthly
- Yearly

CHAPTER – 4

DATA ANALYSIS

4.1 General

The study aims to investigate the patterns and trends of road traffic injuries and fatalities in District Gujrat. The study contains graphs and tables to show the dynamics of the research findings, amongst which are to define the composition of road traffic injuries and fatalities in District Gujrat and to identify road traffic injuries and fatalities black spot within the study area, as well as to examine the different factors that contribute to injuries and fatalities as determined from the research data collected. The data collected from the research findings were graphically presented and explanatory analyzed.

Analysis of data helps in the identification of corrective efforts to be applied e.g. predominance of accidents due to tire burst implies enforcement of strict vehicle fitness check. The predominance of accidents due to sleeping or drunk drivers demands enforcement of strict checks at the entrance of such a facility. More number of night accident demands improved lighting conditions. The identification of accident blackspots will help enforcement agencies to take extra measures regarding road safety at that particular location and also it will highlight any engineering related fault in roadway design and identify general bad habits of road users at that particular point such as over speeding or taking wrong u-turn.

4.2 Accident Analysis

The accident data of District Gujrat for the period of the Year 2017 to 2019 has been analyzed for the determination of causes of accidents, several injured people, the age group most affected by RTAs, and Vulnerable Road Users.

4.3 Road Traffic Accidents in Punjab Province

Data obtained from Rescue1122 of the total road traffic accident happened in Punjab from 2017 to 2019 reveals that the accident trends in the province are increasing with every passing year.

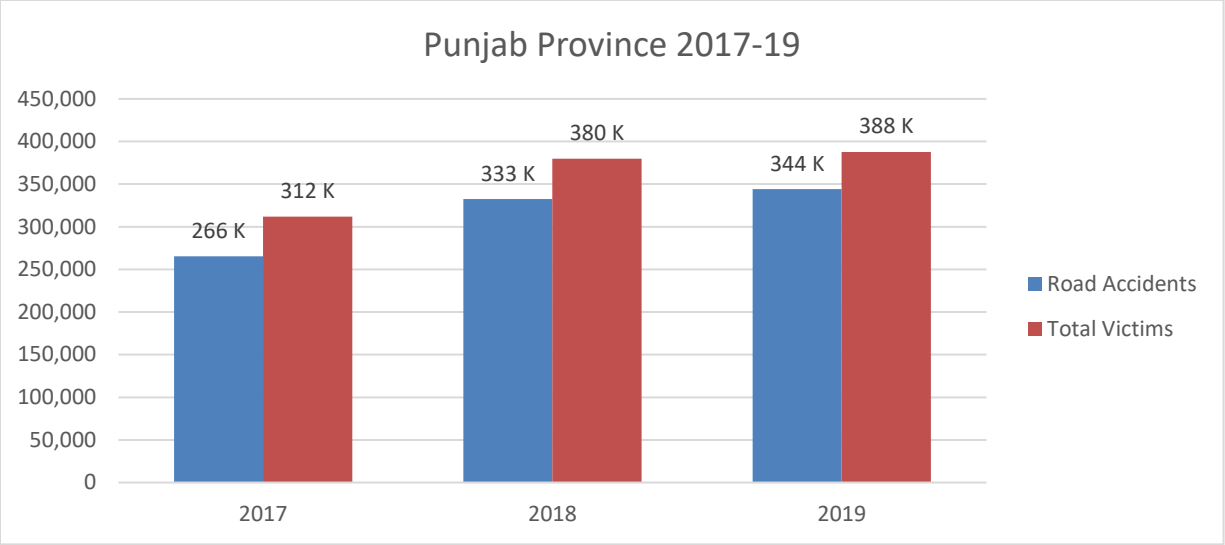


Figure 7 RTAs in Punjab 2017-19

In the year 2017 total road traffic accidents happened in Punjab were 265,510 as a result 311,716 persons become the victims of accidents. In the succeeding the year 2018, the total number of accidents was 332,516 rose by 25%, and total 379,815 persons effected by crashes an increase of 21.8% compared to preceding years. Between 2018 to 2019 the number of accidents was 344,104 and number of persons became victim of incidents were 387,733.

4.3.1 RTAs in Various Districts of Punjab

Data on road traffic accidents for different districts were collected from Punjab emergency service Rescue 1122 and the analysis was done as followed.

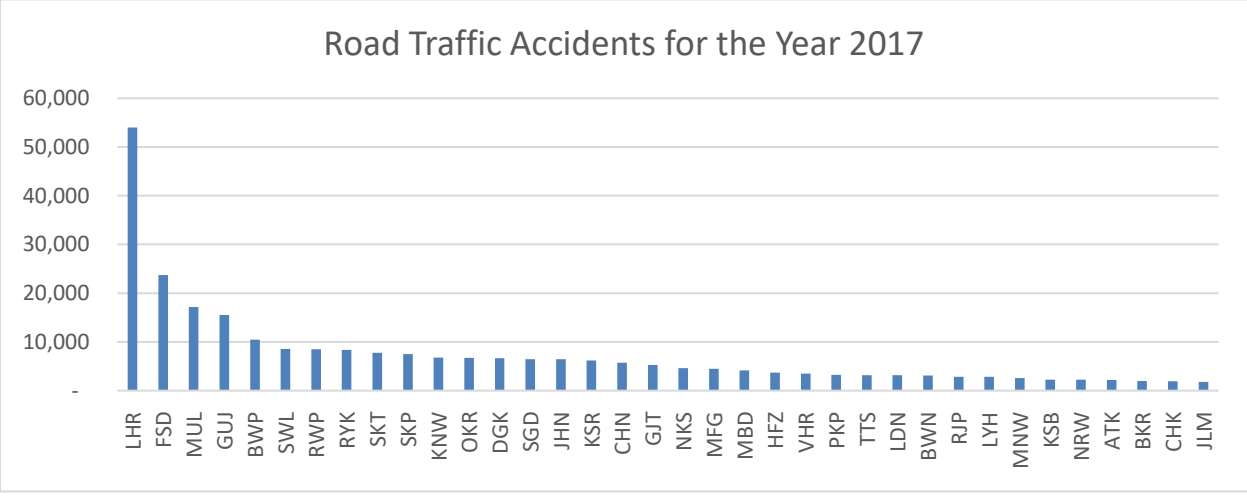


Figure 8 RTAs in Districts of Punjab 2017

The graphical representation of data showed that in the year 2017 District Lahore capital of the province recorded the highest number of accidents which is 53,979 followed by district Faisalabad having 23,731 road accidents almost half of what district Lahore recorded. The lowest number of accidents occurred in district Jhelum.

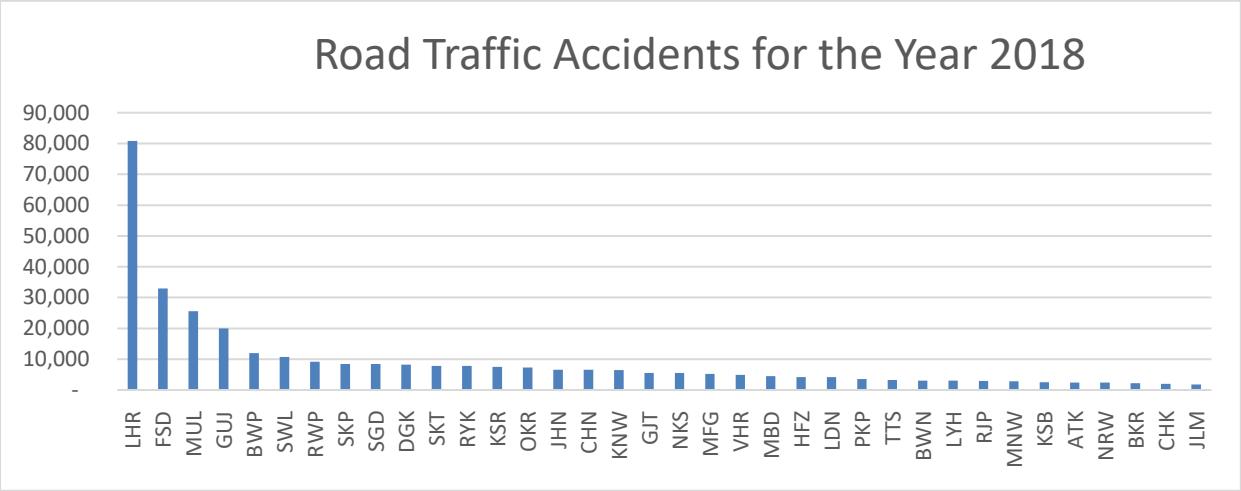


Figure 9 RTAs in Districts of Punjab 2018

The data of the year 2018 showed the same pattern as of the preceding year 2017. District Lahore recorded the highest number of accidents and having 40% more accidents followed by district Faisalabad having 32,899 accidents. Jhelum remained the lowest recorded accident district in Punjab.

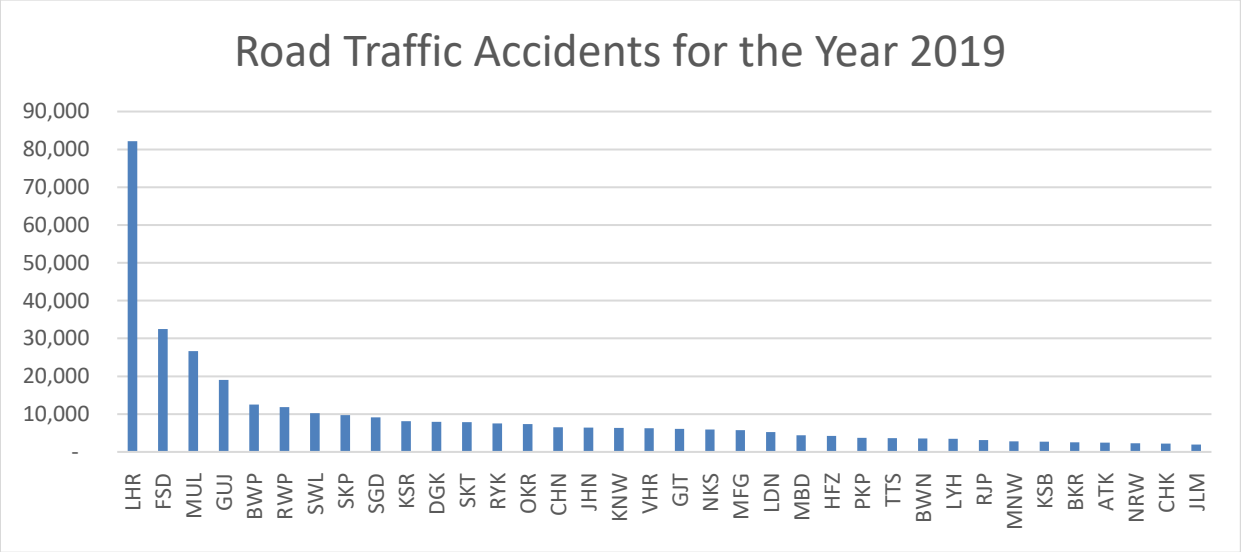


Figure 10 RTAs in Districts of Punjab 2019

The graphical representation of data showed that in the year 2019 District Lahore capital of the province recorded the highest number of accidents which is 82,136 followed by district Faisalabad having 32,497 road accidents almost half of what district Lahore recorded. The lowest number of accidents occurred in district Jhelum.

4.3.2 Age group involved in RTAs

World Health Organization report on Global Status on road safety revealed that the leading cause of death in the age group 15-29 years is a road traffic accident (Toroyan, 2009). This indicates that the young drivers are at greater risk of getting involved in a crash than the older driver. It is predicted that a young person as a driver will have more chances of causing an accident (Mayhew and Simpson, 1990). A study indicates that in high-income countries young men in their initial year of driving have a higher crash involvement (Cerrelli, 1998).

The age-wise analysis was carried out to determine which age group is mostly involved in road traffic accidents.

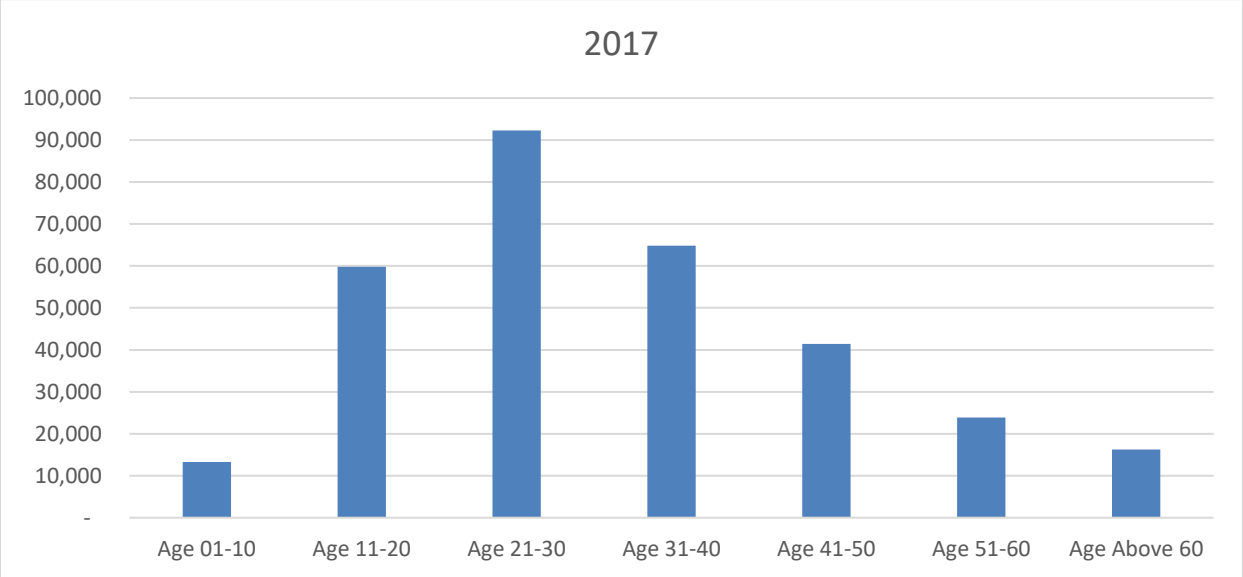


Figure 11 Age Group-wise RTAs in Punjab 2017

The data revealed that most of the accident victims belong to the age group 21-30 which resonates with the World Health Organization fact that most of the victims of RTAs are young drivers. This also refers to the adverse impact of RTAs on the younger generation.

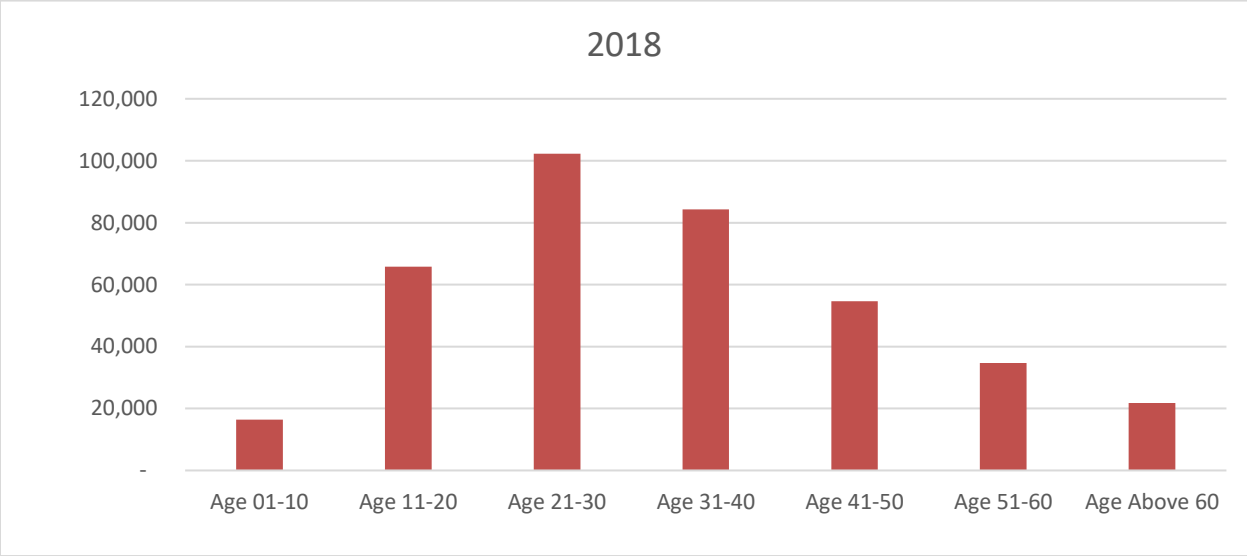


Figure 12 Age Group-wise RTAs in Punjab 2018

The year 2018 and 2019 reflected the same pattern. People belonging to the age of 21 to 30 years were most affected by accidents.

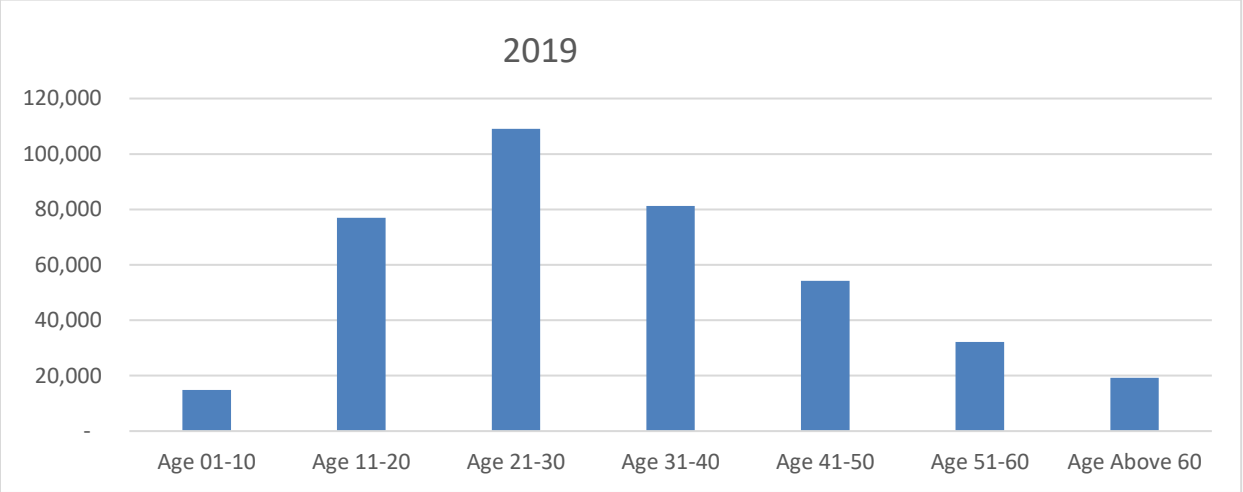


Figure 13 Age Group-wise RTAs in Punjab 2019

4.3.3 Deaths per 100,000 population

Census data obtained from the Pakistan Bureau of statistics for each district of Punjab then each district analyzed by computing deaths per 100,000 population.

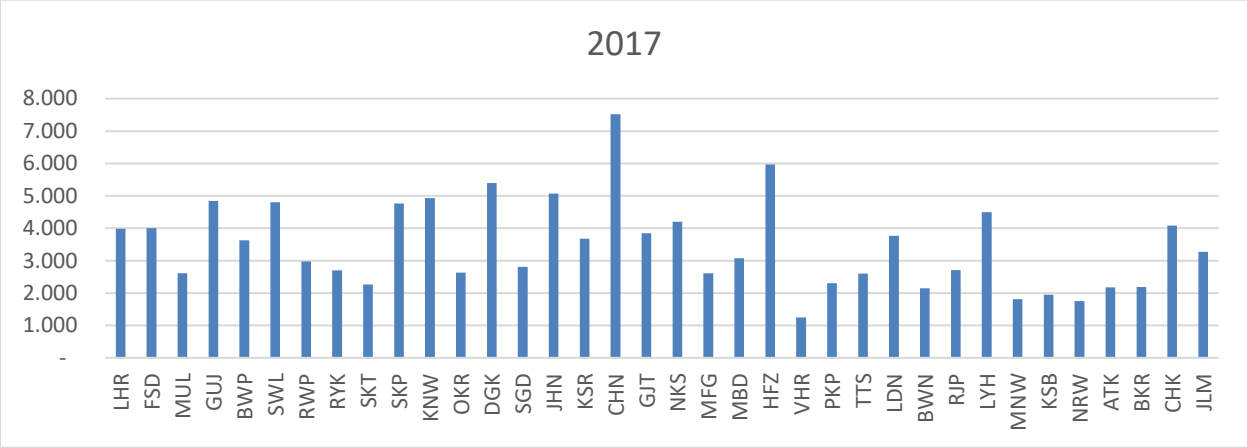


Figure 14 Death per 100,000 Population in Punjab 2017

The analysis revealed that the most death per 100,000 population occurred in district Chiniot which is 7.520 deaths per 100,000 followed by district Hafizabad having 5.964 deaths per 100,000 population. The last death occurred in district vihari which is 1.242 death per 100,000 population. This analysis presents a completely different picture of road traffic accidents in Punjab compared to the number of accidents that occurred in the province. A maximum number of accidents happened in Lahore but the number of deaths per 100,000 population was 3.982 ranked at 13th number in Punjab province.

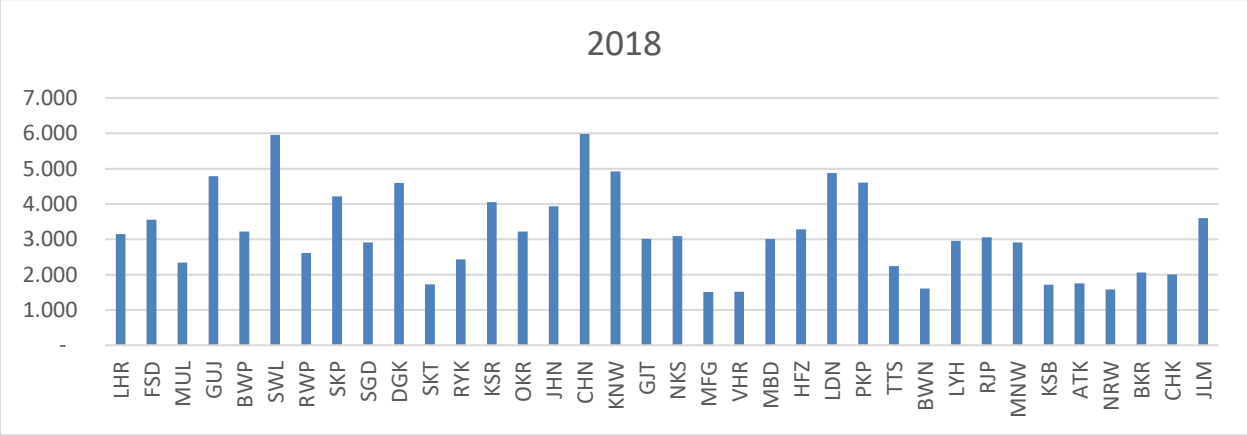


Figure 15 Death per 100,000 Population in Punjab 2018

In the year 2018, the analysis revealed that the most death per 100,000 population occurred in district Chiniot which is 5.987 deaths per 100,000 followed by district Sahiwal having 5.958 deaths per 100,000 population. The last death occurred in district Muzaffargarh which is 1.504 death per 100,000 population. As compared to 2017 year the death rate in district Chiniot reduced from 7.520 to 5.987 showing a considerable improvement while in district Sahiwal rate increase from 4.806 to 5.958 reflecting a deteriorating road safety situation in the district. The district has a maximum number of road traffic accidents also shows a little improvement in road safety as the rate reduced from 3.982 to 3.416.

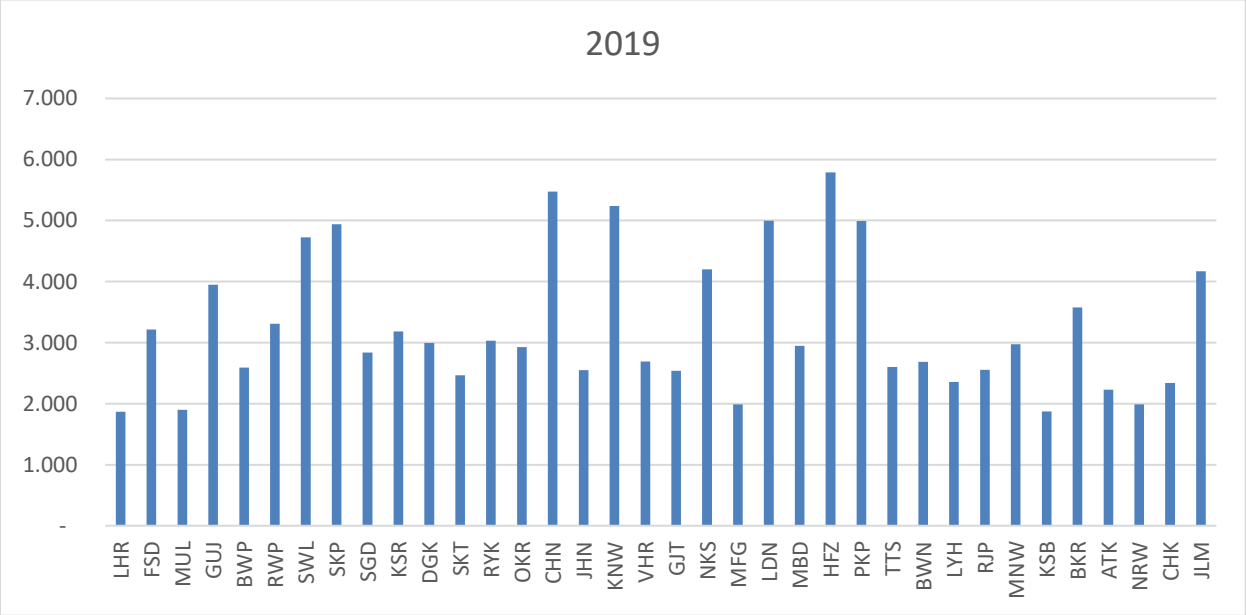


Figure 16 Death per 100,000 Population in Punjab 2019

In the year 2019, the analysis revealed that the most death per 100,000 population occurred in district Hafizabad which is 5.791 deaths per 100,000 followed by District Chiniot having 5.475 deaths per 100,000 population. The last death occurred in district Lahore which is 1.869 death per 100,000 population. As compared to the 2018 year the death rate in district Hafizabad increased from 3.284 to 5.791 reflecting a deteriorating road safety situation in the district whereas district Chiniot shows little improvement as the rate reduced from 5.987 to 5.475. The number of deaths also reduced from 3.416 to 1.869 in district Lahore.

4.3.4 Death per 10,000 registered vehicles

The data of registered vehicles in each of the districts was obtained from the Punjab development statistics report. Each district analyzed the annual deaths and number of vehicles registered in that particular district.

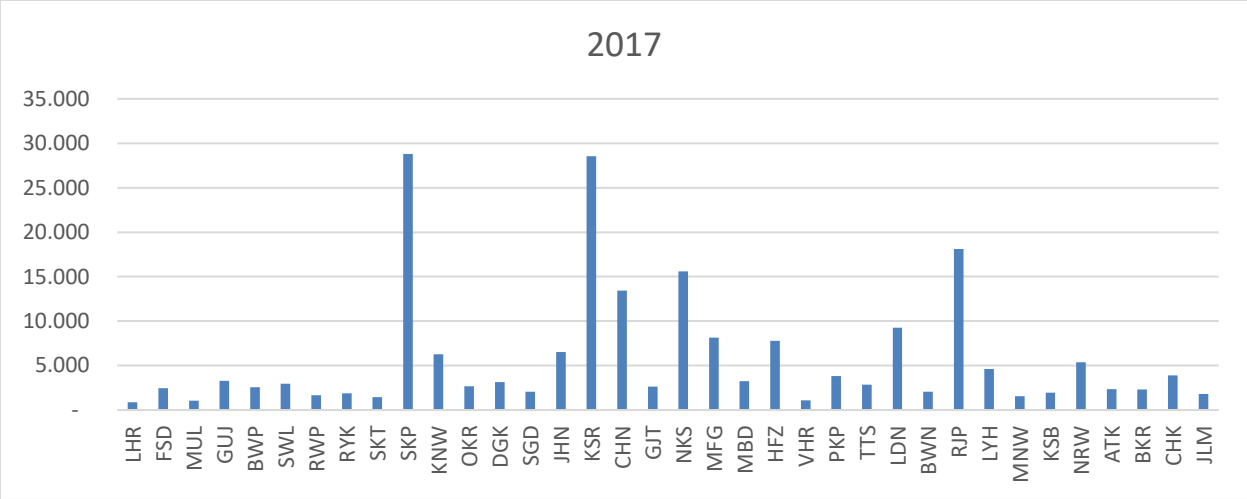


Figure 17 Death per 10,000 Registered Vehicles in Punjab 2017

Sheikhupura recorded the highest number of deaths per 10,000 registered vehicles. The number of deaths in Sheikhupura is 28.804 death per 10,000 registered vehicles. This indicates that the district has a smaller number of cars and has a greater number of fatal accidents in a year. District Kasur also recorded a similar number of deaths in terms of registered vehicles. The number of deaths in district Kasur is 28.535 little less than district Sheikhupura. District Lahore recorded the least number of deaths in the province.

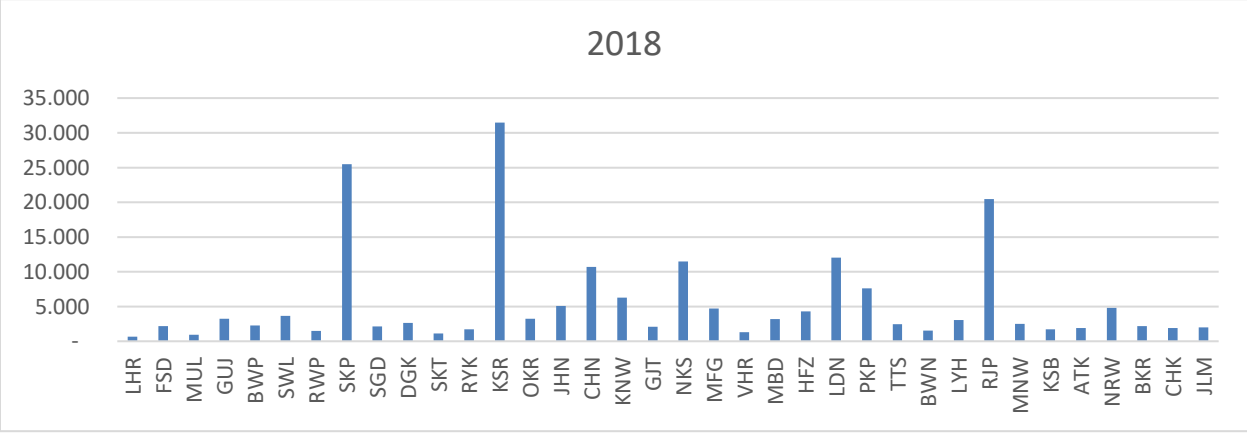


Figure 18 Death per 10,000 Registered Vehicles in Punjab 2018

In the year 2018, Kasur recorded the highest number of deaths per 10,000 registered vehicles. The number of deaths in Kasur is 31.456 death per 10,000 registered vehicles. This indicates that the district has a smaller number of cars and has a greater number of fatal accidents in the year 2018. After district, Kasur District Sheikhupara ranked 2nd in terms of death per registered vehicle. The number of deaths in district Sheikhupura is 25.48t. District Lahore recorded the least number of deaths in the province.

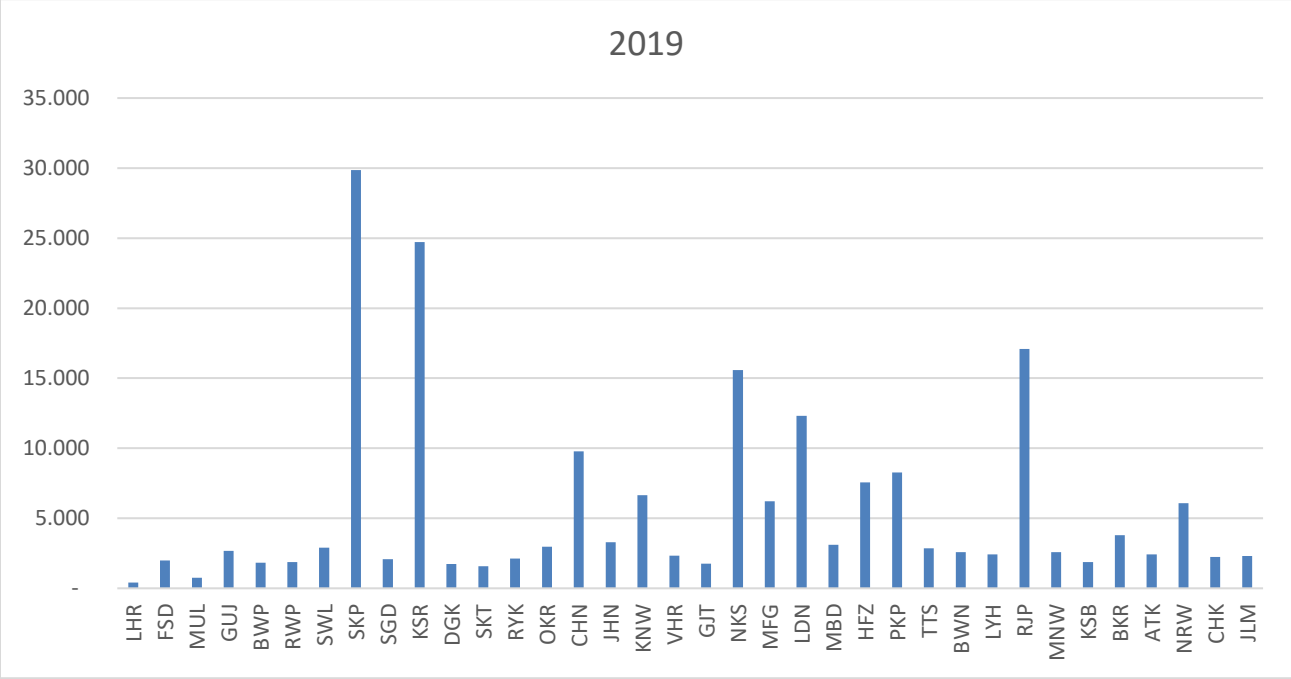


Figure 19 Death per 10,000 Registered Vehicles in Punjab 2019

In the year 2019, Sheikhupura recorded the highest number of deaths per 10,000 registered vehicles. The number of deaths in Sheikhupura is 29.851 death per 10,000 registered vehicles. This indicates that the district has a smaller number of cars and has a greater number of fatal accidents in a year. District Kasur also recorded a similar number of deaths in terms of registered vehicles. The number of deaths in district Kasur is 28.535 little less than district Sheikhupura. District Lahore recorded the least number of deaths in the province.

4.3.5 Road User Vulnerability

Analysis of three years of road traffic accident data reveals that the most effected road users from road traffic accidents are Passengers. Although there is strict law persist which mandates the driver of the vehicle to wear a seat belt, but no attention has been paid for the safety of passengers. This may be the apparent reason that the passengers are more likely to affect road traffic accidents. The other group of users most involved in RTAs is pedestrians. In three years, 2,764 number of RTAs involved pedestrians.

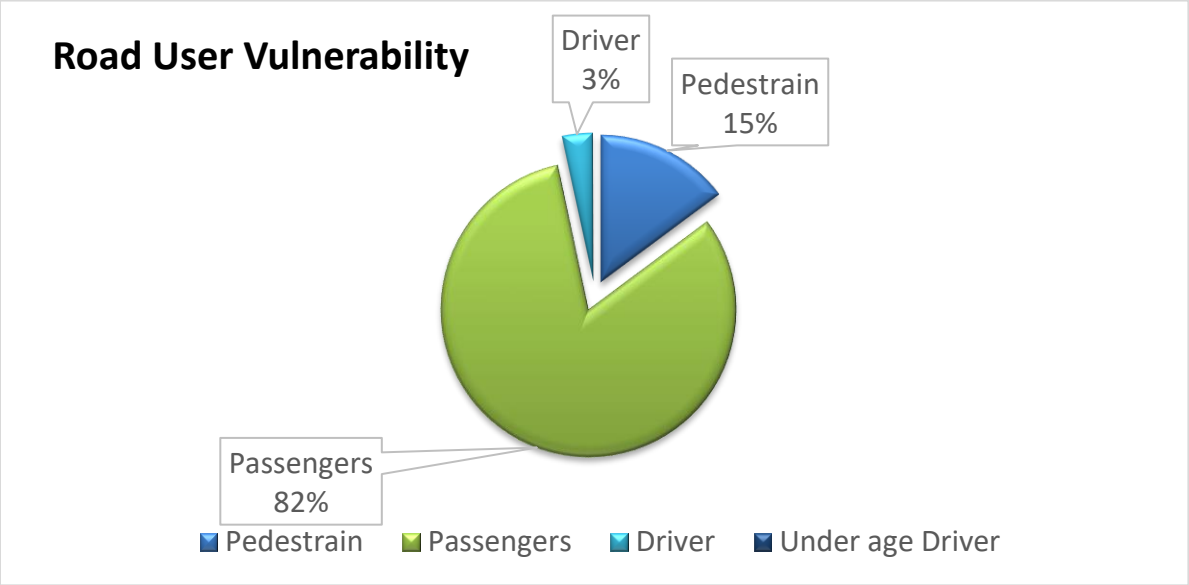


Figure 20 Road User Vulnerability in Punjab

Pedestrians, cyclists, and riders of motorized two-wheelers and their passengers account for around 46%of global road traffic deaths and are considered vulnerable road users.1 Commuters on public transport due to their risky behaviors are also identified as a high risk group for RTIs. The proportions of high-risk vulnerable road users are greater in LMICs than in HICs.

4.4 RTAs in District Gujrat

Data obtained from Rescue1122 shows that the total road traffic accident happened in District Gujrat from the last three years is 16,866.

4.4.1 Year-wise Analysis

Year wise data reveals that road traffic accidents are on the rise and if necessary measures are not taken in time then this will put the safety of road users at greater risk.

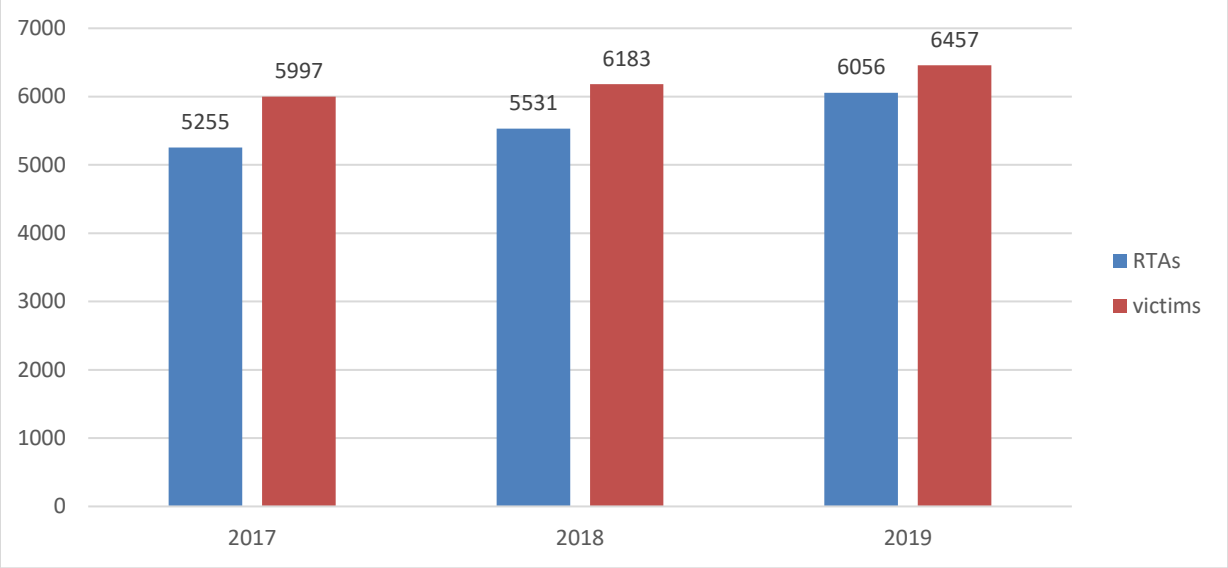


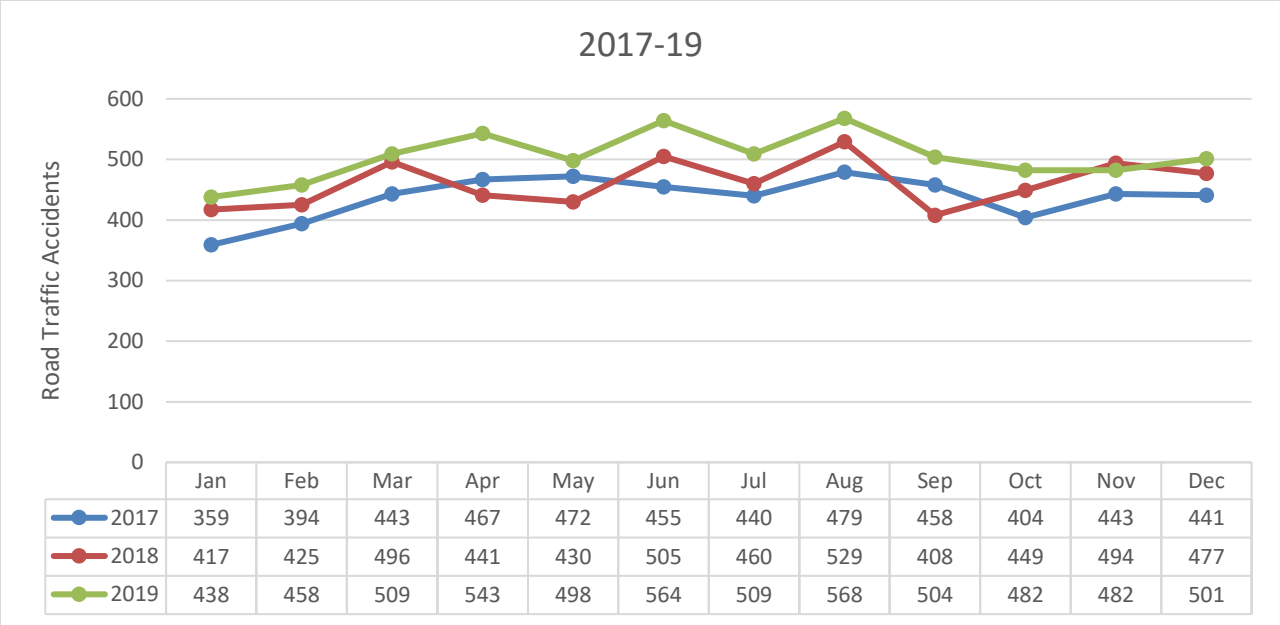
Figure 21 RTAs in District Gujrat 2017-19

The number of accidents is increasing with every passing year and also the number of victims is also increasing. This means that the road safety situation in district Gujrat is deteriorating with every passing year.

4.4.2 Month wise Analysis

A month-wise analysis is carried out to determine the effects of weather on the accident. Analysis of accident data shows a slightly upward trend in accidents i.e. from January to August accidents per month are on increase. The month of August has the highest number of accidents (479, 529, 568) Month of May recorded the second-highest number of accidents which are 472, 430, 498 in each year, respectively.

The monsoon with peculiarities of heavy rains. Month wise analysis depicts the considerable effect of climate on accident happening.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017	359	394	443	467	472	455	440	479	458	404	443	441
2018	417	425	496	441	430	505	460	529	408	449	494	477
2019	438	458	509	543	498	564	509	568	504	482	482	501

Figure 22 Month Wise Analysis of RTAs in District Gujrat

4.4.3 Vehicles Involved

Vehicle analysis are essentially required to ascertain vehicle category role causing accidents. All categories of vehicles are not dealt with the same set of rules in District Gujrat.

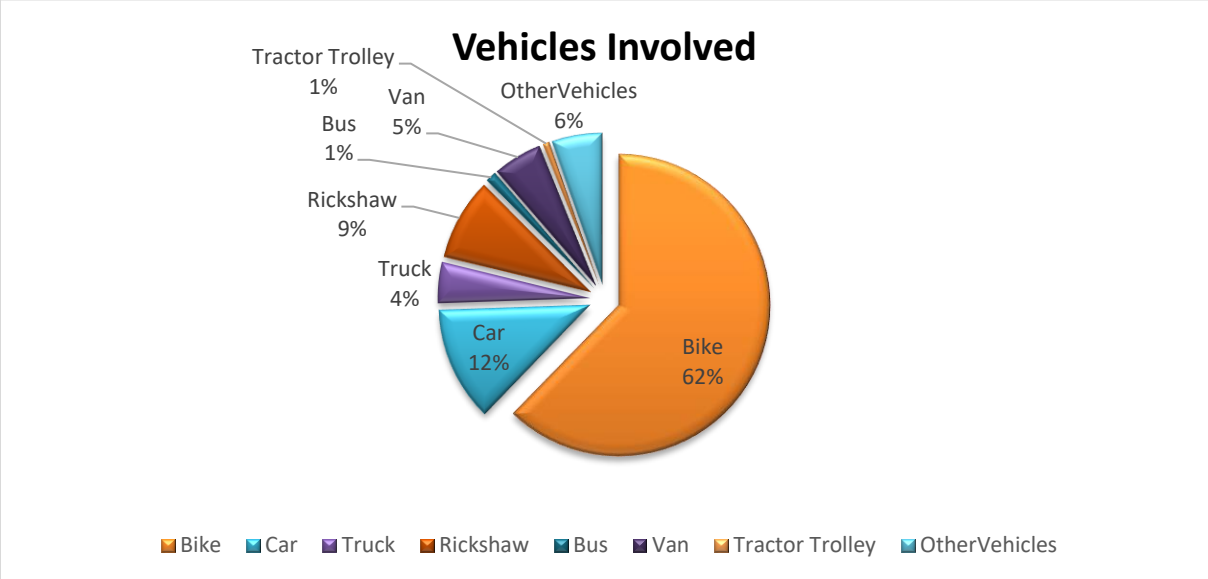


Figure 23 Share of Vehicle Involved in RTAs in District Gujrat

The analysis revealed that out of total RTAs bike were involved in 62% of them occurred in District Gujrat from 2017 to 2019 followed by passenger car having a share of 12%.

4.4.4 Deaths per 100,000 Population and 10,000 registered Vehicles in District Gujrat

To measure the magnitude of the problem some indicators or parameters should be defined for setting targets and assessing performance. The most frequently used parameter for assessing road safety region is finding out the number of deaths per 100,000 population and other indicators is finding out the number of deaths per 10,000 registered vehicles. Although these give a clear picture of the road safety of that region, but it has some limitations. In district Gujrat it is observed that most vehicles are having a registration plate of some other big district like Lahore or Islamabad this means that the number of registered vehicles is less as compared to the actual vehicles in Gujrat.

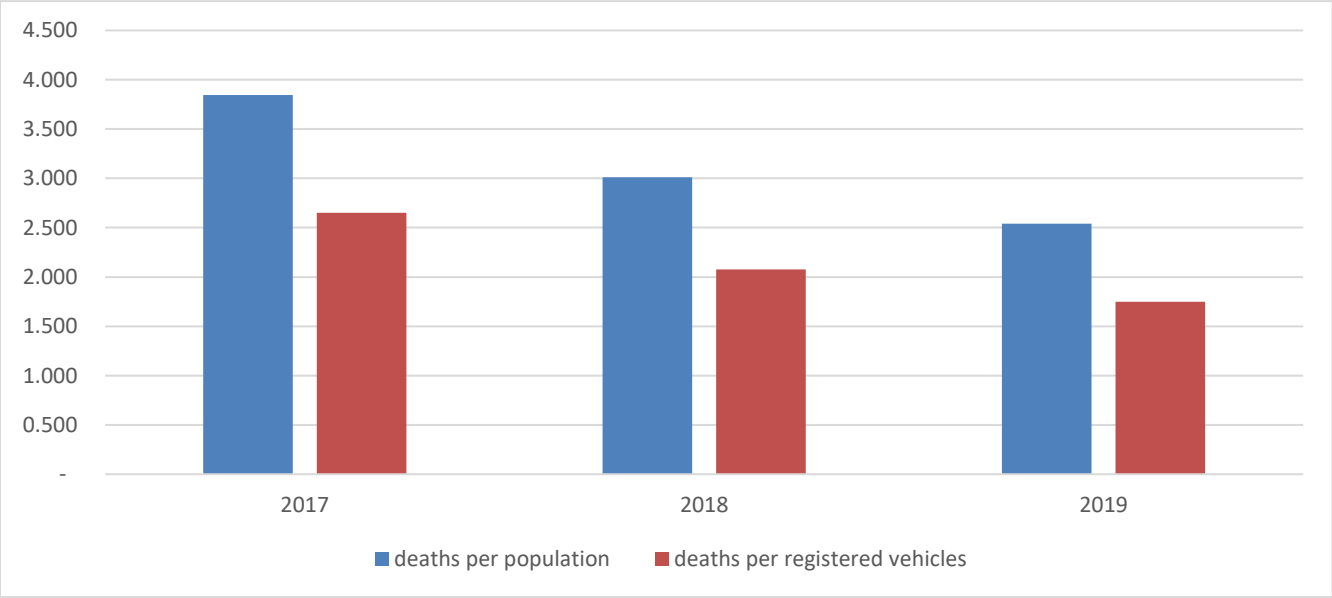


Figure 24 Deaths per 100,000 Population and 10,000 registered Vehicles in District Gujrat 2017-19

4.4.5 Severity wise analysis

Severity analysis is helpful in the determination of accident costs, assessing the impact on human life, and property damage most important aspect is gauging the safety efficiency of the transportation system.

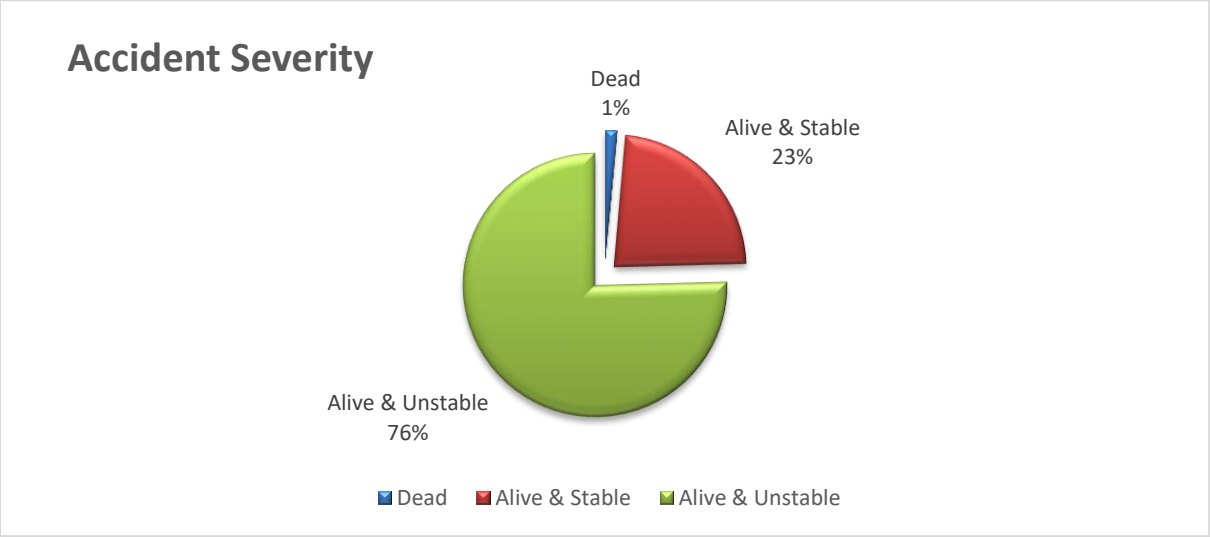


Figure 25 Accident Severity in District Gujrat 2017-19

Data revealed that 76% of total victims of RTAs were alive but unstable means they got some serious injury as a result of accidents 23% of total victims are alive and stable means that they suffered from minor injury only 1 % of total victims were found dead on the spot.

4.4.6 Injury wise analysis

This study helps in assessing the impact of road traffic accidents on Human Life analysis revealed that most of the accidents result in minor injury followed by leg fracture.

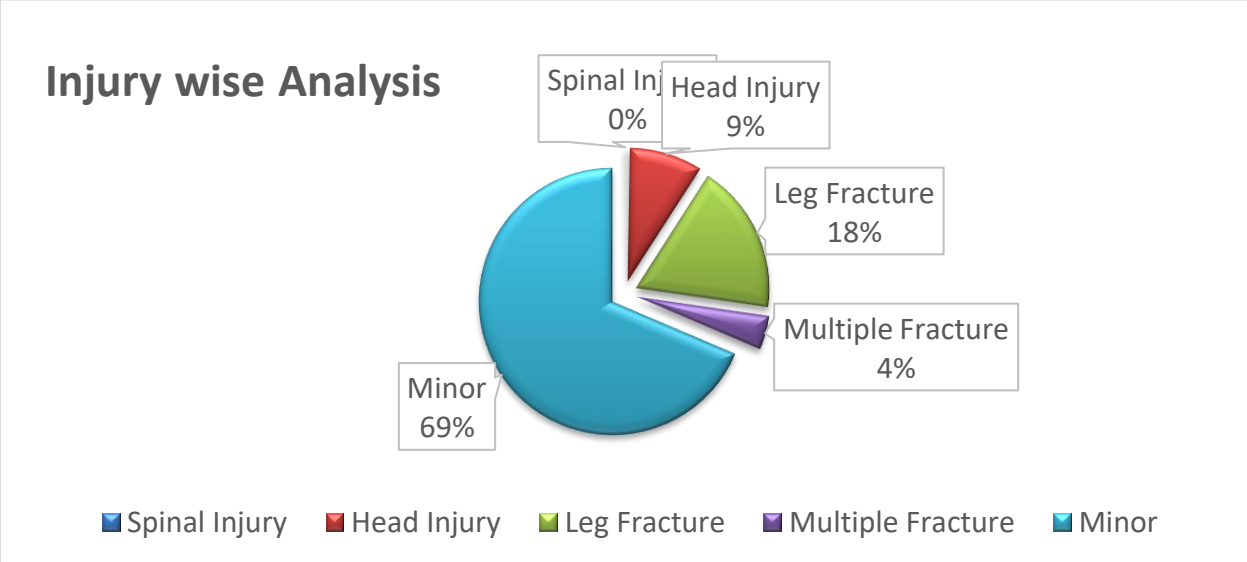


Figure 26 Injury wise analysis of RTAs in District Gujrat 2017-19

4.4.7 Cause wise analysis

This analysis is done to quantify the accidents as per their cause of happening. The result can precisely pinpoint the required direction of remedial efforts.

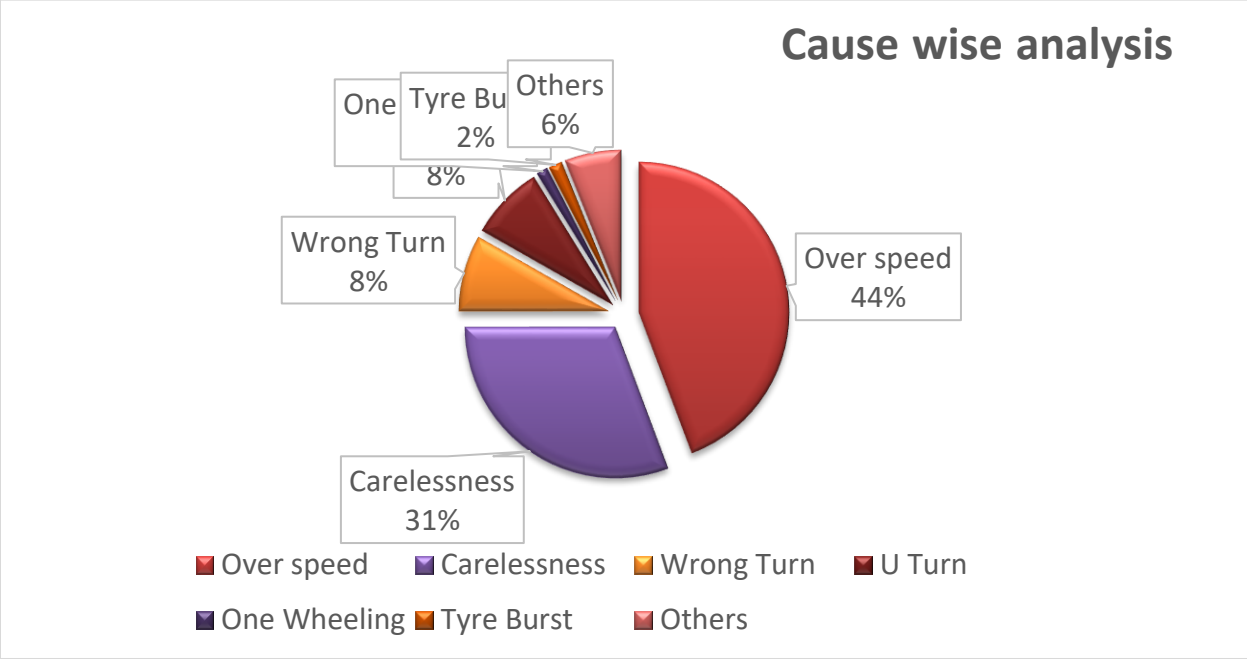


Figure 27 Cause Wise RTAs Analysis in District Gujrat 2017-19

Analysis reveals that the major cause of accidents is over speeding. It accounts for 44% of the total number of accidents. 31% of the total road traffic accidents are caused by carelessness.

4.5 Identification of Blackspots in District Gujrat

The location at which accidents occurred repeatedly within a certain period is known as accident blackspots. The location can be a junction or section of highway with a heavy concentration of numbers of accidents. Black spots in district Gujrat were identified by counting the reoccurrences of accidents within a patch of 1 km. According to the definition of black spots by National Transport and Research Centre Pakistan, a stretch of 1 km having 9 or more accidents in a year. For the analysis purpose locations having more than 30 accidents per year have been selected.

4.5.1 Accidents near Dewna Mandi

Dewna mandi is a small village near just outside the main city of Gujrat situated on the main National Highway N-5. Data revealed that in three years 173 road traffic accidents occurred near this location. 188 persons become victims of these accidents. 66 persons receive major and serious injuries that include multiple fractures lacerations and deep wounds. Bikes were involved in 95 accidents and passenger car were involved in 39 accidents. 61 accidents caused by the carelessness of drivers and 42 accidents were happened due to over speeding. Rough road also emerges as a dominating cause of accidents. 69% of accidents occurred in the daytime and 31% of accidents occurred at night.

4.5.2 Accidents near Bismillah More

The point where Baharwal link road meet with National Highway N-5 is named as Bismillah More. Data revealed that in three years 153 road traffic accidents occurred near this location. 192 persons become victims of these accidents. 77 persons receive major and serious injuries that include multiple fractures lacerations and deep wounds. Bikes were involved in 73 accidents and passenger car were involved in 45 accidents. 36 accidents caused by the carelessness of drivers and 50 accidents were happened due to over speeding. Wrong-way also emerges as a dominating cause of accidents. 77% of accidents occurred in the daytime and 23% of accidents occurred during the night.

4.5.3 Accidents near Kunjah Stop

Kunjah is a small town situated on Sargodha road. It comes under the jurisdiction of Tehsil Gujrat. Analysis revealed that in three years 176 road traffic accidents occurred near this location. 192 persons become victims of these accidents. 55 persons receive major and serious injuries that include multiple fractures lacerations and deep wounds. Bikes were involved in 104 accidents and passenger car were involved in 23 accidents. 52 accidents caused by the carelessness of drivers and 40 accidents were happened due to over speeding. Wrong-way also emerges as a dominating cause of accidents. 67% of accidents occurred in the daytime and 33% of accidents occurred at night.

4.6 Intersection Analysis

Four intersection namely Shaheen Chowk, Harya Wala Chowk, GTS Chowk, and Ramtalai Chowk were analyzed. These four intersections come into the jurisdiction of Tehsil Gujrat. Shaheen Chowk is located on Main National Highway N-5. Sargodha road Intersect N-5 at this intersection.

4.6.1 Accidents near Shaheen Chowk.

Shaheen chowk is a major intersection in District Gujrat situated on national highway N-5. Sargodha road coming from the city area intersects the national highway at this point. Both roads have high traffic volume.

Data revealed that in three years 234 road traffic accidents occurred near this junction. 238 persons become victims of these accidents. Three accidents are fatal in which 4 persons lose their lives at the spot. 110 persons receive major and serious injuries that include multiple fractures lacerations and deep wounds. Bikes were involved in 127 accidents and passenger car were involved in 31 accidents. 88 accidents caused by the carelessness of drivers and 84 accidents were happened due to over speeding. Tire burst also emerges as a dominating cause of accidents. 67% of accidents occurred at daytime and 33% of accidents occurred during the night

4.6.2 Accidents near Harya Wala Chowk.

Haryawala chowk is situated on national highway N-5. Shadiwal roads coming from the city area intersects the national highway at this point. Data revealed that in three years 288 road traffic accidents occurred near this junction little more than shaheen chowk. 310 persons become victims of these accidents. Two accidents were fatal in which 5 persons lost their lives at the spot. 133 persons receive major and serious injuries that include multiple fractures lacerations and deep wounds. Bikes were involved in 160 accidents and passenger car were involved in 46 accidents. 134 accidents caused by the carelessness of driver and 92 accidents were happened due to over speeding. Rough road also emerges as a dominating cause of accidents. 73% of accidents occurred in the daytime and 27% of accidents occurred during the night. This junction is also identified as a black spot.

4.6.3 Accidents near G.T.S Chowk.

G.T.S Chowk is situated on old Grand Trunk Road. Circular road and railway road meet at this junction. Data revealed that in three years 330 road traffic accidents occurred near this junction little more than shaheen chowk. 336 persons become victims of these accidents. five accidents were fatal in which 5 persons lost their lives at the spot. 118 persons receive major and serious injuries that include multiple fractures lacerations and deep wounds. Bikes were involved in 222 accidents and passenger car were involved in 35 accidents. 145 accidents caused by the carelessness of driver and 115 accidents were happened due to over speeding. Rough road also emerges as a dominating cause of accidents. 70% of accidents occurred in the daytime and 30% of accidents occurred during the night.

4.6.4 Accidents near Jail Chowk.

Jail Chowk is located at almost the center of the city. Jail Road intersects Rehman Shaheed Road at this junction. Data revealed that in three years 134 road traffic accidents occurred near this junction little more than shaheen chowk. 137 persons become victims of these accidents. 56 persons receive major and serious injuries that include multiple fractures lacerations and deep wounds. Bikes were involved in 88 accidents and passenger car were involved in 17 accidents. 67 accidents caused by the carelessness of drivers and 53 accidents were happened due to over speeding. 69% of accidents occurred in the daytime and 31% of accidents occurred during the night.

4.6.5 Accidents near Katchehry Chowk.

Katchehry Chowk is situated on Gujrat Jalalpur Jattan road. Bhimber road and Court road meet at this junction. Data revealed that in three years 75 road traffic accidents occurred near this junction. 78 persons become victims of these accidents. 39 persons receive major and serious injuries that include multiple fractures lacerations and deep wounds. Bikes were involved in 42 accidents and passenger car were involved in 8 accidents. 22 accidents caused by the carelessness of drivers and 35 accidents were happened due to over speeding. Rough road also emerges as a dominating cause of accidents. 72% of accidents occurred in the daytime and 28% of accidents occurred during the night.

4.6.6 Accidents near Ramtlai Chowk.

Ramtlai Chowk is situated on the old Grand Trunk Road. Gulzar-e-Madina road and Shadiwal road meet at this junction. Data revealed that in three years 165 road traffic accidents occurred near this junction. 178 persons become victims of these accidents. 57 persons receive major and serious injuries that include multiple fractures lacerations and deep wounds. Bikes were involved in 96 accidents and passenger car were involved in 21 accidents. 70 accidents caused by the carelessness of driver and 57 accidents were happened due to over speeding. Rough road also emerges as a dominating cause of accidents. 66% of accidents occurred in the daytime and 44% of accidents occurred during the night.

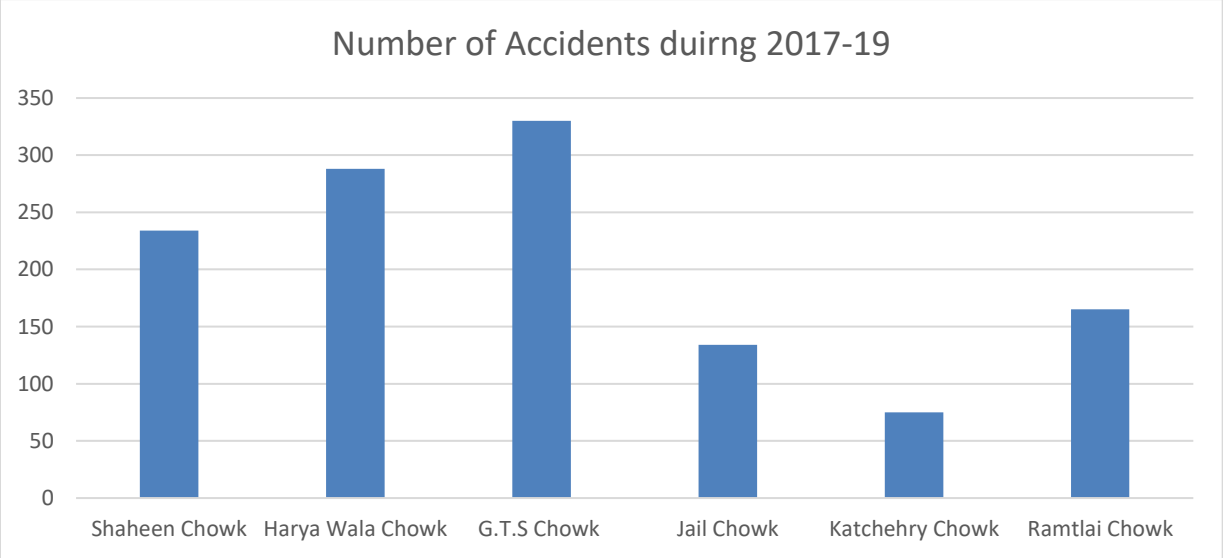


Figure 28 Accidents at Different Intersections in Gujrat 2017-19

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Acquiring Reliable data on RTAs is a challenging task. Three government agencies National Highway and Motorway Police, Punjab Emergency Rescue Service 1122, Tehsil Head Quarter Hospitals were contacted for RTAs data. The analysis was carried out on rescue 1122 data as the data of NH&MP limited to only national highway passing through district Gujrat. The accidents occurred both on provincial highways and national highways were recorded by rescue 1122. There is also a contrast difference between the number of reported injuries and reported deaths in the data of NH&MP and rescue 1122. In rescue 1122 data the location of accidents was not recorded separately whereas the locations were given in the general victim directory which contains all the medical emergencies besides road traffic accidents.

The analysis of data reveals that the accident occurrence trend is on increase due to rapidly increasing traffic exposure and motorization in district Gujrat. The rate of fatality in district Gujrat is 1%.

- Bikes are most often involved in accidents that are 89% Moreover the same category is also responsible for causing the maximum number of injuries.
- Human error (Overspeed and Negligence) was figured out as the primary contributor factor in causing accidents.
- Negligence emerged as the second major cause of accidents that means road users still lack requisite understanding of the importance of traffic safety laws and administration seems to be failed in enforcing strict regulations.
- Bikes and human error remained the highest in causing the accident. Maximum accidents are attributed to human error even bursting of tire either due to over usage of tire or over speeding in both cases humans behavior vital role to ply therefore these problems required strict administrative remedies rather than costly engineering kindly do the needful work.

Key pillars of Road safety are education enforcement and engineering, without paying attention to these elements reduction in RTAs cannot be achieved. Recommendations are given with the focus on the above stated facts.

It is observed that major roads of district Gujrat are missing shoulders at various locations. Shoulders should be provided on these roads to reduce the number of accidents. Road Studs should be installed on major roads before it connects to another road this will reduce the speed of traffic.

At service more road coming from Gujrat city connect National Highway from the right side which is in contradiction with the basic rule of traffic safety. Merging lane should be constructed for the traffic coming from Gujrat city.

Pedestrian bridges are occasionally seen in district Gujrat which reflects that insufficient attention has been given to the safety of the pedestrian. Also, no separate lane is given for motorcyclists and three-wheelers. A separate lane should be provided for three and two-wheelers. As bikes constitute more than 80% of road traffic accidents. Distractions alongside roads should be removed such as utility poles, advertising boards, encroachments, and other solid objects.

Three-wheelers also cause several accidents and it is observed that the recent volume of three-wheelers is increasing rapidly. This causes enormous obstruction not only inflow of traffic but also involves in number of RTAs. Three-wheelers must be stopped from coming to the main roads and heavy fined should be imposed if found violating traffic rules.

It is evident from the study that most of the accidents happened due to human error either it is due to negligence or due to over speeding both involved human error. This can be reduced by educating road users about road safety.

Road safety education should be given at the school level. Seminars on road safety should be held with the maximum participation of road users. Publicity of legislation and laws can create shared social norms for road safety. This can deliver tangible and sustained reductions in RTAs, deaths, and serious injuries.

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