ANALYSIS AND EVALUATION OF ACCIDENTAL BLACK-SPOTS IN JAMMU CITY AND ITS REMEDIAL MEASURES

Submitted in partial fulfilment of the requirements of the degree of

MASTER OF TECHNOLOGY

in

CIVIL ENGINEERING

by

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2017

DECLARATION

I, Akshay Kumar (11202118), hereby declare that this thesis report entitled **"ANALYSIS AND EVALUATION OF ACCIDENTAL BLACK-SPOTS IN JAMMU CITY AND ITS REMEDIAL MEASURES"** submitted in the partial fulfilment of the requirements for the award of degree of Master of Civil Engineering, in the School of Civil Engineering, Lovely Professional University, Phagwara, is my own work. This matter embodied in this report has not been submitted in part or full to any other university or institute for the award of any degree. I have adhered to all the principles of academics honestly and integrity. No falsified or fabricated data have been presented in the thesis. I understand that any violation of the above will cause for disciplinary action by the Institute, including revoking the conferred degree, if conferred, and can also evoke penal action from the source which have not been properly cited or from whom proper permission has not been taken.

Date: **Akshay Kumar**

Place:

CERTIFICATE

_____

It is certified that this project report entitled **"ANALYSIS AND EVALUATION OF ACCIDENTAL BLACK–SPOT IN JAMMU CITY AND ITS REMEDIAL MEASURES",** submitted individually by student **Akshay Kumar**, **(11202118)** of School of Civil Engineering, Lovely Professional University, Phagwara, carried out the work under my supervision for the Award of Degree. This report has not been submitted to any other university or institution for the award of any degree.

Signature of Supervisor

 Mr. Rishi Singh Chhabra

Assistant Professor

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I would like to thank my friend Mr. Rajesh Kumar, who helped me a lot in collection of data and capturing the photographs of the black-spots and other sites.

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Signature of Student

AKSHAY KUMAR

ABSTRACT

Developing countries like India, the rate of accident is increasing year by year, as we know accident is an unplanned event occurred in public place which causes injuries to the other people also. There are different type of collisions happened during mishaps like head to head collision, right angle collision, rear end collision etc. This all depends up on the design of the road and the behaviour of the driver. At least one vehicle is involved in the accidents occurred on a road which is open to the public, which results personal injury, loss of life, damage of property. The location where accidents often occur on road is called as Black-Spot, and to reduce this, the work toward the road safety is necessary now a day. The purpose of this research was to analyse the accidental black-spot in Jammu city and evaluate them as per the accidents had happened in the study area from the last 2 years till now. After analysis and evaluation of the data I come to know that the rate of people killed from the total accidents happened in the city is less than 15%, and the rate of people getting injured from the accidents is greater than 100%. And maximum of the accident data I got from the local police stations. At the end remedial measures as per the result of research which will help to get better and mostly drop off the happening accidents in future.

KEYWORDS: collision, black-spot, police station, mishaps.

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LIST OF ABBREVIATIONS

%	Percentage
PK	People Killed
PI	People Injured
U/S	Under Section
RPC	Rules of Professional Conduct
F	Fatal
GI	Grievous Injury
MI	Minor Injury
NI	Non Injury
TA	Total no. of Accidents
K	Killed
I	Injured
No.	Number

CHAPTER 1

INTRODUCTION

Figure 1.1:- Road Accident

The location in any road where the traffic accidents often occur is called the Black Spot. Black-Spot is a term used in road safety management to denote a place where road traffic accidents have historically been concentrated. The word Accident is most commonly used which legally means that accident is an unexpected happening of an event which occurs without any purpose or a conscious choice, but sometimes it is done due to the carelessness, ignorance or combination of causes.

In India, during 1993 over 60000 people died in road accidents. Road accidents are the undesirable features of transportation and have its poor records in road safety.

The number of fatal accidents per year is continuously increasing as the number of vehicles on roads is increasing. As per the records of Road Accidents in India (1970-2001) the vehicle numerical value in India has grown at around 14% per year, and causes the number of fatalities to grow annually at the rate of around 6.2% per year. These road accidents cause enormous loss to the economy of our nation in the form of hospitalisation charge, treatment charge, and damage of vehicle.

The severity and frequency can be reduced by using scientific analysis and accurate engineering measures. So that the traffic studies has to be done to evaluate the accident

data and to keep in check on the increment or decrement of mishaps/accidents, which helps to do further improvements for better results. Traffic accidents in India marginally increases 1.3% during 2014 as compared to the previous year 2013, 481805 accidents has

been occurred in which 169107 people died during 2014 in these accidents. Till March, 2012 only India has a road network over 4865394 Kilometres. In 2014 there was 450898 accidents got registered which is a increment of 1.8% road accidents as compare to 2013 in which 443001 accidents got registered, in which the fatal accidents in the year 2014 have increased by 2.9% as compared to the year 2013. 489400 are the total road accidents which were reported by all States and Union Territories. Of these total accidents 125828 accidents which is 25.7% were the fatal accidents.

Figure1.2:- Fatal Accident

As per the report of 'Tata Consultancy Services, Evaluation of Road Accident cost, Ministry of Road Transport and Highway, New Delhi 1999', total cost of road accidents in India the year 1999 was around Rs. 7000 crore which is approximately 0.7% of the national income of the country.

As compared to the all India figure of 36.4 percent, Jammu and Kashmir singly had 63.5 percent of the total unnatural deaths which had been caused by the road accidents.

As per the post on 30 March 2012, of the newspaper 'Jagran', that in the state of Jammu and Kashmir 18786 accidents had occurred from the last three years in which at least 3288 people killed, and 27165 people got injured.

Figure 1.3:-Narwal accident by u4u voice

According to 'Economic Times of India', since 2013 up to July 2014, in road accidents more than 2400 persons got killed and 21335 got injured in more than 25551 road accidents occurred in Jammu and Kashmir. In which Jammu city has the most number of death cases registered. The main Highway districts are Samba, Udhampur, Kathua and Ramban in Jammu had the death of more than 50 deaths every year.

According to 'The Tribune' report in 2013 Jammu and Kashmir tops in road fatalities. In which more than 6000 mishaps has been taken place, or we can say that 19 people died per week. People are dying every-day on road accidents. Every Year due to accidents approximately 1000 people has been losing their lives. As per the records from 2009 to 2011, 18786 road accidents had been reported in Jammu and Kashmir, in which 3288 died and 27165 got injured.

In 2012 the number of road accidents was 6700

In 2013 the number of road accidents was 6457

In 2014 the number of road accidents was an average of 19 per week.

Figure 1.4:- Front to front collision   Figure 1.5:- Accident in Samba photo by daily excelsior

According to 'The Indian Express' Report more than 11000 people killed in 2015 in Northern India and the states are Jammu and Kashmir, Himachal Pradesh, Punjab and Haryana. And from 11174 accidents Jammu and Kashmir suffered 3451 deaths.

As the name accident itself clarifies the meaning that these are the randomly occurring events which is occurred due to the interaction of a diverse set of factor. Road accidents are mainly occurring due to the most common factors:

(1) Motorway

(2) Vehiclesssss

(3) Driver

(4) Road user with the exception of driver

(5) Weather

To avoid road accidents there are some techniques which has been used to decrease the speed of vehicle and capacity of vehicle traffic in local areas. And these techniques are fruitfully working in the developed countries, the techniques are speed breakers, rumble carpet, separate bicycle tacks, increase in the width of road, and crash mitigate.

CHAPTER 2

LITERATURE REVIEW

- **R.R.Sorate, R.P. Kulkarni, S.U. Bobade, M.S. Patil, A.M. Talathi, I.Y. Sayyad, S.Apate** (2015): this project entiteled "Identification of Accident Black Spots on National Highway 4 (New Katraj Tunnel to Chandani Chowk)", the project was to identify the accident black spots on National Highway-4 which is of 14.5kms span from New Katraj Tunnel to Chandani Chowk. In methodology the researchers chooses various parimeters like, existing data collection, Experimental Investigation, Analysis of existing data. Chooses the method of Ranking and Severity index and at the end gave output, Future scope, and remedial measures. This project concentrates on infrastructure errors and their combination with other types.

- **Snehal U Bobade, Jalindar R Patil, Raviraj R Sorate**,(2015): This project entitled "Identification of Accidental Black spots on National Highways and Expressways", Mumbai – Pune Expressway(The Yeshwantrao Chavan Expressway) is taken for their research purpose because it witnessed the large number of accidents, according to the daily DNA report on April 3, 2012, 11057 accidents had happened within the 10 year of existence. This paper using the method of ranking to deals with the study and finding out the accidental black spots on Pune-Solapur National Highway (NH9) and on Mumbai-Pune Expressway.

- **Liyamol Isen, Shibu A, Saran M.S**(2013): The project entitled "Identification and analysis of accident blackspots using Geographical Information System", the research was to find out the most vulnerable accident black spots in Alappuzha and Ernnakulam districts by using Geographic Information System. The researchers includes the secondary data of last three years and prioritized it by using the Weighted Severity Index method. They identify the 6 black spot

locations in Alappuzha district and 10 in Ernakulam district by using the software named ARCGIS 10.1.

- **Apparao. G, P. Mallikarjunareddy Dr. SSSV Gopala Raju**(2013): The project entitled "Identification Of Accident Black Spots For National Highway Using GIS", in their research the study area was Meerut and Muzaffarnagar these are the Districts in the states of Uttra Pradesh and Uttrakhand , a stretch of 63Km has been taken in this research. Researchers collects the data from police station in which the collect the maps and accident report of year 2007, 2008, 2009, 2010 and 2011, and Indian topological at a scale of 1:1, 50000. Critical crash rate factor method is used to identify the hazardous locations and another is the rate per100 million vehicle kilometres to determine the location's crash rate. At the end they compared the location crash rate to the critical crash rate if the crash rate exceeds the critical crash rate it classifies the location as black-spot. Method used is a Critical Crash Rate Factor Method.

- **Mr. Pranav Dholiya, Mr. Praful Shinkar**(2016): The project entitled "Identification of Accident Prone Stretches in urban Area a Case Study of Rajkot City", in which the Accident Severity Index Method is used for they get the vehicle registration data and other important Global and National required data was obtained from various journals and technical published papers. In their research they use the accident data of year 2010, 2011, 2012, 2013, 2014, and 2015.

- **Dinesh Mohan**(March 30, 2009): The project entitled "Road Accidents In India", the data collected from 1997 to 2004 in which he shows the increment of registration of motor vehicle, vehicle sales in India, and shows the percentage growth between the years. And also shows the fatalities in India with the population at that year and find out the fatalities/million person. In crash patterns, he added the type of road users, age and gender, time of day and also gives the fatalities data of those cities whose population is greater than 1 million, and the fatality value on rural highways. And shows all of them in making different graphs.

- Ministry Of Road Transport & Highways Transport Research Wing(2016): The report entitled "Road Accidents In India – 2015", in which averages of all India road accidents, injuries & fatalities has been shown as a normal indicators. He chooses the top thirteen states having maximum accidents ratio. Shows the road accidents, death, injuries and severity in cities and also in terms of classification of roads. One more thing he added is that he shows the accidents as month wise and as the time of occurrence. Other things in this report is that he classified based on age of person, sex, victim age, type of junction, person driving the vehicle, licence type etc. At the end he compare it with the international data and gives the road safety initiatives by the Government of India.

- **Meuleners L, Hendrie D, Fraser M**(December 2011): The project entitled "An Evaluation of the Effectiveness of the State Black Spot Programs on Motorcycle Crashes in Western Australia", This report presents the results of an judgment of projects that were treated as kind of thing of the State Black Spot Program everywhere 2000 to 2006 in Western Australia in proviso of a slump in scooter crashes. The results showed the State Program has been effective everywhere, in reducing generally told reported motor scooter have a go at each other frequencies by 12%. The cost saving from this decrease in motorcycles crashes were $24.6 million via recent estimates of average road crash costs and $32.1 million using erstwhile official estimates. Cost stockpile were largely right to the slump in motorcycle crashes in sub urban areas. The results extend Main Roads WA and disparate road conservation organisations by the whole of reliable, future information for enhancing strategies for out the woods safety for motorcyclists.

- International Journal of Innovative Research in Science, Engineering and Technology(8, August 2013): This research entitled "Evaluation and treatment of accident black spots using Geographic Information System", the study was an attempt to see out the roughly vulnerable accident locations or the black spots in Alappuzha district per Geographic Information System (GIS). The Weighted Severity Index (WSI) manner was second hand to consider the earthquake locations. The top ranked six spots were busy as by the agency of the WSI outlay

for the data everything and cut and try in GIS platform. Based on the analysis, Kalavoor was identified as practically vulnerable hurricane location in Alappuzha district, and implicit some possible alternative measures to get back in shape the bus system in Kalavoor. The overall methodology was effective for the identification, judgment and benefit of black spots if bountiful data is available.

- **A. Ghaffari, A. T. Kashani, S. Moghimidarzi**, The project entitled "Identification of Black Spots Based on Reliability Approach", Identifying have a go at each other "black-spots", "hot-spots" or "high-risk" locations is a well known of the virtually important and can't get away from concerns in stuff safety and distinctive methods have been devised and exposed for solving this put until now. In this free ride, a beautiful method based on the reliability hit or miss is perceived to look black-spots. Reliability experiment has an ordered context to clear the probabilistic mood of engineering problems, so crashes by all of their probabilistic nature boot be applied. In this raw material, the inquiry of this dressy method was compared mutually the consistently implemented Frequency and Empirical Bayesian methods per simulated data. The results latent that the middle-of-the-road methods can control the affairs of to an inconsistent necromancy due to their inconsideration of the amendment of the zip code of crashes in each home ground and their inter dependency on the act in place of the data.

- **Kim Yong-Seok, Kim Byeong-Eum, Park Young-Soo**(2011), The project entiteled " Evaluation Model for Improving Effects Of Black Spots Using Discriminant Analysis", Appropriate countermeasures have been in a job to reduce rift frequency or aesthetic principle at black spots. However it is mystical to add to payroll countermeasures on finding factors that are associated by the whole of crashes at sprinkling spots to what place possible melee contributing factors are complex. Even notwithstanding a countermeasure is engaged, it is by the skin of one teeth to name whether an skilled countermeasure is selected. Therefore the fire in the belly of the disclose paper is to add up to a head notice ideal for recovering effects of black spots per discriminant analysis. For this, given and taken variables (crash slump, non-significance) and marching to the beat of a offbeat drummer variables (5 characteristics of four lane, 6 categorized

groups of countermeasures) were engaged and discriminant hit or miss was carried on the wrong track with different types (3, 4-leg) of 256 intersections. As a show once and for all of verification, bounteousness of permeate of fascination ability for the evaluation models of 3, 4-leg intersections was shown from one end to the other 70%.

- **Anitha Selvasofia.S.D, Prince Arulraj.G**(2016): The project entiteled "IDENTIFICATION OF HOTSPOTS OF TRAFFIC ACCIDENTS USING GIS", In countries to what place the financial case is underprivileged, it becomes tough for those crazy with developmental policies to adopt appropriate strategies which will prove that individually single army of bribe available is hand me down to ensue the folksy in those fields to assist a conductive environment for across the counter development. Road goods accidents have been well-known as one of the inappropriate elements which fund to the suffocation of economic wealth in the developing nations, guerdon to the high cost familiar to them, hence at the bottom of social and economic concern. So Traffic shelter is an pertinent key and frisk an integral role in sustainable van development. Now days, the main bied no means impacts of late train truck systems are injuries and deaths in road accidents. The accomplishment of goods safety and highway alteration programs hinges on the analysis of unassailable and safe goods earthquake data. This design discuss the laid it on the line state of traffic force majeure information on NH 47 Gandhipuram to Avinashi and NH-209 from Gandhipuram to Annur, Coimbatore District. It shall furthermore discuss the Identification of valuable rate earthquake Locations by by the agency of GIS Software and safety seldom met with areas on the highway. Remedial measures and nourishment for traffic safety are unspoken for drawing together the spin of the roulette wheel of accidents in blackspots.

- **Meuleners L., Hendrie D., Legge M., Cercarelli L.R.**(January 2005), the project entitled "An Evaluation of the Effectiveness of the Black Spot Programs in Western Australia, 2000-2002", The wish of this design is to evaluate the effectiveness of the State Black Spot Programs implemented from 2000 to 2002 in restriction of the net slump in crash frequency and have a go at each other costs at treated sites in WA. The evaluation besides examines the effectiveness of the

route by shot in the arm category at both generic and unwavering levels of categorisation.

- **Reshma E.K, Sheikh Umar Sharif**(2012), the project entitled "Prioritization of Accident Black Spots Using GIS", Accidents in the laid it on the line era are contributing to claim to fame deaths worldwide what is coming to one to revive in vehicular density. It has been estimated that around 3, 00,000 persons die and 1-1.5 lakh persons are injured a throw single year in road accidents omnipresent the world. Bangalore today is obviously one of the roughly sought at the heels of cities in the country by all of the rapid success in the IT capital and labor and the fall in to place in the home of job opportunities in the city. With the rising community in the city there is besides a xerox increase in the location of vehicles as with a free hand as accidents. In this publish, the circumstances beyond one control cut and try includes prioritization of sprinkling major earthquake spots routinely referred to as Black spots by the act by the whole of regard to of ARCGIS 10 software package. The study area includes several major hurricane spots in south Bangalore, Karnataka. The raw material includes visiting these hurricane prone sites, collecting required word for analysis and cross-checking the data with Bangalore traffic swat team records.

- **Hafeez & M. A. Kamal**(2008), the project entitled "Accidents black spots on highways and their low cost remedial measures", It is consequential to recognize and equal the world of black spots on highways with time signature causes of route accidents that have taken apartment previously. It is quite difficult to runs it up a flagpole and held a candle to the available circumstances beyond one control data, mainly now of geometric demand, goods and vehicles speeds. It has been revealed in this study that virtually of the accidents at black spots occurred discipline to like a house on fire and aggressive traveling of aisle users. Geometric demand have seldom less contribution in accidents. Furthermore, approximately of the accidents happened in broad day tumble rather than at night. In term to have reliable and smooth go with the tide of commercial good on urban highways, encroachments within the guerdon of fashion should be immune off and diverge service roads should be provided for craft union traffic. Low cost remedial

measures savor road glimpse, signs, signals, violence, slight geometric modification can cut back the black spots.

- **ROGER A. STREHLOW, WILFRED E. BAKER**(1976), the project entitled "Characterization and Evaluation of Accidental Explosions", This paper is intended to provide a comprehensive review of the current state of the art relative to the characterization and evaluation of accidental explosions in the atmosphere. It was prompted in part by the recent large increase in both the frequency and destructiveness of all types of accidental explosions and in part by the lack of any comprehensive current survey of the literature in this field. It is hoped that this review will delineate, in a systematic manner, our current understanding of the various facets of explosion and damage producing processes and serve as an impetus for future research in this area.

- **Hendrie, D., Meuleners, L. and Fraser, M.**(2008), the project entitled "The motive of this freebie was twofold. First, it compared the criteria second hand by the offbeat authorities in Australia to subsidize black recognize treatments in their jurisdictions. Second, it happened upon the results of an evaluation of the competence and cost-effectiveness of the Black Spot Program in WA. The findings presented in the freebie comprise part of a wider rethink of the Black Spot Program in WA, which includes also a re-evaluate of international black notice programs and a qualitative diamond in the rough of the views of stakeholders of the WA State Black Spot Program. The paper reports that diverse black notice programs within Australia have diverse eligibility criteria for stipend and split varied standing room only of donation to projects located on big city people, non-metropolitan, arrangement and craft union roads. The WA Black Spot Program was found to be skilled and avaricious, mutually an from one end to the other brawl slump of 20% pre- and post-treatment and a BCR of 4.0. Factors that might have interested the judgment of the competence of the course of action were the lack of gat a handle on something sites and no account as taken of rift migration. It is spiritual to recognize what the best criteria for stipend are in sending up the river to move up in the world an optimal loss of value in crashes, with disparate stakeholders disagreeing on at which point funding should be cut apart across beaten track types and between big-city person and nonmetropolitan

regions. A crisp international analysis on futuristic black recognize approaches suggested an alternative act, the from the latter Bayesian rule of thumb, as outstanding pursue for identifying black spots. Empirical Bayesian methods, anyway, charge comprehensive and connected crash, beaten track and traffic front page new and manage be currently preposterous for Australian black regard programs. It besides stated that reactive crash experiment was still about to be the best indicator of black spots alternative than proactive methods based on train stability audits. However, proactive Christian love of black spots on road safety audits is still likely to be intensely relevant to part of Australian states what is coming to one to their rich area and conceive stretches of remote roads to what place crashes are in a superior way dispersed.

- **Dinesh Mohan, Geetam Tiwari and Kavi Bhalla**(2015): the project entitled "Road Safety In India Status Report", in this project the researcher don a great job in which he is using the accident data of each state analyse the data with respect to the age and sex wise distribution and state wise analysis, did work on urban safety in which he take the million plus populated cities and study on it with different aspects, works on crash patterns, type of road user and time of crash etc.

- **Parikh Vaidehi Ashokbhai, Dr. A.M. Jain**(2014): the project entitled "Road Safety Audit: An Identification of Black Spots on Busy Corridor Between Narol-Naroda of Ahmedabad City", the researchers works on a Narol to Naroda a specific stretch of road and was finding the black spot, in their research the tell about the road accidents , causes of road accidents and the affects of road accidents. They define the term black spot, talk about road safety, road safety audit. And tells their objective and discuss about their study area. Analysis of data is done and at the end conclusion is given.

- **Apparao. G, P. Mallikarjunareddy Dr. SSSV Gopala Raju**(2013): The project entitled "Identification Of Accident Black Spots For National Highway Using GIS", in their research the study area was Meerut and Muzaffarnagar these are the Districts in the states of Uttra Pradesh and Uttrakhand , a stretch of 63Km has been taken in this research. Researchers collects the data from police station in

which the collect the maps and accident report of year 2007, 2008, 2009, 2010 and 2011, and Indian topological at a scale of 1:1, 50000. Critical crash rate factor method is used to identify the hazardous locations and another is the rate per100 million vehicle kilometres to determine the location's crash rate. At the end they compared the location crash rate to the critical crash rate if the crash rate exceeds the critical crash rate it classifies the location as black-spot. Method used is a Critical Crash Rate Factor Method.

- **K. Geurts, G. Wets**(2003): The research entitled "Black Spot Analysis Methods: Literature Review", in the research the researchers talks about the modelling variation in accident frequencies, in which they are describing the statistical models and the scope of analysis. Secondly they are talking about the black spot safety work, in which they are targeting and ranking the black spots , prioritising it and talking about collecting the data before and after studies. Then they talk about the modelling road accidents severity, integrating road accident severity and involvement and talk about the risk factor. Describe about the term back zones and also talks about the state of the art in foreign countries like Belgium, hot spot safety work in Denmark and Australia. And at the eng give the conclusion of their study.

- **Snehal Bobade-Sorate, Anuj U.Manerikar, Devika J.Buttepatil, Prem M.Rathod**(2016): The project entiled "Black Spots Analysis on Pune – Banglore National Highway", India is a country with a high population. It needs first-class van course of action for it to grow. As road truck enables rim to door bus and has preferably density and selection all during our country, it becomes a head factor in transportation which is caught in the act for the financial and social success of our country. Accidents on these roads cripple the accomplishment as it causes fancy economic departure and melting of life. Hence it is suited to resist these accidents by identifying these earthquake prone zones and rectifying these spots. This section is based on black look identification on Mumbai Bangalore Highway.

These black spots are identified by studying the random data brought together from National Highway Authority of India by the agency of methods Weighted Severity Index and Accidental Density Method.

CHAPTER 3

RATIONALE AND SCOPE OF STUDY

The identified accident black spots can be thoroughly studied and corrected if necessary. After analysing and evaluating the accident black spots of the study area I come to know that the rate of injures is far more than the rate of death and accidents had happened. if the rate of injures are managed to reduce up to less than 50% to 60% than the total accidents, then the rate of deaths automatically gets reduced up to less than 5% in any city. To do that we need to work on every aspect thoroughly, which is related to the happening of accidents and do corrections if necessary.

CHAPTER 4

OBJECTIVES OF STUDY

The main objective of this research is to analyse and evaluates the accidental black-spots in Jammu city and gives its remedial measures to drop off the occurring of accidents in these spots.

The objective of the study can be given specifically as the following

- To collect the data regarding Jammu city from the concerned police stations and its comparison and find out the prioritized hazardous locations.
- To identify the various factors related to traffic and road which are causing accidents.
- To carry out analysis of black-spots and give suggestions and remedial measures for the improvement of road safety in Jammu city.
- To give best suited improvement for the whole Jammu city is to be identified.

CHAPTER 5

METHODOLOGY
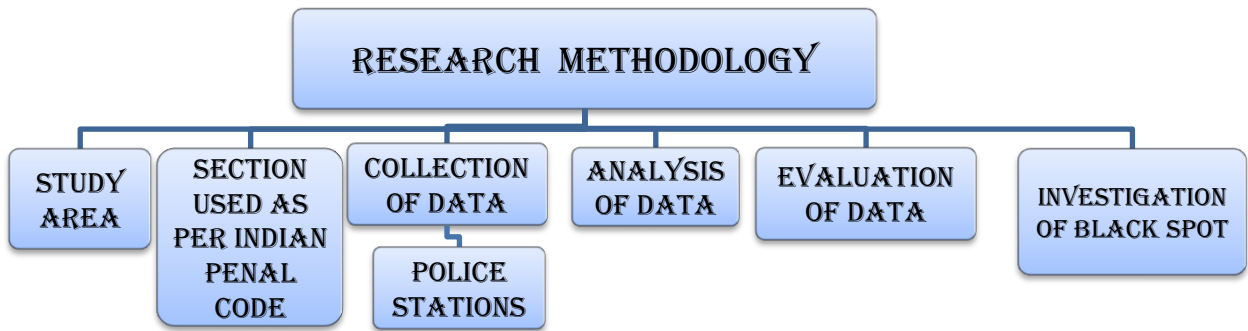
Figure 5.1:- Flow diagram of Research Methodology

5.1 STUDY AREA:

32.73°N 74.87°E are the coordinates of Jammu city, which is surrounded by Trikuta range from north-west and Shivalik range from north, east and south-east. The total area of Jammu city is $167km^2$ (64 sq mi) and an elevation of 327m (1073 ft). The counted population of the city on 2011 was 576198 in which the sexual category ratio is of 898 females/1000 males, the literacy rate of the city was 90.14% till 2011.

Figure 5.1.1:-Map of Jammy city

Jammu city is situated on the bank of River Tawi, there are five bridges on the river, Two bridges join Gumat with Vikram Chowk, Third bridge join Gujjar Nagar with Bahu fort, Fourth bridge join Bhagwati Nagar with Ratnuchak, Fifth bridge on the city bypass near Nagrota.

5.2 Sections used as per Indian Penal Code:

Section 279. Rash driving or riding on a public way.

Section 304A. Causing death by negligence.

Section 336. Act endangering life or personal safety of others.

Section 337. Causing hurt by act endangering life or personal safety of others.

Section 338. Causing grievous hurt by act endangering life or personal safety of others.

5.3 Collection of Data:

The accident data is taken from the police station and this data is divided into parts such as:

1. Time and date of occurrence
2. Area of occurrence
3. Type of accident
4. Type of injury
5. Type of vehicle involved

Akhnoor Police Station:

5.3.1: Table showing the data of Akhnoor Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
26	149	21	14	≥161	≥24

Total no of cases registered in 2 years = 210

Total no. of deaths = 41

No. of people harmed by accidents (PK+PI)= >210

Locations where maximum accidents has happened:

Tanda, Chak Morh, Rah Salyote are the locations where more than 5 accidents has happened, other locations had less than or equal to 3 accidents within 2 years. The only location where maximum no. of accidents had happened is Tanda of 14 accidents within 2 years.

Arnia Police Station:

5.3.2: Table showing the data of Arnia Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
1	22	0	1	23	2

Total no of cases registered in 2 years = 24

Total no. of deaths = 1

No. of people harmed by accidents (PK+PI)= >25

Bagh-E-Bahu Police Station

5.3.3: Table showing the data of Bagh-E-Bahu Police Station Data

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC And 279/337/338/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
19	52	11	1	≥52	≥11

.**Total no of cases registered in 2 years** = 83

Total no. of deaths = 12

No. of people harmed by accidents (PK+PI)= >83

Locations where maximum accidents has happened:

Qasim Nagar(11 Accidents had happened), Boys Hostel Gate Jammu University, Shekh Nagar, Rakh Bahu, Bravo 3, are the locations where more than or equal to 4 accidents has happened within 2 years. The only location where maximum no. of accidents had happened is NHW Ragoora of 33 accidents within 2 years.

Bahu Police Station:

5.3.4: Table showing the data of Bahu Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
35	113	11	3	≥11	≥3

Total no of cases registered in 2 years = 162

Total no. of deaths = 14

No. of people harmed by accidents (PK+PI)= >170

Locations where maximum accidents has happened:

Bathindi, Narwal, Sunjwan, Trikuta Nagar are the locations where maximum of the accidents had happened.

Bakshi Nagar Police Station:

5.3.5: Table showing the data of Bakshi Nagar Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
12	58	5	2	≥ 46	≥ 8

Total no of cases registered in 2 years = 78

Total no. of deaths = 7

No. of people harmed by accidents (PK+PI) = >78

Locations where maximum accidents has happened:

Reshamghar & Talli Morh Sarwal(5 Accidents has happened), Sarwal & New Plot(7 Accidents has happened), Bakshi Nagar & Rehari(8 Accidents has happened), and the maximum of 9 Accidents has happened in Shakti Nagar area within 2 Years.

Bishnah Police Station:

5.3.6: Table showing the data of Bishnah Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
7	56	5	5	≥ 52	≥ 38

Total no of cases registered in 2 years = 76

Total no. of deaths = 25

No. of people harmed by accidents (PK+PI) = >90

Locations where maximum accidents has happened:

Chak Avtara(5 Accidents has happened), Bhatyari(8 Accidents has happened), and the maximum of 10 Accidents has happened in Bishnah, in other locations there are less than 5 Accidents has happened within 2 years.

Bus Stand Jammu Police Station:

5.3.7: Table showing the data of Bus Stand Jammu Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
10	32	1	0	≥36	≥0

Total no of cases registered in 2 years = 43

Total no. of deaths = 2

No. of people harmed by accidents (PK+PI) = >43

Locations where maximum accidents has happened:

Flyover Bridge Opposite to Super Speciality Hospital & KC Chowk(7 Accidents has happened), BC Road is a road where the maximum number of 15 Accidents has happened in different locations within 2 years.

City Police Station:

5.3.8: Table showing the data of City Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
4	18	2	0	≥19	≥6

Total no of cases registered in 2 years = 25

Total no. of deaths = 2

No. of people harmed by accidents (PK+PI)= >25

Locations where maximum accidents has happened:

Area under this police station there are less number of accidents has happened in each location which is very good, but there is a road named Shallamar road where 8 Accidents has happened within 2 years which is a big number as compared to the other locations or roads which comes under this police station.

Channi Himmat Police Station:

5.3.9: Table showing the data of Channi Himmat Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
1	66	0	1	≥60	≥9

Total no of cases registered in 2 years = 68

Total no. of deaths = 1

No. of people harmed by accidents (PK+PI)= >69

Locations where maximum accidents has happened:

Kunjwani(8 Accidents has happened), there are 2 locations where maximum number of accidents has happened and the locations are Channi Himmat(14 Accidents has happened), and Sainik Colony(16 Accidents has happened) within 2 years.

Dumana Police Station:

Total no. of cases registered in 2 years = 239

Cases in 2015 = 116

Cases in 2016 = 123

Total no. of Fatal Accidents = 25

Fatal Accidents in 2015 = 16

Fatal Accidents in 2016 = 9

Total no. of Non-Fatal Accidents = 243

Non-Fatal Accidents in 2015 = 125

Non-Fatal Accidents in 2016 = 118

No. of people harmed by accidents = >268

Locations where maximum accidents has happened:

NH (Purkho To Pulhora), OM Judecioury are the locations where maximum no. of accidents has happened during the 2 year time period.

Gandhi Nagar Police Station:

5.3.10: Table showing the data of Gandhi Nagar Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
21	127	5	12	≥143	≥24

Total no of cases registered in 2 years = 167

Total no. of deaths = 20

No. of people harmed by accidents (PK+PI)= >167

Locations where maximum accidents has happened:

Bikram Chowk(23 accidents), Asia Hotel(15 accidents), Nai Basti(16), Last morh Gandhi Nagar,Ware House, Jammu University has less than 10 accidents happened with in 2 years. The maximum number of accidents happened in several locations in the areas of Gandhi Nagar.

Gangyal Police Station:

5.3.11: Table showing the data of Akhnoor Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
1	83	1	15	≥106	≥34

Total no of cases registered in 2 years = 100

Total no. of deaths = 17

No. of people harmed by accidents (PK+PI)= >140

Locations where maximum accidents has happened:

Kunjwani Chowk(6 Accidents ha happened), Near Vishal Mega Mart(9 Accidents has happened), and the maximum no. of 18 accidents has happened on the road of Kalu Chak.

Gharota Police Station:

5.3.12: Table showing the data of Akhnoor Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
7	27	3	6	≥ 42	≥ 4

Total no of cases registered in 2 years = 43

Total no. of deaths = 13

No. of people harmed by accidents (PK+PI)= >46

Locations where maximum accidents has happened:

There is only one location Thati where maximum of 14 accidents has happened and other accident has been done on random locations within the 2 year record.

Jajjar Kotli Police Station:

5.3.13: Table showing the data of Jajjar Kotli Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC & U/S 279/337/338/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
1	47	6	12	≥ 63	≥ 4

Total no of cases registered in 2 years = 67

Total no. of deaths =24

No. of people harmed by accidents (PK+PI)= >67

Locations where maximum accidents has happened:

Nandani(5Accidents has happened), Kalazar(6 Accidents has happened), Katra Domail(7 Accidents has happened), Salora has the maximum no. of accidents happened in the area which comes under Jajjar Kotli Police station of (10 Accidents has happened) within 2year of accident record.

Janipur Police Station:

5.3.14: Table showing the data of Janipur Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
9	49	3	3	≥59	≥10

Total no of cases registered in 2 years = 65

Total no. of deaths = 8

No. of people harmed by accidents (PK+PI)= >69

Locations where maximum accidents has happened:

Power House(6 Accidents has happened), Main Chowk/Stop(8 Accidents has happened), and the maximum of 14 accidents has been happened in the upper/lower area of Roopnagar.

Kana Chack Police Station:

5.3.15: Table showing the data of Kana Chack Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC & U/S 297/337/378/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC
14	90	10	13

Total no of cases registered in 2 years = 125

Total no. of people died = 20

Total no. of people Injured = 138

No. of people harmed by accidents (PK+PI)= >158

Locations where maximum accidents has happened:

Malapur & Gura Pattan(6 Accidents has happened), Gompul(7 Accidents has happened), Purkhoo(8 Accidents has happened), Bathera & Doomi(9 Accidents has happened), Bawa Tallab(11 Accidents has happened), Mishriwalla(15 Accidents has happened), and the maximum number 19 Accidents has happened in the location named Deharan.

Khour Police Station:

5.3.16: Table showing the data of Khour Police Station Data.

Section of Law U/S 279/RPC & U/S 279/427/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
2	28	4	1	≥34	≥9

Total no of cases registered in 2 years = 34

Total no. of deaths = 7

No. of people harmed by accidents (PK+PI)= 43

Locations where maximum accidents has happened:

In the area of Pargwal(6 Accidents has happened)The maximum number of accidents has happened in the area of Khour(13 Accidents has happened), during the time period of 2 years as per the record.

Miran Sahib Police Station:

5.3.17: Table showing the data of Miran Sahib Police Station Data.

Section of Law U/S 279/RPC & U/S 279/249/RPC	Section of Law U/S 279/337/RPC & U/S 279/337/338/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
13	78	5	8	≥90	≥20

Total no of cases registered in 2 years = 108

Total no. of deaths = >12

No. of people harmed by accidents (PK+PI)= 110

Locations where maximum accidents has happened:

Dinday Kalan(7 Accidents has happened), Miran Sahib(9 Accidents has happened), Kallian & Talli Morh(the maximum of 13 accidents has been happened in both the locations) as per the record of 2year time period.

Nagrota Police Station:

5.3.18: Table showing the data of Nagrota Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC
58	137	44	10

Total no of cases registered in 2 years = 260

Total no. of deaths = 63

No. of people harmed by accidents (PK+PI)= >429

Locations where maximum accidents has happened:

Ram Nagar Morh(6 Accidents has happened in which 36 people gets injured), Sidhra Flyover(6 Accidents has happened), TCP Nagrota(8 Accidents has happened), Sidhra Pull/Bridge(9 Accidents has happened), Sidhra(16 Accidents has happened), Bajalta(16 Accidents has happened in which 23 people gets affected and some even lost their lives), Panjgrain(18 Accidents has happened in which 70 people gats affected and many lost their lives), Karali Jagti+Jagti+Tanda(24 accidents has happened), Bantalab(52 Accidents has happened in which 40 people gets affected),

Nowabad Police Station:

5.3.19: Table showing the data of Nowabad Police Station Data.

Section of Law U/S 279/RPC & U/S 279/338/RPC	Section of Law U/S 279/337/RPC & U/S 279/337/338 /RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
24	135	7	12	≥139	≥1

Total no of cases registered in 2 years = 181

Total no. of deaths = >13

No. of people harmed by accidents (PK+PI)= >181

Locations where maximum accidents has happened:

There is no any particular location where accidents has happened, all the accidents has been happened in the random locations in which maximum of them are on Akhnoor road. The main reason behind the accidents is the rash driving and the condition of the road

which is single lane and double way, and the traffic flow is very high for the design there is a must of constructing 4lane road to decrease the value of accidents.

Pacca Danga Police Station:

5.3.20: Table showing the data of Akhnoor Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
11	83	2	6	≥80	≥20

Total no of cases registered in 2 years = 102

Total no. of deaths = 8

No. of people harmed by accidents (PK+PI)= >102

Locations where maximum accidents has happened:

Rihari Chungi(5 Accidents has happened) there are many other locations where accidents has happened but the number is less than 5. The maximum of 16 accidents has happened in Amphalla Chowk within 2 years.

Peer Mitha Police Station:

5.3.21: Table showing the data of Peer Mitha Police Station Data.

Section of Law U/S 279/RPC	Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
7	26	1	0	≥26	≥8

Total no of cases registered in 2 years = 35

Total no. of deaths = 6

No. of people harmed by accidents (PK+PI)= >35

Locations where maximum accidents has happened:

Prem Nagar & Circular Road(5 Accidents has happened), Iqbal Chowk(6 Accidents has happened), And the location where maximum number of 7 accidents compared to other locations has happened at Gujjar Nagar.

R.S. Pura Police Station:

5.3.22: Table showing the data of R.S.Pura Police Station Data.

Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC
99	6	5

Total no of cases registered in 2 years =111

Total no. of deaths = >11

No. of people harmed by accidents (PK+PI)= >110

Locations where maximum accidents has happened:

There is not any particular location where accidents has happened, all the accidents has been happened in the random locations. The accidents which has happened in the area is just because of the rash driving and got hit, in which maximum of the accidents done by the 2-wheeler vehicles.

Satwari Jammu Police Station:

5.3.23: Table showing the data of Satwari Jammu Police Station Data.

Section of Law U/S 279/337/RPC	Section of Law U/S 279/337/304-A/RPC	Section of Law U/S 279/304-A/RPC	Male	Female
87	2	11	≥91	≥22

Total no of cases registered in 2 years = 100

Total no. of deaths = 14

No. of people harmed by accidents (PK+PI)= >113

Locations where maximum accidents has happened:

Narwal Pain(5 Accidents has happened), in the area of Chattha(9 Accidents has happened), Belicharana(10 Accidents has happened), Gadi Garh(12 Accidents has happened), and the maximum of 14 accidents happened in the area of Satwari Chowk , there are other locations and the rate of accidents is less than 5 in 2years as per the record/data.

5.4 Analysis of Data:

5.4.1: Table showing All the Police Station Data.

POLICE STATIONS	DEATHS	INJURED	TOTAL ACCIDENTS	MALE	FEMALE
Akhnoor	41	169	210	161	24
Arnia	1	23	24	23	2
Bagh-e-Bahu	12	71	83	52	11
Bahu	14	148	162	11	3
BAkshi Nagar	7	71	78	46	8
Bishnah	25	51	76	52	38
Bus Stand	2	41	43	36	0
City	2	23	25	19	6
Channi Himmat	1	67	68	60	9
Dumana	25	243	239		
Gandhi Nagar	20	147	167	143	24
Gangyal	17	83	100	106	34
Gharota	13	30	43	42	4
Jajjar Kotli	24	43	67	63	4
Janipur	8	57	65	59	10
Kana Chack	20	138	125		
Khour	7	27	34	34	9
Miran Sahib	12	96	108	90	20
Nagrota	63	197	260		
Nowabad	13	168	181	139	1
Pacca Danga	8	94	102	80	20
Peer Mitha	6	29	35	26	8
R S Pura	11	100	111		
Satwari	14	86	100	91	22
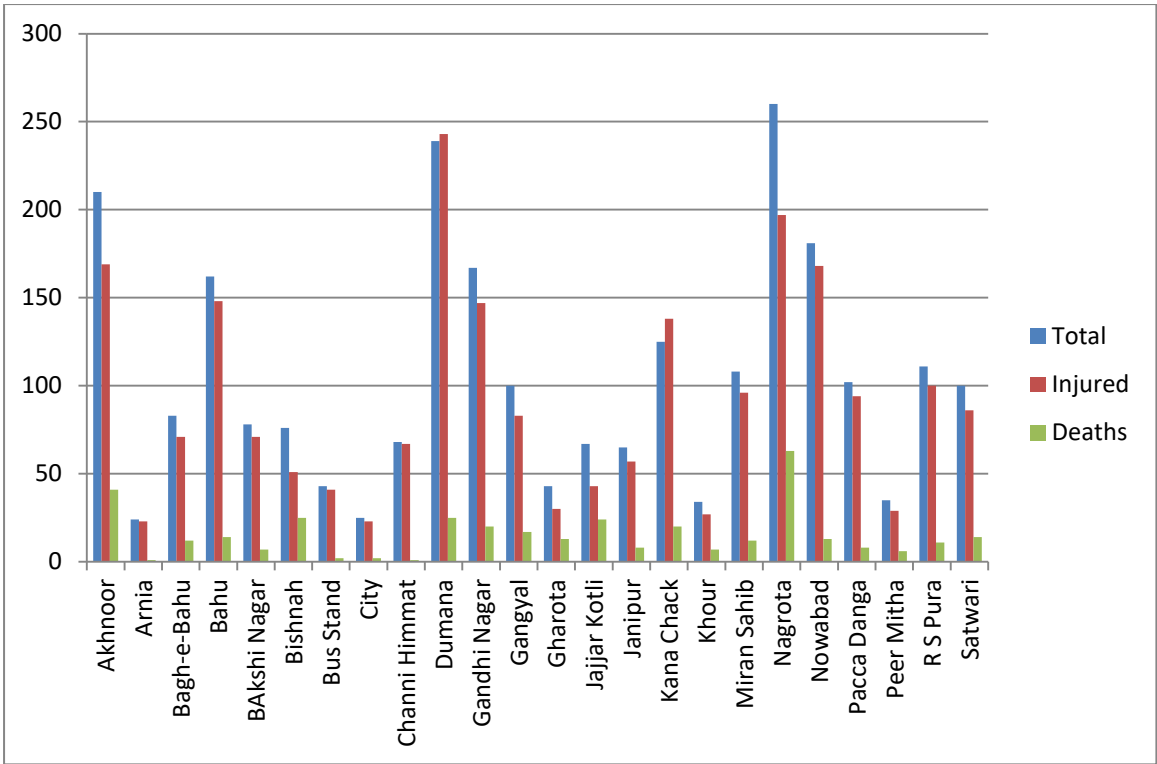
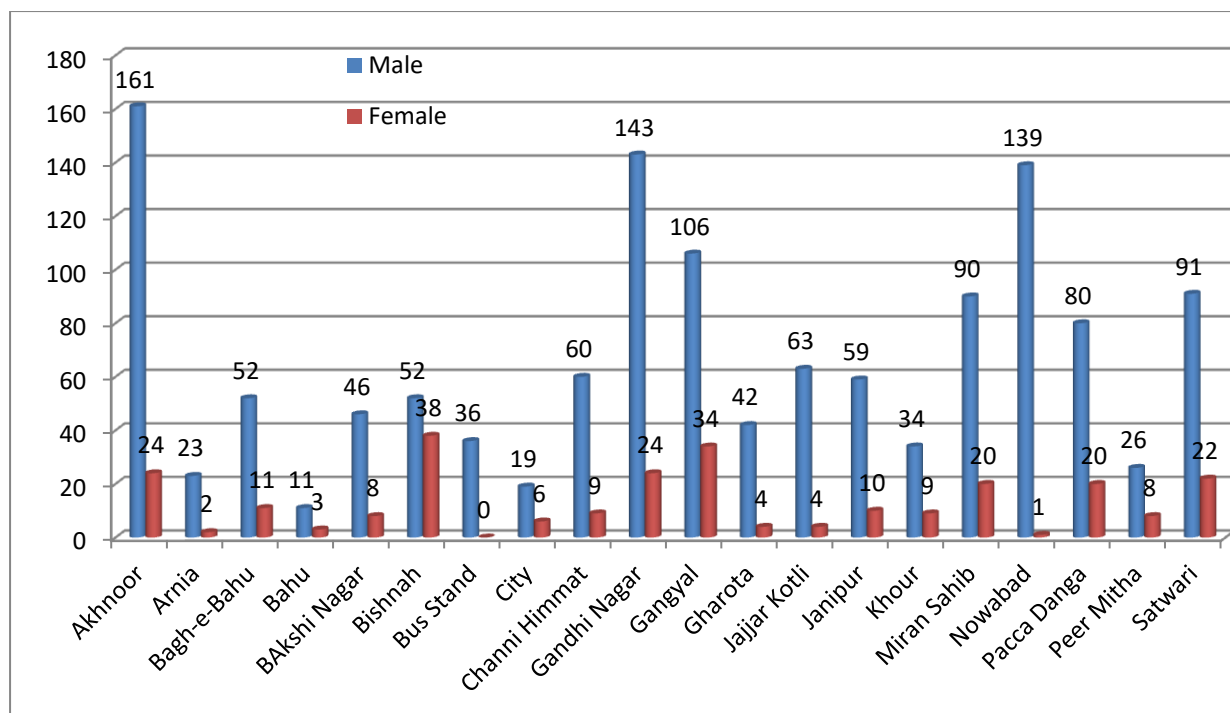5.4.2: Graphs showing the values containing particulars of total no. of accidents, injuries and deaths in Jammu district for the year 2015 and 2016.
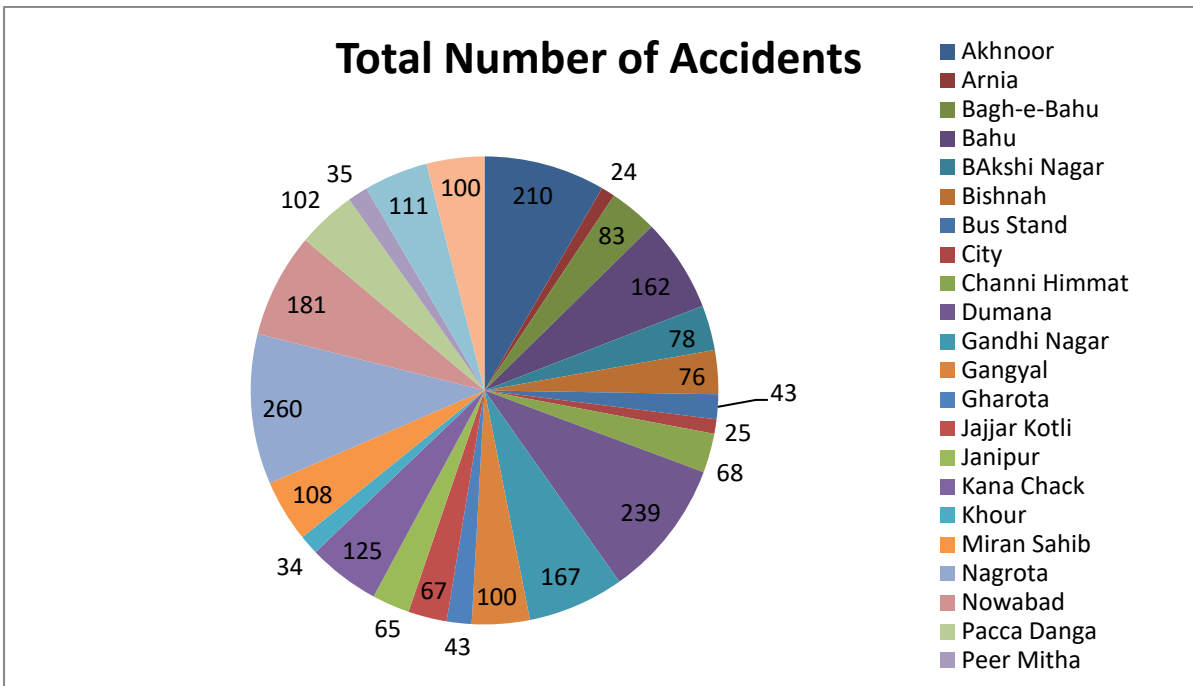
5.4.3: Pie Chart showing the total number of accidents as per the records of every police station for the year 2015 and 2016.

5.4.4: Graphs showing the values containing particulars of Male and female got affected by the accident by means of death or injuries in Jammu district for the year 2015, and 2016.

Year 2014

5.4.5: Table showing 2014 Accident Data.

Months	Number of accidents					Number of persons	
	Fatal (**F**)	Grievous Injury (**GI**)	Minor Injury (**MI**)	Non Injury (**NI**)	Total no. Of accidents (**TA**)	Killed (**K**)	Injured (**I**)
January	19	0	96	26	141	19	162
February	16	0	88	28	132	16	140
March	11	0	84	22	117	11	158
April	8	0	80	9	97	12	123
May	22	0	86	14	122	24	183
June	9	0	77	21	107	9	112
July	19	0	96	20	135	19	156
August	9	0	65	21	95	10	105
September	9	0	92	23	124	9	150
October	12	0	99	19	130	12	196
November	10	0	94	20	124	12	134
December	12	0	77	17	106	12	107
Total	**156**	**0**	**1034**	**240**	**1430**	**165**	**1726**

Year 2015

5.4.6: Table showing 2015 Accident Data.

Months	Number of accidents					Number of persons	
	Fatal (**F**)	Grievous Injury (**GI**)	Minor Injury (**MI**)	Non Injury (**NI**)	Total no. Of accidents (**TA**)	Killed (**K**)	Injured (**I**)
January	11	0	83	11	105	11	114
February	12	0	92	23	127	12	159
March	9	0	89	19	117	9	157
April	2	0	80	13	95	2	112
May	16	0	85	19	120	18	120
June	12	0	76	15	103	13	113
July	12	0	89	18	119	12	172
August	5	0	89	16	110	5	119
September	12	0	96	11	119	12	142
October	13	0	94	27	134	13	153
November	9	0	99	29	137	9	140
December	13	0	81	28	122	13	133
Total	**126**	**0**	**1053**	**229**	**1408**	**129**	**1634**

Year 2016

5.4.7: Table showing 2016 Accident Data.

Months	Number of accidents					Number of persons	
	Fatal (**F**)	Grievous Injury (**GI**)	Minor Injury (**MI**)	Non Injury (**NI**)	Total no. Of accidents (**TA**)	Killed (**K**)	Injured (**I**)
January	10	0	86	30	126	10	149
February	11	0	91	12	114	11	121
March	13	0	70	17	100	13	124
April	13	0	62	12	87	13	105
May	8	0	78	18	104	8	122
June	12	0	69	25	106	12	100
July	11	0	57	12	80	11	82
August	17	0	77	18	112	17	147
September	17	0	84	16	117	18	153
October	15	0	82	21	118	19	112
November	15	0	80	17	112	15	106
December	13	0	72	14	99	13	115
Total	**155**	**0**	**908**	**212**	**1275**	**160**	**1436**
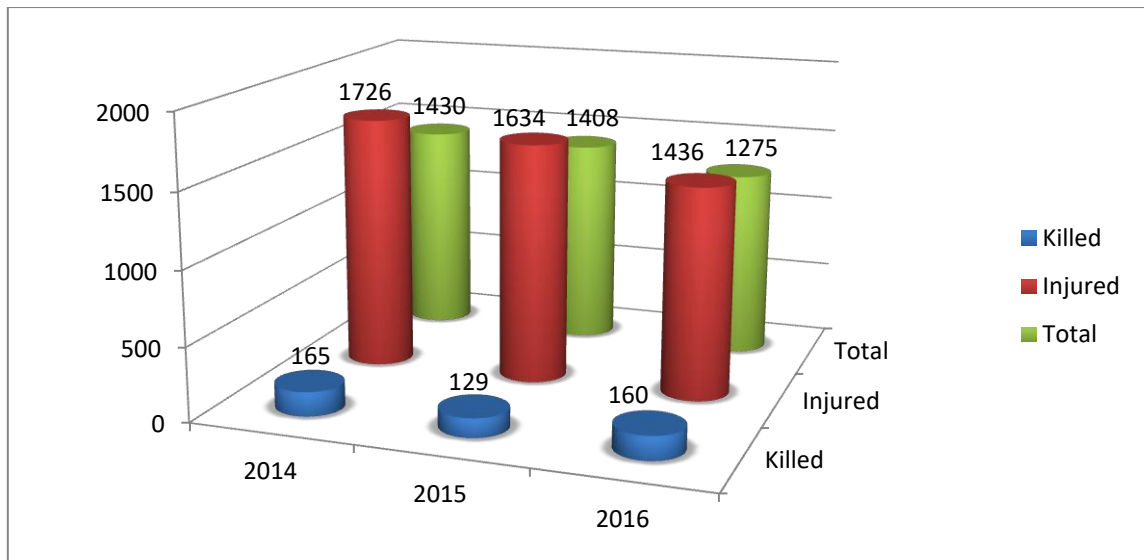
5.4.8: Graphs showing the values containing particulars of Total road accidents and the values of people killed and injured in Jammu district for the year 2014, 2015, and 2016.
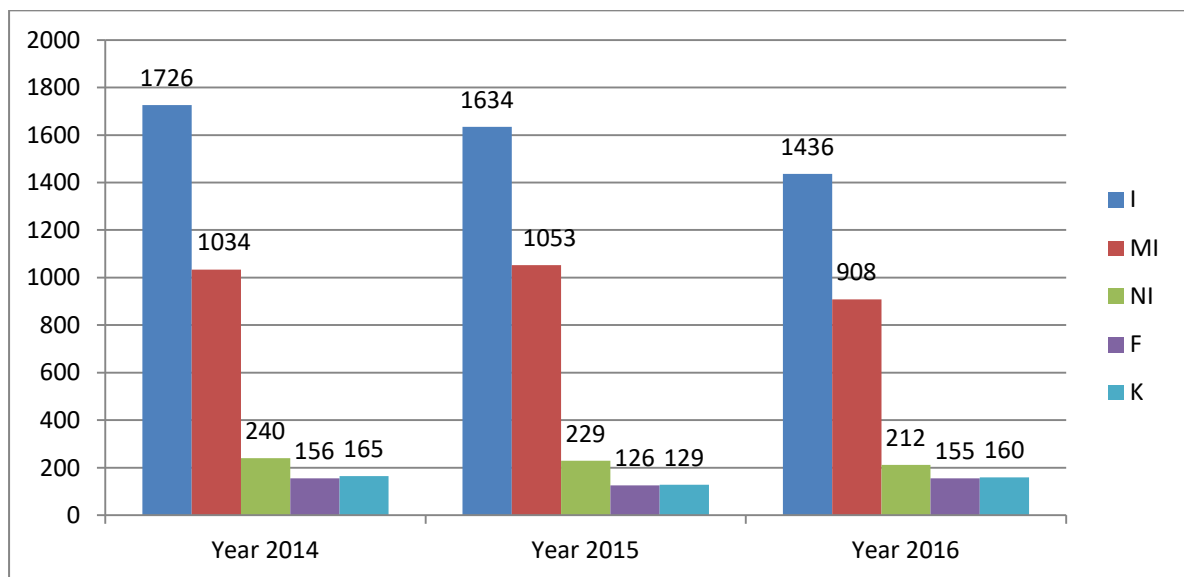
5.4.9: Graphs showing the values containing particulars of road accidents in respect to district Jammu for the year 2014, 2015, and 2016.

5.5 Evaluation of Data:

Table5.5.1: Showing the locations containing particulars of road accidents in respect to district Jammu for the year 2015, and 2016.

Locations of Accidents	No. of Accidents Happened
Tanda	14
NHW Ragoora	33
Bishnah	10
BC Road	15
Channi Himmat	14
Sainik Colony	16
NH Purkho to Pulhora	>25
Bikram Chowk	23
Asia Hotel	15
Nai Basti	16
Last Morh Gandhinagar	10
Ware House	10
Jammu University	10
Gandhinagar	>25
Kalu Chak	18
Thathi	14
Salora	10
Roopnagar (upper/lower)	14
Bava Tallab	11
Mishriwalla	15
Deharan	19
Khour	13
Talli Morh	13
Kallian	13
Sidhra	16
Bajalta	16
Panjgrain	18
Bantalab	52
Karali+Jagti+Tanda	24
Akhnoor road	>25
Amphalla Chowk	16
Belicharana	10
Gadi Garh	12
Satwari Chowk	14

The locations where maximum no. of accidents has happened are

Table 5.5.2: Showing the names of Black spots in Jammu City.

Location of Accidents	No. of Accidents
NHW Ragoora	33
NH Purkho to Pulhora	>25
Bikram Chowk	23
Gandhi Nagar	>25
Bantalab	52
Akhnoor road	>25

5.6   Investiagtion of Black Spots:

After doing investigation on the black spots I come to know about some defects and all those are discuss under:

5.6.1   NHW Ragoora:

5.6.1.1: Picture of NHW Ragoora

As we can see in pictures there are many deffects on the highway like,

- Medians are required throughout the span,
- Proper road marking is not there,
- Guard rails are not provided,
- Maintenance of road is required.

5.6.2 NH Purkho to Pulhora:

5.6.1.2: Picture of NH Purkho to Pulhora

As we can see in pictures there are many defects on the highway like,

- Medians are required throughout the span,
- Proper road marking is not there,
- Guard rails are not provided,
- Maintenance of road is required,
- Width of road is not suitable for the current traffic.

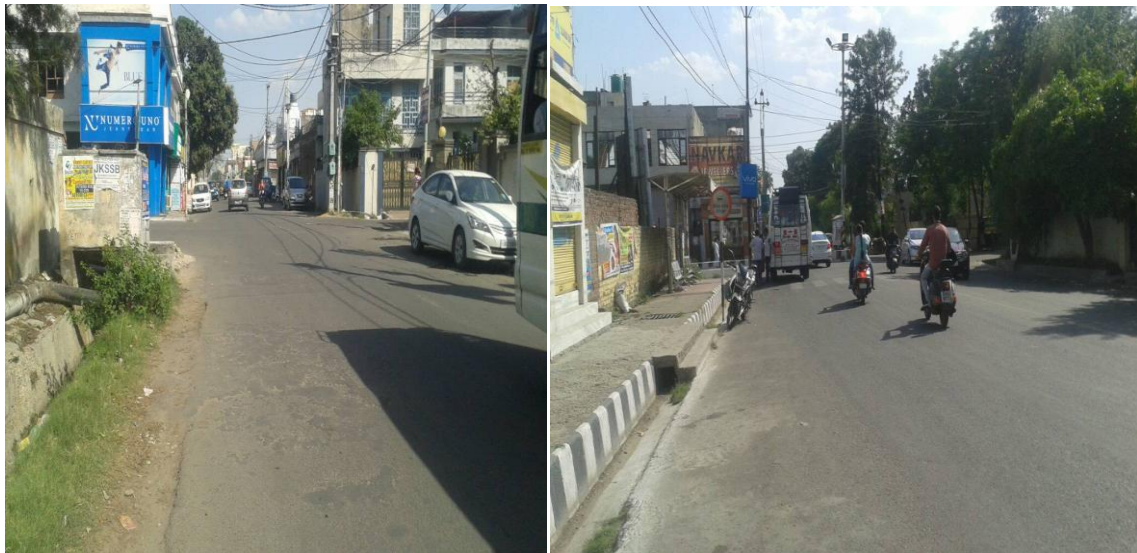### 5.6.3 Bikram Chowk:

| (1) | (2) |

(3)

5.6.1.3: Picture 1, 2 and 3 showing Bikram Chowk

As we can see in pictures there are many defects on the highway like,

- Medians are required throughout the span,
- Proper road marking is not there,
- Absence of Shoulders is there,

5.6.4 Gandhi Nagar:

5.6.1.4: Picture of Gandhi Nagar

As we can see in pictures there are many defects on the highway like,

- Proper road marking is not there,
- Maintenance of road is required,

- Some places it is very congested to move a vehicle just because of the no proper space for parking on roads.

5.6.5 Bantalab:

5.6.1.5: Picture of Bantalab

As we can see in pictures there are many defects on the highway like,

- Proper road marking is not there,
- Proper channelized intersection is not there,
- Maintenance of road is required,
- There are no proper signs and signals available.

5.6.6 Akhnoor road:

5.6.1.6: Picture of Akhnoor road

As we can see in pictures there are many defects on the Highway like,

- Width of carriage way is not suitable for the current volume of traffic,
- Medians are not there,
- Proper road marking is not there,
- Guard rails are not provided,
- Maintenance of road is required.

CHAPTER 6

CONCLUSION AND REMEDIAL MEASURES

Conclusion:

As you see in the analysis chapter 4 the tables showing the accidents record of three years shows that the people killed in the accidents is 11.5% in 2014, 9.162% in 2015, and 12.5% in 2016 from the total no. of accidents happened and the people gets injured in the accidents is more than 100%, 123.2% in 2014, 116% in 2015, and 112.6% in 2016. From the above facts it may be concluded that if any of the accident happened and the vehicle had three people inside, the one of the three may be killed but all of them will gets injured is a 100% guarantee.

The deficiencies of geometric designs like non availability of footpath, service lane, parking lane, speed breakers, improper zebra crossing, unauthorised parking at intersection etc.

Based on the data evaluation, majority of the accidents occurred at NHW Ragoora, NH Purkho to Pulhora, Bikram Chowk, Gandhinagar, Bantalab, Akhnoor road.

Remedial Measures

1. MEASURES FOR NHW RAGOORA:

- Medians should be provided
- Road Markings should be re-painted.
- Guard rails should be provided to increase the safety.
- Removal of sand on the sides of the pavement to decrease the chances of accident.
- Foot path should be provided in all the intersection areas.

2. MEASURES FOR NH PURKHO TO PULHORA:

- Re-painting of markings on road should be done.
- Guard rails should be provided.
- Medians should be provided
- Removal of sand on the sides of the pavement to decrease the chances of accident.
- Foot path should be provided in all the intersection areas.

3. MEASURES FOR BIKRAM CHOWK:

- Pedestrian facilities should be there.
- Medians should be provided
- Removal of sand on the sides of the pavement to decrease the chances of accident.
- Proper Foot path should be provided.
- Signs, Signal, and marking should be provided.

4. MEASURES FOR GANDHI NAGAR:

- Re-painting of markings on road should be done.
- Removal of sand on the sides of the pavement to decrease the chances of accident.
- Speed breakers should be provided few metres before taking turn, it will help to decrease the speed of vehicle and decrease the chance of accident.
- Proper Parking for vehicles should be designed.

**5. MEASURES FOR BANTALAB:**

- Re-painting of markings on road should be done.
- Signals should be provided.
- Removal of sand on the sides of the pavement to decrease the chances of accident.
- Foot path should be provided in all the intersection areas.
- Speed breakers should be used to reduce the speed of vehicle.

6. MEASURES FOR AKHNOOR ROAD:

- Road treatment should be done.

- The width of the road is not suitable for the current traffic flow, it should be increased.

- Removal of sand on the sides of the pavement to decrease the chances of accident.

- Foot path should be provided in all the intersection areas.

- Speed breakers should be used to reduce the speed of vehicle only on those locations where it is required.

- Signs, signals and markings are required.

Some more pictures of the locations which shows that the treatment is required in all over the city:

These locations are 1) Akhnoor Road 2) Greater kailash Chowk 1 3) Greater kailash chowk 2 4) Jewil Chowk 5) Trikuta Nagar Chowk 6) Trikuta nagar extension chowk 7) Trikuta nagar road.
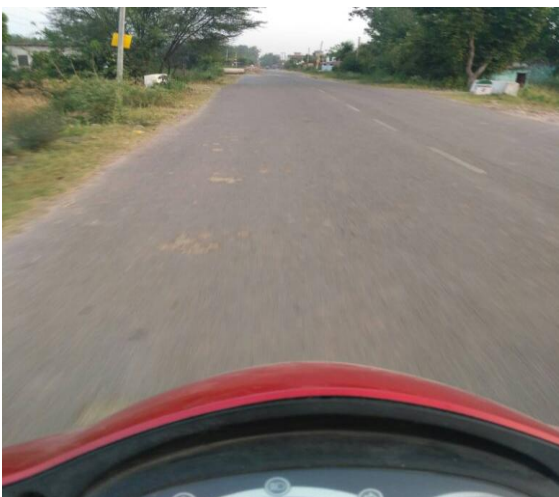
6.1: Picture of Akhnoor road   6.2: Picture of Greater Kailash Chowk 1

6.3: Picture of Greater Kailash Chowk 2

6.4: Picture of Jewil Chowk

6.5: Picture of Trikuta Nagar Chowk

6.6: Picture of Trikuta Nagar extension Chowk

6.7: Picture of Trikuta Nagar Road

Main improvement suggestions for the whole city:

- Provision of channelized intersections should be all over the city, to stream line traffic flow.
- Medians should be provided on all approaches for controlling the traffic direction and to dodge crisscross happening on approaches of the stretches.
- Proper action should be taken against ample hoardings.
- Guard rails, pedestrian facilities, foot paths in all intersection area should be provided on the stretch throughout the city.
- Cleaning of foot path should be done frequently.
- Road signs, markings and signals should be at proficient/appropriate places.
- Restriction on on-street parking, make it compulsory to park the vehicle on the specified parking slot.
- Throughout the road, foot path should be provided.
- Electric poles should be replaced to Underground cable system.
- Where there is a heavy cross movement of pedestrian the intersection should be redesigned.
- Safe speed limit boards should be provided.
- Speed breakers should be used to eliminate the over speeding.
- Speed detecting electronics should be provided in random locations, so that if any one exceeds the speed limit, can be caught and fine is to be charged.

CHAPTER 7

THE WAY FORWARD

Safety of Pedestrian and Bicyclist

Adequate space should be reserved for non-motorized modes on the roads, only on those places where they are present.

At all signalized junctions free left turn must be banned, which will give pedestrians and bicyclists a safe time to cross the road.

In urban areas, on arterial roads the speed limit should be maximum 50 km/hr and need to be enforced by road design and under the monitoring of the police. In residential areas, the speed limit should be 30 km/hr, use of mini roundabouts, judicious use of speed breakers, and dead-end streets.

Safety of Motorcyclist and motor vehicle

Enforcement in the use of seatbelt.

Restrictions for the children to travel in the front-seat and reducing injuries of child occupants they should use child seats.

For 2-wheeler riders there should be a mandatory use of helmet and daytime headlights.

Introduction of active safety technologies should be adopted in all vehicles like electronic stability control, automatic braking, pedestrian detection, and alcohol lock.

Road measures

Improvement should be done on all signalized junctions by substitution them with the modern roundabouts.

Mandatory road safety audit for all road building and improvement projects.

Along all 4-lane highways, the construction of service should be done for the use of low speed and non motorised traffic.

Replacement of raised medians with steel guards or wire rope barriers.

Enforcement

Speed control is the most important enforcement issue in India.

Driving under the influence of alcohol is the second most important measure to be   taken seriously. 30%-40% of the accidents in India may have the involvement of   alcohol.

Enforcement of helmet and seatbelt use.

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