JIMMA UNIVERSITY

JIMMA INSTITUTE OF TECHNOLOGY

FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING

HIGHWAY ENGINEERING STREAM

Causes and effects of road traffic accidents in Jimma town

A thesis is submitted to the School of Graduate Studies of Jimma University as a Partial fulfillment for the requirements of Master of Science in Highway Engineering stream.

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By:

Fikadu Kitessa

NOVEMBER, 2015

JIMMA, ETHIOPIA

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Abstract

Ethiopia has the highest rate of RTAs, owing to the fact that road transport is the major transportation system in the country. The Ethiopian traffic control system archives data on various aspects of the traffic system, such as traffic volume, concentration, population density and vehicle accidents. With more vehicles and traffic, the main towns like Addis Ababa, Jimma, Bahirdar and so on takes the lion's share of the risk, for example in Addis Ababa with an average of 20 accidents being recorded every day and in Jimma town with average of 4.4% accidents being recorded every month.

The research was based on the collected data from Traffic Police Office in year 2010/11 to year 2014/15. The data from the questionnaire survey and field observations has been carried out to realize the data performed from traffic police, which was used as complement to the traffic accidents analysis for the purpose of this research work. A statistical analysis serve as tables, figures and excels were utilized to describe the relationship between dependent variables and independent variables.

The research analysis indicated that the number of road traffic accidents occurring on the roads around the market and residential areas were very high within a range of 50-60 % of the total. The highly occurred traffic accidents in this area due to pedestrian's lack of awareness about the severity of the accidents, failure to give priority to pedestrians, inaccessibility of pedestrians cross road, inaccessibility of pedestrians walkway, the absence of traffic signs on the road or lack of road facilities, poor traffic management etc.

In this research out of the road users, pedestrians were the most affected parties by the road traffic accidents. Then the average causality of pedestrians was about 56 % of the road users. Passengers and drivers were frequently involved in the accidents. The most sever in road traffic were males particularly whose age group under 18 to 50 years old who have a great role in any activity of economic development. This indicated us the country becomes with aged people who were not active in economic development. All safety measures introduced to protect the road users are disregarded by the large number of drivers, pedestrians, school children ; and that the majority of them have a tendency in complete ignorance of the dangers encountered by traffic accidents.

The study recommend that road safety improvement on the road like pedestrians walkway, pedestrians cross road, traffic signs, channelizing of the road at intersection, and educating all the road users must be practiced. That means better traffic accommodation with planning, education, administration data capturing, regulation, enforcement and making capital investments in a new transport facilities.

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Lists of Acronyms

CBE	Commercial Bank of Ethiopia
DALYS	Disability Adjusted Life Years
ERA	Ethiopia Road Authority
JiT	Jimma Institute of Technology
RTA	Road Traffic Accident
RTAs	Road Traffic Accidents
UN	United Nation
WHO	World Health Organization
yr	Year
Illi	Illiterate
Bedu	Basic Education
JuSS	Joiner Secondary School
HSch	High School
AHSch	Above High School

CHAPTER ONE

INTRODUCTION

1.1Background of the study

Transportation is one of the basic requirements for the proper functioning of societies as its demand is highly related to the movement of people from one place to another. Therefore, transportation has a direct impact on the day to-day activities of people, especially in large cities where the distance to be traveled is too far to cover on foot or by bicycle within a reasonable time. Cities in the developing nations are not only showing a rapid population growth, but also a change in their residents 'way of life. This obviously implies that there is a need for a corresponding expansion of infrastructures and services. But due to inadequate road networks, slow road construction and maintenance, rapid traffic growth, shortage of parking space in the narrow streets, as well as ineffective traffic management and enforcement, there is rapid growth of road traffic accidents. This problem is mainly manifested in most of the cities of African nations [16].

Since every activity of human kind has its own consequences, positive or negative, transport is not an exception to this fact. The constraints associated with transport include the risk of traffic congestion, traffic accident, pollution, noise, and the like [17].

Serious injuries and mortality in road collisions are a public health problem with consequences similar to those of major diseases such as cancer and cardiovascular disease. Worldwide, about 1.2 million persons were killed on the roads and an additional 20 to 50 million were injured. Road traffic injuries were the 11thleading cause of death and accounted for 2.1% of all deaths [18].

High-income countries reduced fatalities from road traffic accidents by more than 25%during 1968 - 1998, and another drop of 30% will be recorded by 2020. While in low and middle income countries, where 81% of the world's population live and own about 20% of the world's vehicles, and the annual deaths and disabilities from road traffic accidents will rise considerably by 2020 [19].

The costs of fatalities and injuries due to road traffic accidents (RTAs) have a tremendous impact on societal well-being and socioeconomic development. RTAs are among the leading causes of death and injury worldwide, causing an estimated 1.2 million deaths and50 million injuries each year (World Health Organization, 2004). Ethiopia has the highest rate of RTAs, owing to the fact that road transport is the major transportation system in the country. The Ethiopian traffic control system archives data on various aspects of the traffic system, such as traffic volume, concentration, and vehicle accidents. With

more vehicles and traffic, the capital city of Addis Ababa takes the lion's share of the risk, with an average of 20 accidents being recorded every day and even more going unreported [12].

As modernization and consequently the urbanization moves forward, the use of motorized transport to maintain the socio economic and physical integration of the city increases. The rise in automobile ownership although not yet very significant together with the poor condition of the roads and the poorly functioning traffic system have resulted in high level of congestion particularly at peak hours., where by the probability of occurrence of accident is very high. The vehicle fleet in Ethiopia is estimated to be 197,509. Those vehicles as of 2002 reports are composed of 70,972 private cars, 72,024 trucks (dry and liquid cargo) 30,367 Government vehicles, 16,064 buses, 17,253 taxis, 10,091 international vehicles and 1600 motorcycles. The greater numbers of motor vehicles are found in Addis Ababa with a total share of 77% of the total motor vehicles. And annual motorization rate of the city had been 5.8 %on the average [20].

Each year, an estimated 1.2 million people are killed in road crashes and up to 50 million injured worldwide. Road traffic injuries are currently ranked 9th globally among the leading causes of disease burden in terms of disability-adjusted life years (DALYs) lost. In the year 2020, road traffic injuries are projected to become the 3rd largest causes of disabilities in the world. Developing countries bear the brunt of the fatalities and disabilities from road traffic crashes, accounting for more than 85% of the world's road fatalities, and about 90% of the total DALYs lost due to road traffic injuries. The problem is increasing in these countries at a fast rate, while it is declining in all industrialized nations (Western Europe, North America, Japan, Australia and New Zealand) [8].

The annual cost of road crashes is in excess of US $500 billion, and in the developing world the estimated cost is about US $65 billion each year. Due to the scarcity of costing data for African countries, it is difficult to make a precise estimate of the cost of road crashes in the continent. However, some costing data are available for Zambia, Botswana, Kenya, Tanzania, Ethiopia and South Africa. The estimated costs in these countries, as a percentage of national GNP, range from about 0.8% in Ethiopia and 1%in South Africa to 2.3% in Zambia and 2.7% in Botswana to almost 5% in Kenya [21].

Ethiopia is one of those developing countries with low level of income accompanied by high rate of population growth. As part of the developing world, Ethiopia is predominantly an agrarian country with low level of urbanization. The economic performance of different sectors of the national economy is very low. This low performance is due to a number of constraints such as low level of investment in different sectors of the national economy. Among these sectors, the existing transport

could be mentioned as one of the sectors in the country. Transport is an important sector for facilitating different developing economic activities in the national and regional economy in whole country.

Nevertheless, due to low level of urbanization and the poor performance of the economy, transport could be said to be at its infantry stage in Ethiopia .The mode of transport mobility are limited. The greater percentage is covered by the natural mode of walking and animal transport system leaving only a very negligible share for the motorized. According to the 1994 population and housing census result, its population is estimated to be 63 million. There are 926 urban centers in the country out of which only 302 urban centers are designated with municipal status (Central Statistical Authority) [13]. Among all urban centers, Jimma Town is the largest urban center, accounting one third (around 28 percent) of the total population of all the urban centers.

1.2. Statement of the problem

"Many countries in Africa, including Ethiopia, have extremely high accident rates. The death rates per vehicle can be in the order of 50 times that of European countries. "This should be added urgently to address the problem." In fact it has been predicted by the World Health Organization that unless the country takes urgent action in road accidents, it will become one of the top causes of death within the developing world"[12].

The costs of fatalities and injuries due to road traffic accidents (RTAs) have a tremendous impact on societal well-being, socio-economic development and the costs of property damage due to the accidents can affect any infrastructural development. This problem is highly increasing in developing countries because of less awareness in road safety audit including poor control system of traffic.

Ethiopia is one of the poorest countries in the world loses around 400 million Birr each year due to road accident with an average of 12 million Birr/years, 15 years ago. This figure did not include the socio-economic costs associated with the accidents. This alarming accident rate is recorded as the third killing vector in the past years. Even those figures declared based on statistical data from the authorities showing a very hazardous situation, however there had been seem a sufficient work being done to reduce this alarming accident rate [5].

The rate of road traffic accidents and the pollution size in Jimma Town and its surrounding woredas is increasing together with the RTAs increase of motor vehicle ownerships and population size. However, the growth rate is lesser as compared to other main cities in Ethiopia.

In connection with the above facts road traffic accidents in Jimma Town have increased over the years in a disturbing rate in terms of both the direct economic loses and the social lives. This observation is supported by Jimma Town Traffic Police Office (2014/15) accident statistics which shows that 256 accidents occurred in the years between 2010/11 and 2014/15 , which cost Birr around 2,273,072 for property damage accidents only. It is for this reason that the researcher would investigation the causes and effects of RTA in Jimma Town in order to the occurrence.

1.3. Research Questions

The research questions that the researcher has been sought to answer are as the following:

1. What were the characteristics of the accidents, its causes, effects and level of severity?

2. What were the factors contributing to RTAs from the view point of respondents and actual site investigation?

3. What sections of the road network revealed the accidents prone area in Jimma Town?

1.4. Objective of research study

1.4.1. General objective

The main objective of the study was to investigate the cause and effects of traffic accidents in Jimma Town.

1.4.2. Specific objectives

The specific objectives of the research are as follows:

1, to determine the characteristics of accidents, its causes, effects and level accidents severity;

2, to identify the factors contributing to RTAs from the point of view of respondents and actual site investigation;

3, to identify accident prone areas along the sections of the road network; and

4, to provide counter measures to reduce occurrence of traffic accidents.

1.5. Limitation of the study

The main objective of this thesis is to investigate the causes and effects for road traffic accidents in Jimma town. To conduct such type of the study two ways of data collection is made; collecting primary data and secondary data, for collect the primary data a long period of surveys needs different technical persons and enough budget allocation. However, the lack of finance and the shortage of time restrict the study of researcher. In addition, the secondary data was recorded in improper ways (in simple ways in soft copy, which makes simple). That is the availability of data in the form of hard copy which makes the data may not recorded or may forgotten some important points , so that

affects the quality of data and difficult to organize the data in a proper way in short period of time because the related variables are not addressed in a proper way. Thus, this takes a long period d of time to organize and analysis the data.

1.6. The benefit of the study

Road traffic accident problem in Ethiopia ,especially in the main City is now a major concern of the government, its organizations and other institutions concerned with road safety as well as the public in general [23].

As can be seen from the CSAE(Central Statistical Agency Of Ethiopia)data, (from 1994 to 2007) the main towns and cities of Ethiopia has becoming populous from time to time; and also the number of vehicles running in these cities is increasing at an alarmingly faster rates than ever before. The infrastructural arrangements in the city are also increasing both in quantity and quality; New asphalt roads and cobble stone works are being built. But the increase in infrastructural setups compared with the increase in the number of population and vehicles is not proportionate. Some roads are narrow and one way direction others are without pedestrian way, and we can observe that almost all roads are without appropriate traffic signs and signals. Thus these situations joined with the low levels of understanding of the people about road safety makes the road traffic accidents worse than before. So, the findings of this study would be used as a data base for road traffic accident, and could increase the awareness of stakeholders of the so that all parties can device a mechanism to alleviate the problems and decrease damages to human life and property. The findings could also serve as a an input for those who will be interested to conduct further in depth and detail studies in the area and finally enable policy makers to design appropriate strategies so that practitioners and other concerned bodies take preventive as well as countermeasures and monitor road safety problems. Generally, the results that would be obtained and recommendations made, all members of the community in area will be benefitted.

This significant increase is known to be done to road network improvement and construction with in Jima city. The report of Traffic Accident data from the traffic police office should be necessary to establish the exact rate of road accident in order to quantify how much road safety functions and device shall be needed to improve traffic rules and regulation, which may cater local settings. In addition, the magnitude of road accidents compels to improve the driving licenses and checking the vehicle performance.

1.7. Organization of the thesis

The thesis is organized in five chapters. The preceding chapter is an introductory part, which contains the statement of problems, background of the study, objectives, the research questions, and limitation of the study and definition of terms. Chapter two reviewing of different related studies on road traffic accidents. Chapter three methodology of the research. Chapter four analysis and discussion the effects of accidents the report from traffic police office in Jima town and the possible causes contributing to road traffic accidents are discussed in chapter five. Finally, in chapter five, the conclusion is drawn and some possible remedial measures to arrest occurrence of accidents are recommended.

CHAPTER TWO
REVIEW LITIRATURE

2.1 Introduction

Peoples are always moving from one place to other in everyday activities, such as searching for food, job and finding suitable living conditions. That is all raw materials must be conveyed from the place of manufacturing and all goods must be moved or transported from the factory to the market place of customers. Therefore, transportation by vehicles is the major means by which people travels from place to place throughout the country. It is used to connect together with communities and their daily works or activities. To succeed it needs the task of transport within the road network. The way how people live and work has been changed as a result of the improvements in life styles and transport capabilities. Since the interactive change of these activities will continue in the future the duty of traffic engineer and transport planner to cope with them is increasing.

Due to the universality of transport, solution for transport problem can have the major effect up on people's lives. Transport engineering applies technical and scientific principles to planning, functional design and operational and management facilities for any type of transport in order to provide safe, economical, comfortable and environmentally compatible movement of peoples and goods.

Accessibility and mobility are crucial things in transportation system. Accessibility is the ability to have the desired services and mobility is the movement of goods and peoples. Restrictions of accessibility and mobility causes traffic congestion, which have the impact on the economy, lives and safety. Again the lack of awareness of transportation system in the community have a great impact on economy and human lives which allow us to understand disruptions in the transportation systems, predict the effects like fatalities ,injuries and property damage.

Road traffic accidents (RTAS) are a global problem affecting any sectors of society. But up to know road safety does not give sufficient attention at all level (national and regional level). This is from the lack of information on the magnitude of severity and its preventability; fatalistic and property damage; and lack of political responsibility and multidisciplinary approach needed to tackle effectively. The Global status report on road safety 2013 presents information on road safety from 182 countries, accounting for almost 99% of the world's population. The report indicates that worldwide the total number of road traffic deaths remains unacceptably high at 1.24 million per year. Only 28 countries, covering 7% of the world's population, have comprehensive road safety laws on five key risk factors: drinking and driving, speeding, and failing to use motorcycle helmets, seat-belts, and child restraints.

This report serves as a baseline for the Decade of Action for Road Safety 2011-2020, declared by the UN General Assembly. *Made possible through funding from Bloomberg Philanthropies, this is the second in a series of *Global status reports. [15]*

2.2. Causes and effects of road traffic accidents

What is a traffic accident?

An accident is defined as a traffic accident if it occurs on a road or in a place to which the public have access. As a report indicates from the report of WHO Traffic accidents in Ethiopia have been increasing with the alarming growth rate in the recent years.

There are many reasons why the number of road traffic accidents has been increasing.

- The distracted deriver
- Emotional and mental disasters
- Weather condition
- Fatigue deriver
- Carelessness of deriver or pedestrians
- Disregarding of road signs
- Lack of awareness of community about road traffic accidents
- The vehicles it self
- Road condition
- And others

The distracted derivers: is the person who does not pay full attention to their driving. For example, when the driver takes his hand off the wheel to turn on the radio, send messages or talk on cell phones, he cannot focus on driving; therefore, the vehicle can drift over the road line and an accident happens. The driver wound, the vehicle is damaged or ruined. The lack of concentration when the drivers are driving can causes traffic accidents; like property damage, injuries or even deaths.

Fatigue deriver

Most drivers drive under the influence of alcohol, intoxicated substances and under stress caused by economic or family problems which because of the state of mind affect them causing road accidents. He is not able to quickly react in certain during situation. So the vehicle may crash which leads physical injuries: like broken legs; brain Struma; the car may plugs everywhere; the deriver get tired; the deriver cannot control the speed of vehicle.

Carelessness of deriver or pedestrians

Carelessness is one of the cause of road accidents in our country. Under this situation, There is various examples which include, using a handheld mobile telephone while the vehicle is moving, driving through the red light, emerging from a side road into the path of another vehicle. Generally it causes accident on the road which affects losses of human lives and property damage.

Weather condition

It is an element that effort traffic accidents. Heavy rain, snowstorm or hail decrease the visibility of drivers and cause them to misjudge the distance of other vehicles around them that means the deriver cannot see clearly the surroundings so that their means easy to collide others.

Emotional and mental distress

It causes accidents which leads many losses about human life and property.

Disregarding of road signs and warning signs

Some drivers are more concerned of getting to their destination than of how they would get there. Because of this, those drivers can violate road signs and laws just to get to where they are going, so it causes road traffic accidents which losses human lives and property damage.

Vehicle related factor

If the vehicle is found to be the main contributing factor to a road traffic accident, a more detailed classification shows that the issue is related to neglected maintenance, technical faults like the defects of tire, in subsystems or to conceptual Shortcomings. Road traffic accidents affects human lives and economy of the nations. These effects are reliably seen in the world wide. RTAs may affects the countries physically and psychologically.

Effects on countries

All countries in the world affected by road traffic accidents. RTAs influences many sectors of society in the nations. The most important influence on the life's especially young peoples of these countries. Think if these countries lost all of the youth or productive peoples the countries becomes aged nations who are not productive people. That means the youth generation is very important for prolonging and changing the life style of the nations. Because of this it is necessary to have the youth who are healthy and capable of working for nations efficiently [9].

The RTAs affects the wealth or the economy of these countries. For instance in 2002, road traffic accidents cost the global community about US$518bilion [10].

Thus road traffic accidents leads to losses human lives, resources, infrastructures, money and so on. The accident handicaps the human power, damages infrastructures. So the nations need to have enough resources to overcome or to treat this problem. All of these factors may leads the nations to economic crises.

What countries can do to recover this problem? The answer for this problem it needs readiness and actual intrusion through the involvement of all sectors and specialties in order to solve this problem. What solution found? One of the solution is to set up database to collect, store, and analyses information relating to RTAs in every country [11].

Government need to know the causes, effects and affected populations and its magnitude. The significant solution is the legislation of traffic rules and regulations panel to fit every country's specific needs. Further, proper punishment is needed for any violations [11].

According to the WHO, " At governmental level this means establishing close collaboration between the sectors of transport, public health, finance, the judiciary, and other concerned'' [12].

Effects on families

Families also suffer from their children's involvement in road traffic accidents. They are considered another hidden victim of RTAs, and need care and support just like other RTA victims or survivors. Families can be affected psychologically and socially. High levels of anxiety, depression, irritability and mood disturbances are the most common psychological symptoms among victims' relatives [14]. This is related to the shock of losing their close relatives or loved ones. One study found that 15% of young RTA survivors' parents had PTSD 7-12 months after the accident [13]. The distress can be temporary or permanent, which really depends on how close they were to the victims. As well, social interaction can be affected. It will be diminished over time if no proper intervention takes place. Families can experience several interpersonal difficulties such as family friction or poor tolerance. Another study suggests that the reason for this is related to the sudden change in family life which can threaten living or working conditions. Also, this study revealed that there is a significant difference between the way nuclear families and extended families deal with these situations. Overall, family cope is varies from culture to culture and every community has different family behaviors and interaction strategies. However, families can be another burden if the treatment is delayed. Livingston and Brooks recommend a need for having a rehabilitation program for families [14].

The study mentioned is from the UK, and may differ from other communities. I offer it as an example. There is a need to care for families as much as we care about the RTAs victims. Family wellness is the core of any wealthy society worldwide.Injuries (avoidable as well as unavoidable injuries in form of natural disasters) remains the biggest burden over health system of any country. Avoidable injuries require little attention just in mean of educating the people about severity and misery of the accidents. RTAs are totally avoidable in a sense that it only needs to create a sense among people regarding road safety and to enhance its benefits in their own interests [2].

The size of the problem of traffic accidents and the size of human and economic resources lost are enormous. So it is necessary to implement a national strategy to face this problem. May those problem can be overcome:

- Control of poor driving such us violation of traffic rules, for examples, driving at excess speed, ignoring cross-signals, unsafe overtaking and unsafe U turns (turning vehicle through 180^0). This should reduce traffic accidents by more than 50%. Firm punishment for those who violate traffic rules needs to be implemented.
- The compulsory use of safety seat belts for the driver and the front passengers should be implemented [3].

Moreover, drivers' perception and judgment mistakes are important factors for cause of traffic accidents; therefore, to prevent traffic accidents, more attentions on the management of drivers should be paid. We should not only focus on filtering drivers, but also stress on the drivers being trained in road safety improving their stress bearing capacity and ability to control, and also avoid fatigue driving. Only in this way can accidents caused by drivers themselves be reduced more efficiently and effectively [4].

Urgent preventive measures with a target to reduce the occurrence of road traffic crashes are necessary to reduce the morbidity and mortality resulting from these injuries. Deploying traffic policemen mainly in towns, without other preventive measures is not an effective strategy to reduce road traffic accidents. Installing a camera along main streets and intersections with high traffic accidents could be a more cost-effective way of mitigating the violation of traffic laws and penalizing those who transgressed traffic laws. Physical speed restraint measures such as rumble strips and speed humps can be installed on roads to reduce speeds of vehicles. These will have immense beneficial effects at locations with a high frequency of traffic crashes [5].

The results of the identification of traffic accidents could be used to develop strategies to prevent and reduce fatal accidents in the northern region in particular. The strategies include conducting awareness programs to educate both road users and drivers and strict enforcement of the road safety regulations since the variables overloading and obstruction are all violations of the road safety regulations [6].

2.3. Road Safety Audit

A road safety audit is a systematic procedures which brings road traffic safety knowledge in to the road planning and design process in order to minimize or prevent traffic accidents which are addressed the safe operation of a road way and to realize a high level of service for all road users by providing road features for example guard rails at curves, pavement markings, side barriers, speed calming measures and so on.

Figure 1 Guard rails and pavement materials provided at curves **(source** =Road safety audit hand book)

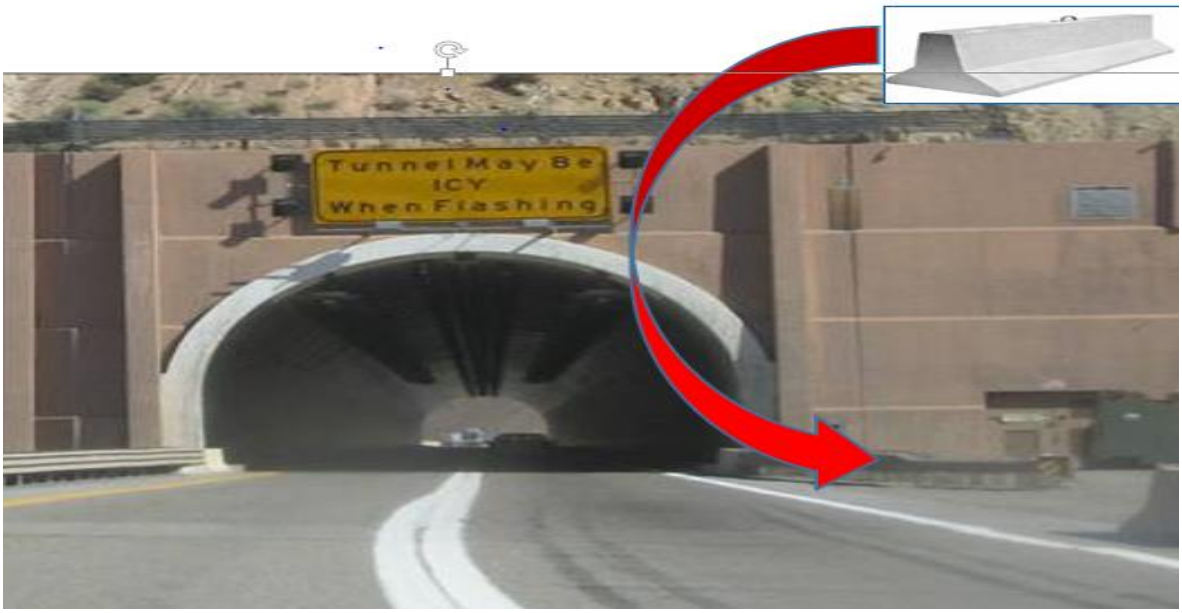

Figure 2 Road side barriers and pavement markings **(source** =Road safety audit hand book)

The RSA could be applied to all kinds of road projects; that is, roads of different hierarchy. In addition, REA could be applied to projects at different stages (feasibility, design, implementation and operation)The RSA focuses on "accident prevention" than" accident reduction" while the latter is mainly addressed through a systematic location of hazardous points (accident black spots) and propose measures to reduce the risk of traffic accident at the locations [8].

Why safety audit?

Road safety audit is very important for the prevention of accident along the road way and which includes in the designing of future projects to save human lives and property damage as well as highly loss of finance every year due to roar traffic accidents.

The benefit-cost ratio of implementing RSA is found to be as high as about 15 to 20:1 in developed countries and it is believed that the ratio could be even higher if properly implemented in developing countries. Experiences show that the maximum cost for RSA is in the order of 4% of the total road project cost. However, this has to be set against the potential benefits such as:

- Savings in the time and cost by changing project details at the planning and design stage rather than the more expensive option of removing or changing road infrastructure once installed;

- Reductions in the number of accidents and the consequent savings in road accident-related costs; and
- Reductions in possible litigation costs.

In general, available evidence suggests that the costs of changes introduced as a result of the RSA are significantly outweighed by the benefits accruing from such work [8].

Costs of Economy in Road Accidents

Apart from the public-spirited aspect of reducing road deaths, injuries and property damage in developing countries, a strong case can be made for reducing road accident deaths on economic grounds alone, as they consume massive financial resources that the countries can harsh afford to lose. That said, it must of course be borne in mind that in developing nations, road safety is but one of the many problems demanding its share of funding and other resources. Even within the boundaries of the transport and highway sector, hard decisions have to be taken on the resources that a country can devote to road safety. In order to assist in this decision-making process it is essential that a method be devised to determine the cost of road accidents and the value of preventing them.

The first need for cost figures is at the level of national resource planning to ensure that road safety is ranked equitably in terms of investment in its improvement. Fairly broad estimates are usually sufficient for this purpose, but must be compatible with competing sectors.

A second need for road accident cost figures is to ensure that the best use is made of any investment and that the best safety improvements are introduced in terms of the benefits that they will generate in relation to the cost of their implementation. Failure to associate specific costs with road accidents will almost certainly result in the use of widely varying criteria in the choice of measures and the assessment of projects that affect road safety. As a consequence it is extremely unlikely that the pattern of expenditure on road safety will, in any sense be 'optimal' in terms of equity. In particular, if safety benefits are ignored in transport planning then there will inevitably be associated under-investment in road safety. But in our country no one give more attention to the road safety

2.4. Black spot investigation

There are so many causes why the severity of road traffic accident at the black spot is high; luck of awareness about accident, violation of traffic rules, and absence of road marking, road conditions and site distances.

The main causes of the accidents at the black spot areas were unavailability of proper pedestrian facilities, pedestrian traffic volume, drivers' fatigue, lack of awareness of traffic rules and regulation and

violation of speed limit in accordance to the pilot study by the National Road Safety Coordination Office [1].

Besides, densities of accidents per kilometer were found to be a function of access points in towns. Narrow bridge, inadequate sight distance, insufficient illumination, road curvature, and faded road markings are usually the major causes of accidents. [1]

There are two complementary approaches why we are going to work the investigation of road traffic accidents; accident reduction and accident prevention.

Accident reduction is the measures, which are taken to minimize or reduces the number and severity of road traffic accidents and Accident prevention which is the application of remedial measures preventing the accidents in the future.

Approaches to accident cluster reduction includes single site, mass, area and route action plans. Of the four basic strategies, the potential to accident reduction using simple low-cost remedial measures at a single hazardous sites is particularly high. In terms of accident reduction and prevention, local authorities in the UK have had considerable success with low-cost engineering safety improvements directed towards treating accident clusters at localized sites [7].

Treatment can be. classified into three -main categories; road safety engineering measures, vehicle safety improvements and measures aimed at improving road user behavior. These notes concern road safety engineering measures. Treatment of locations involving such single sites, are generally known as 'blackspots' or 'high accident treatment sites'. In countries with limited experience of accident remedial measure work, this' straight forward approach is likely to be the most effective [7].

CHAPTER THREE

REASERCH METHODOLOGY

3.1 Introduction

This chapter covers methodology used in this research. It presents the different methods used to carry out the study and gives reasons why a particular method was selected at specific stage of the project. Different ways of data collection were applied in the study. These techniques of data collection are discussed in this chapter.

3.2 Study area

The study was conducted in Jima Town Jimma Zone, Oromia Regional State, located 357 km from Addis Ababa in the southwest direction. It is the largest town in southwestern Ethiopia. The population density of the town in 2012 was estimated to be 155, 000 [28].

Geographically the town located at latitude of 7°40-'N 36°50-'E and longitude of 7°40 7.667°N 36.833°E The town is situated at average altitude of about 1780 m above sea level. The climatic zone of the study area locally known as Wayna Daga, which is considered ideal for agriculture, mainly coffee production. The area is generally, characterized by warm climate with a mean annual maximum temperature of 25°C and a mean annual minimum temperature of 12°C. The annual rainfall ranges from 1138 mm to 1690 mm. Maximum precipitation occurs during the three months period, June to August, with minimum rainfall in December and January. From a climatic point of view, abundant rainfall makes this region one of the best watered of Ethiopian highland areas. For instance, the buildings are too old but know some of the buildings are under construction; the quality of highways in the town are not good, so in summer it becomes muddy and in winter dusty which affect the environment; even the feeder road is getting damaged these days. A range of activities have now been carried out by the government and the municipality which spark a ray of hope for the progress of the town in near future.

Figure 3 Map of Jima Town (Source: Google map 2015)

3.3 Data Collection

To attain the stated objectives, previous research studies were reviewed that are found to be relevant to of this research. The literature review provided a broad background of the existing knowledge of road safety and insight into the problems encountered by the researchers at different stage of their works. The knowledge and experience gained during this period of research helped the researcher to write this paper in developing reliable, efficient and effective study approach to focus on stated aims.

Road traffic accident data were collected from Jima Town Traffic Police Office from 2010/11 to 2014/15 including field survey by floating or distributing to respondents as well as site investigation.

The source of road accident data was accident booklets compiled by Traffic Police Officers. To acquire reliable data, a road traffic accident sheet were compiled using the following information,

- Day and time of accident,
- Vehicle type and ownership,
- Driver sex, age and education,
- Location of accident
- Weather, and road condition,
- Accident type,
- Magnitude of severity,
- Cost of property damage and
- Number of victims.

To back up various analyses and investigations, a road traffic accident database was established.

The database consists of five-years of road traffic accidents which were collected from the Traffic Police Office. During this period, around 265 road accidents were reported with different characteristics and level of severity.

3.4. Research method

The method used when collecting, processing and analyzing the gathered information can be qualitative research method.

Qualitative research methods: the collected data in the form of text, images, sounds drawn from observations, questionnaires' and documentary evidence, and analyze it using qualitative data analysis method [10].

Road traffic accidents data were supplied by Jimma Town Police Office for the period of five years from 2010/11 -2014/15. An accident record book is kept at Jimma Town main police office. The record of the road traffic accidents was a compilation of the accidents occurred in two districts of Jimma Town, District 01 and 02 .Traffic accident report of the two sub towns was consolidated and submitted to the main traffic police office of the town. The record of the road traffic accident at the Main Traffic Police Office includes variables, such as time of the day, day of the week, age, sex and education level of the driver, driving license, driving experiences of the drivers, the relationship between vehicles and drivers, vehicle service year, vehicle type, vehicle owner ship, land use, road type, layout of road (junction type), pavement conditions, illumination conditions, weather conditions, causality type and finally reasons for the accidents were stated.

Vehicle population data were collected from Jimma Town Transport Authority on the numbers of vehicles in different categories. Thus, the road traffic accidents were characterized using descriptive analysis to examine the relationship among different factors and to identify the possible causes and contribution factors. An analysis of time variation accidents, severity of the accidents, the estimated cost of the accidents were identified the most accidents prone hours of the day, number of accidents in order propose applications measures to address the situations. Demography of road users were characterized as drivers, pedestrians and passengers. In addition, road conditions, weather condition factors as well as accidents by collisions and vehicle types were also dealt with. Finally, the data were organized for interpretation using descriptive methods in the form of tables, charts, and graphs.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1. Characteristics of Accidents

The 2010/11-2014/15 RTAs database of the Jimma Town Traffic Police Office are used for this study as secondary data. Two hundred sixty five, 265, accidents were reported out of which 159 were injuries and the rest were property damages. Of the injury of road accidents, 53 were fatal, 106 were serious and slight injuries (64 and 42 respectively) and 106 were the property damage. However, 18 of the accidents were without defined locations. As a result, the total number of accidents reduced to 247. Accordingly, the injury accidents reduced to 145 out of which 48 were fatal, 60 were serious injury, and 37 were slight injury and 102 property damages.

4.1.1 Age of Drivers and Road Traffic Accidents

4.1.1.1 Death

Fatality due to RTA and the age range of drivers is given in Figure 4. The highest counts of death due to road traffic accident were observed in 2010/11–2014/15 and, respectively by drivers of age 18-30 and < 18 year. As shown in the Figure 4, the number of deaths for the years 2011/12, 2012/13 and 2013/14 was less than four individuals. But, in Figure 4 the drivers aged > 50 years caused less accidents on the road as compared to the derivers in the other age group. Thus driver involvement in accidents disproportionately high for the 18-30 age group, followed by the 31-50 age group. The drivers in the age group of 18-30 years most dangerous drivers. The 18-30 year age group was involved in traffic accidents. Youth and elderly drivers were significantly over involved in the road traffic accidents. In addition to the lack of experiences youth drivers often underestimate the level of risk. Also aggressive driving behavior was the major causes of accidents and the carelessness was another causes of this accidents.

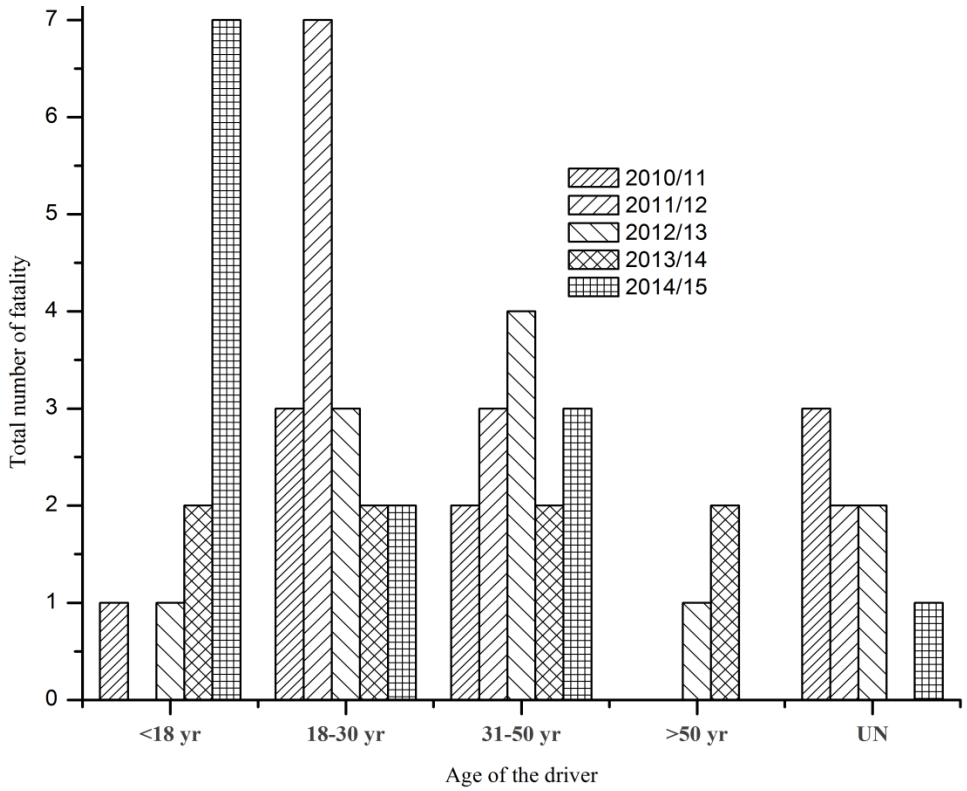

Figure 4 Number of fatalities on the road from 2010/11-2014/15

4.1.1.2 Injuries

I. Serious Injuries

The age of deriver involved in traffic accidents which causes a serious injuries in Fig 5 shows the highest serious injury the involved deriver in 18-30 years and in the age of 31-50 years more or less average injury was occurred. Then the derivers in age of group 18-30 years were involved in more serious injuries. Thus driver involvement in accidents disproportionately high for the 18-30 age group, followed by the 31-50 age group. This trend also applies for all road users seriously injured due to the aggressiveness and carelessness of youth drivers. As a developing country, the population age distribution indicates that about half the population are age grouped in 18-30 (fire age) who were involved in driving the vehicles. So they were involving in causing the accidents on the road because most of youth drivers neglecting (violation) the application of traffic rules and regulation. Also most of the youth peoplewere the working age are more likely to be involved in road accidents. Because on the average road users especially pedestrians use different mode transport for more trips to their work every day so as a result they more exposed to the risk of traffic accidents

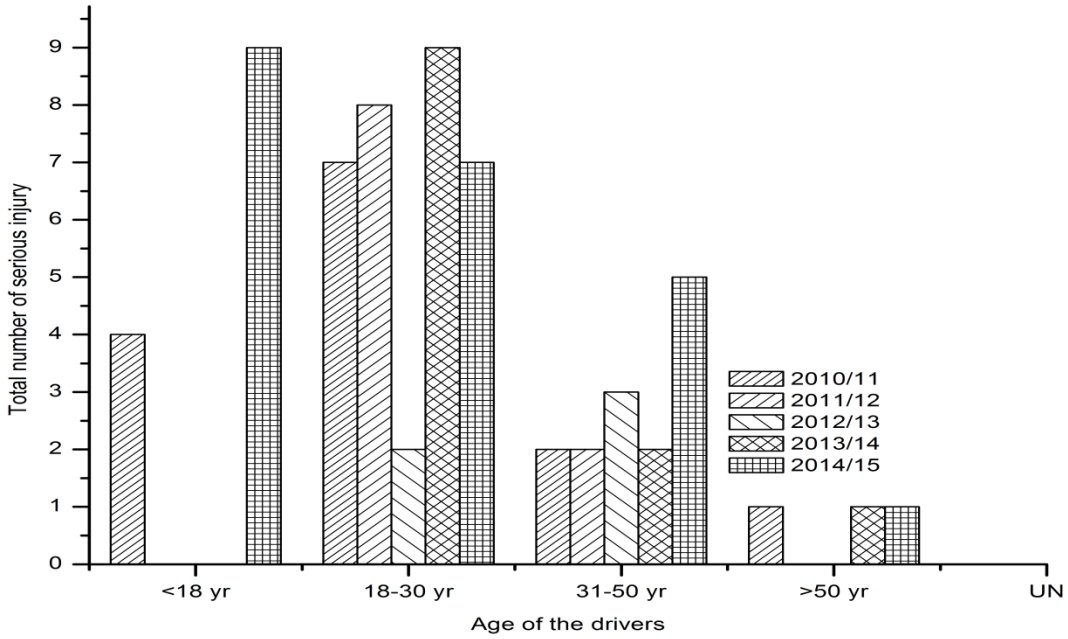

Figure 5 Number of serious injuries on the road from 2010/11-2014/15.

II. Slight Injuries

The drivers involved in road traffic accidents with high magnitude of slight injuries in the Fig 6 shown below in the range of age 18-30 years and the age of 31-50 years less causes as compared to the age of 18-30 years. So in the age group of 18-30 years derivers were more involved in such accidents.

The road traffic accident severity caused by the youth drivers was very dangerous because of most of drivers are more concerned only getting to their destination than of how they would get there. So due to this those drivers can violate road signs and laws like over speeding, failure to give priority to pedestrians, failure to give priority to another vehicle, leave to use belt and the so just to get to where they are going, so it causes road traffic accidents which leads to injuries and property damage.

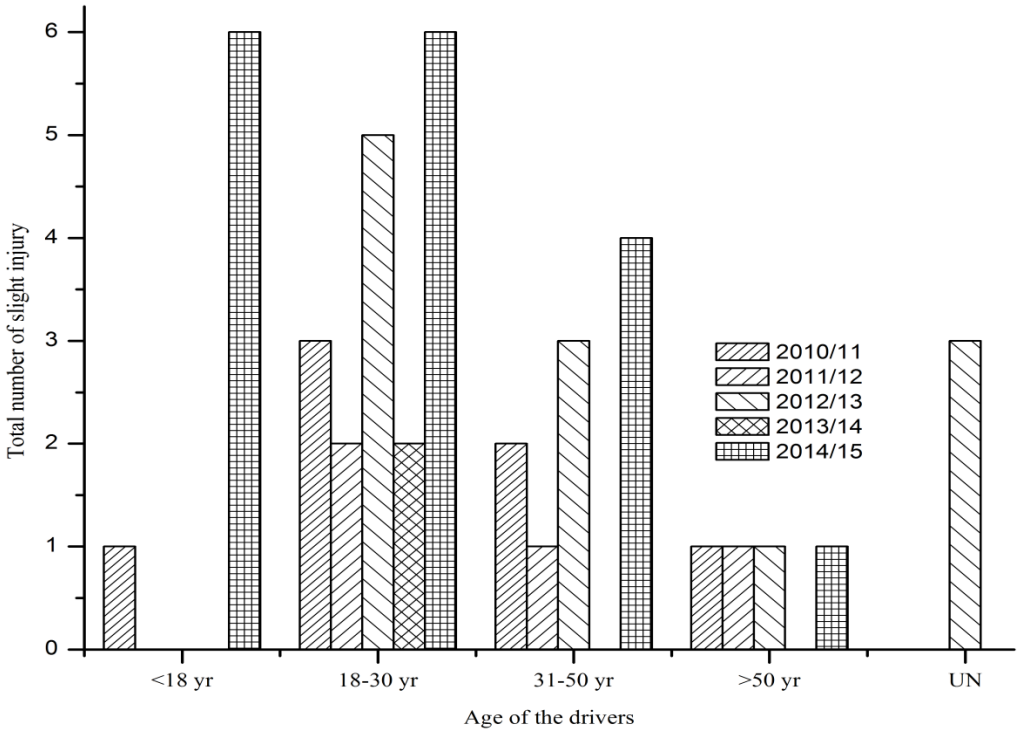

Figure 6 Number of slight injuries on the road from 2010/11-2014/15.

III. Property Damage

The age range of drivers involved in accidents is shown in Fig 7 the highest number of average property damage involved drivers in the 18–30 year age group (48%) and in the 31-50 year age group (31%). The drivers in the age group 18-30 were involved in more loss of property cases, followed by the age group31-50.

In this finding it is obvious that most of young drivers have higher in causing the accident than the other drivers who are the aged drivers, thus the accident can be drawn is that all young drivers do not involved in the same road traffic accident risks that no uniformity towards the road traffic accidents cause because of the young drivers have different life styles. Thus, the life style of the divers have a great role in causing the road traffic accidents on the road. These life styles are the driver who take drugs and alcohols and who did not take any drug while driving. Most accident were happened in Jimma Town always after noon this indicates the young drivers use drug while driving ,that the drug may confuse their thinking ability to concentrate to their work. So if they are not concentrate to their work due to confusion they have high risk taker in causing road traffic accidents on the road.

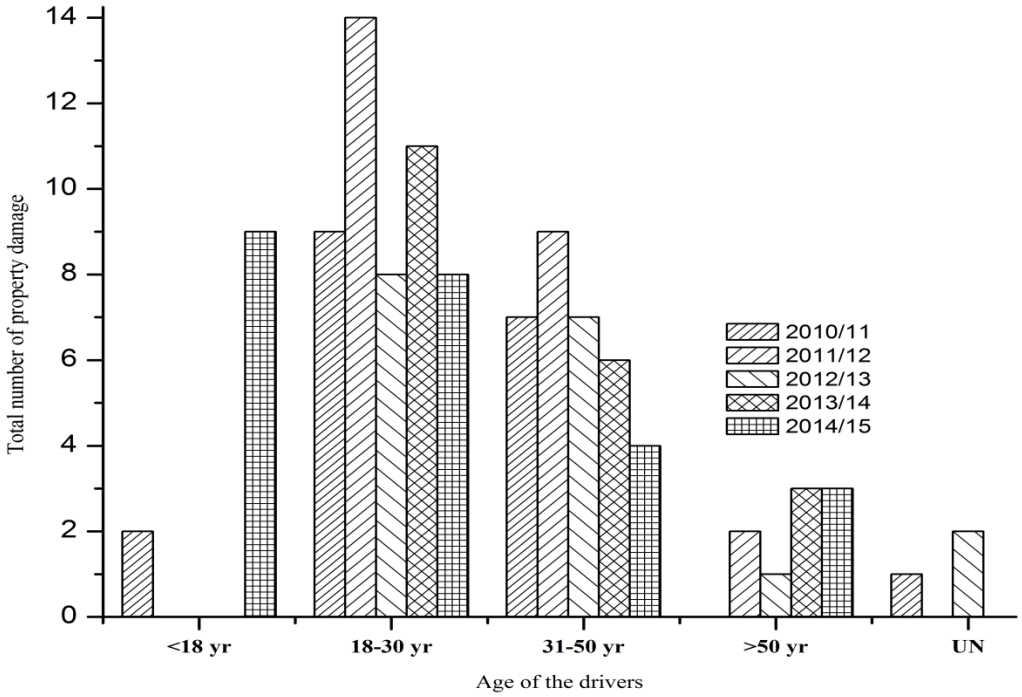

Figure 7 Number of property damage due to road traffic accidents from 2010/11-2014/15**.**

4.1.2 Education Level of Drivers and Road Traffic Accidents

4.1.2.1 Death

Driver education levels were also recorded. As shown in Fig8 drivers whose education level was junior school were the highest number of fatality causals that is 42% of fatality happen under this education levels. And the drivers whose education level was high school cause 21% of fatality of the traffic accidents.

This finding is consistent with previous studies in Ethiopia (24), however it is difficult to reach conclusions about the significance of the findings without knowing the education levels of drivers in the general population**.**

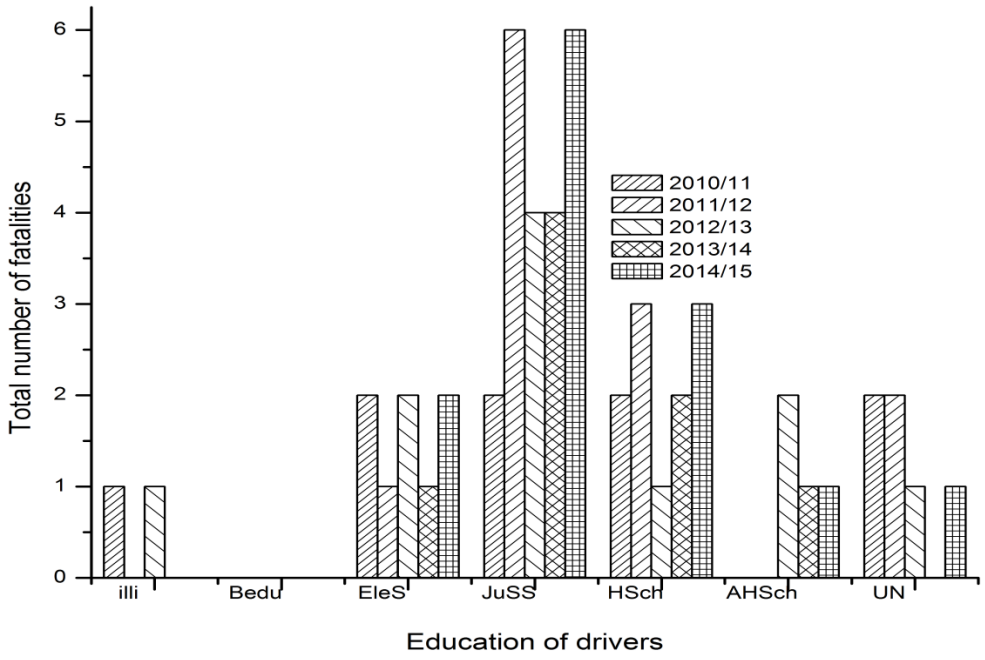

Figure 8 *Number of fatalities from 2010/11-2014/15 versus education level of drivers*

4.1.2.2 Serious Injuries

The level of education drivers were involved in RTAs in Figure 9 shows the highest number of serious injuries involved in the education level of junior secondary school and followed by elementary school level of education .so the injury about 42 and 33% under the education level of junior secondary school and elementary school, respectively. Thus the severity of the accidents due to the level of education could vary. So as the drivers level of education increases the severity of accidents caused by the drivers was decreased **.**

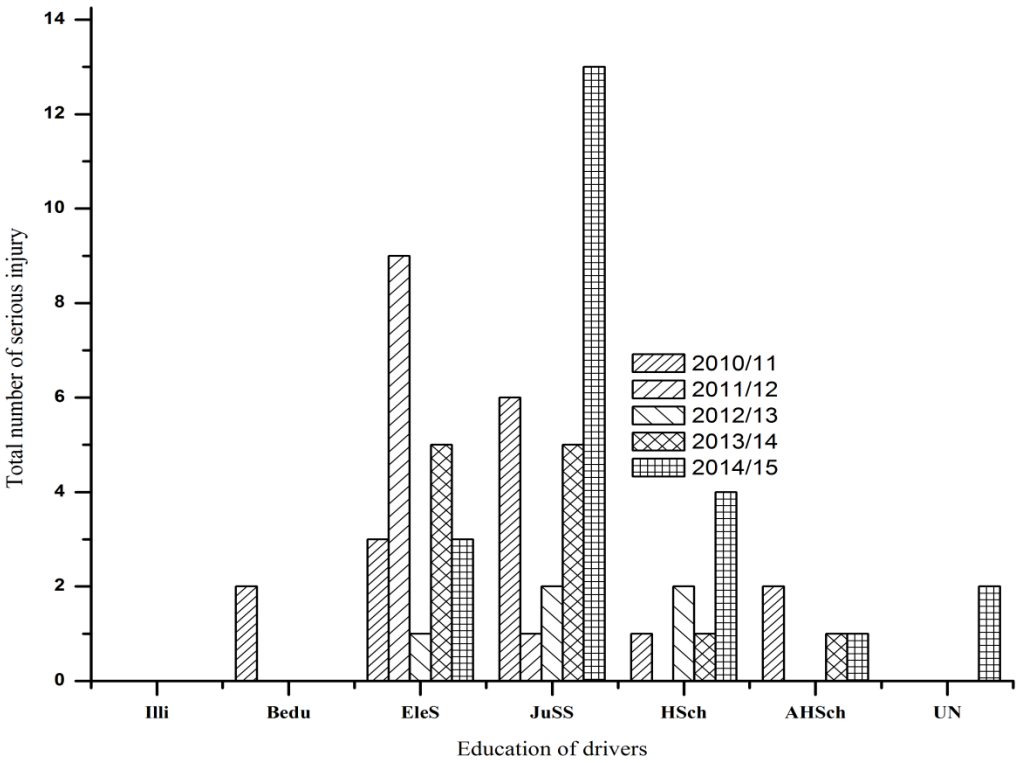

Figure 9 Number of serious injuries from 2010/11-2014/15 versus education level of drivers

4.1.2.3 Slight Injuries

Figure10 shows the highest number of slight injuries caused by drivers whose education levels were elementary and high school, which the same accident happened and followed by junior secondary school level of education. And the injury 32 and 27% under the education level of junior secondary school and elementary school, respectively

This finding is consistent with previous studies in Ethiopia [24], however it is difficult to reach conclusions about the significance of the findings without knowing the education levels of drivers in the general population. The drivers whose education level elementary school was more involved in causing the slight injury as compared to the drivers whose education level were junior secondary school and the others.

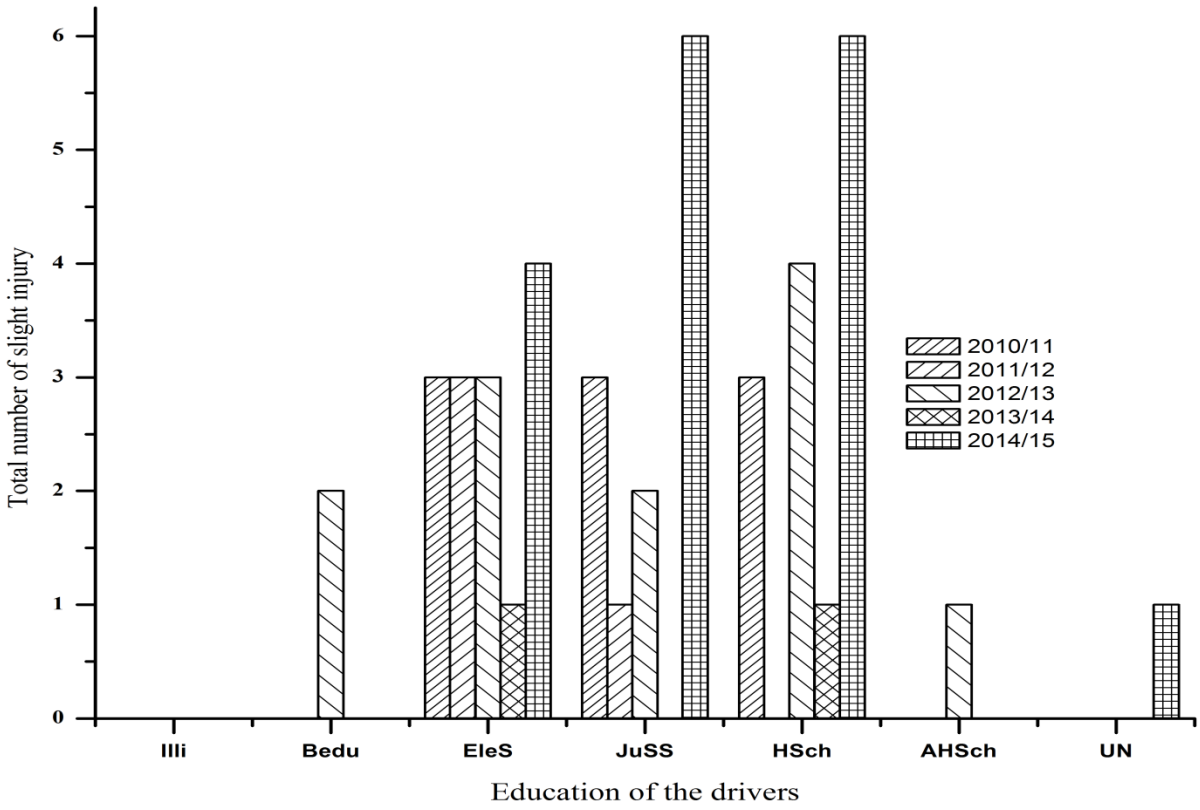

Figure 10 Number of slight injuries from 2010/11-2014/15 versus education level of drivers

4.1.2.4 Property Damage

The level of education drivers were involved in road traffic accidents in Figure11 shown below the highest number of property damage involved in the education level of elementary school and followed by junior secondary school level of education .so the about 30.19 and 27.36% under the education level of elementary and junior secondary school, respectively.

This finding is also consistent with previous studies in Ethiopia [24], however it is difficult to reach conclusions about the significance of the findings without knowing the education levels of drivers in the general population**.** Because it is difficult to know the whole level of education of drivers in all community.

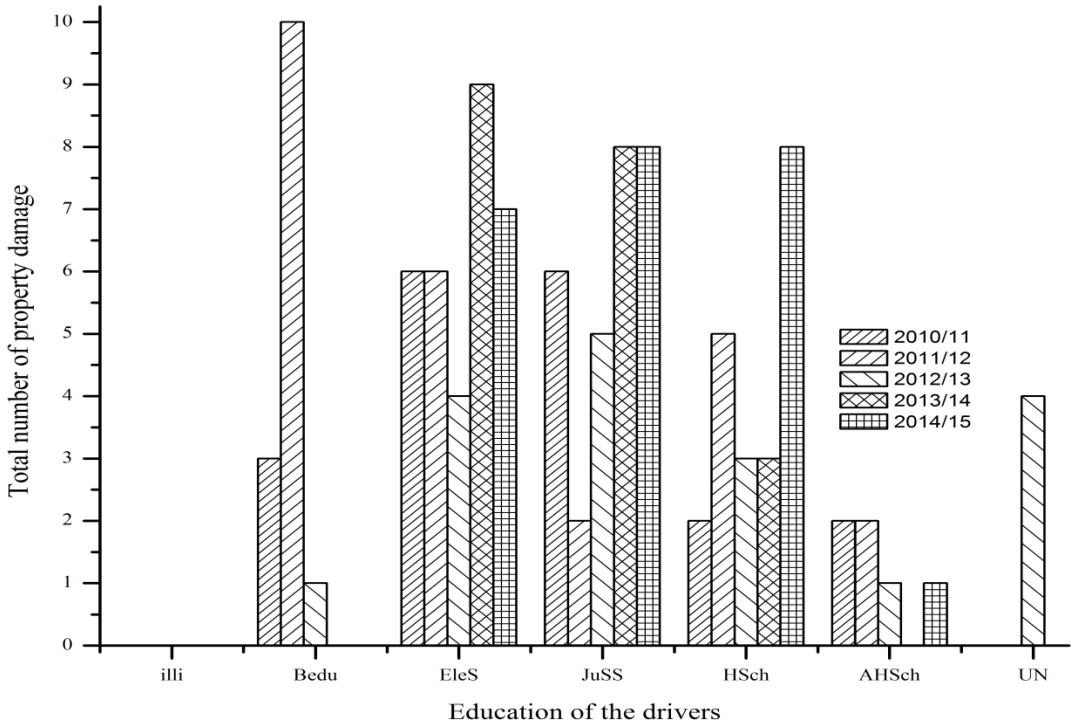

Figure 11 Number of property damage from 2010/11-2014/15 versus education level of drivers

4.1.3 Driving Experiences and Road Traffic Accidents

As indicated in figure.12 the majority of drivers were involved in road traffic accidents with the driving experiences ranges from 1-5 years. That result of the figure indicate that the most of the accident out of total 27% was happened due to the error of the drives with the driving experience of 3-5 years and followed by the driving experience of 1-2 years 25% in average which was reported by the traffic police.

The findings of the study show that the experiences of the driver have the lion share in causing the accidents on the road, that the drivers who drove for a long period of time or the licensed and trained drivers were less involved in accidents on the road. Because the drivers who have a long driving experience were matured enough and giving attention to their work rather than thinking to reach their destination while driving. Also the licensing of the driver before four or five years was given according to the quality of the driver but in a recent year the way to give the license to the driver was automatically as they want ,that means without any experience they got level 4 or level 5 driving license. So this may escalating the road traffic accidents on the road or they put their lives and those of other road users at the risk of traffic accidents. Because of their driving without experience, since they were never given

any tutorial or taught how to use their vehicles on highways by government accredited driving schools, their decision making ability and reaction speed to traffic is bad.

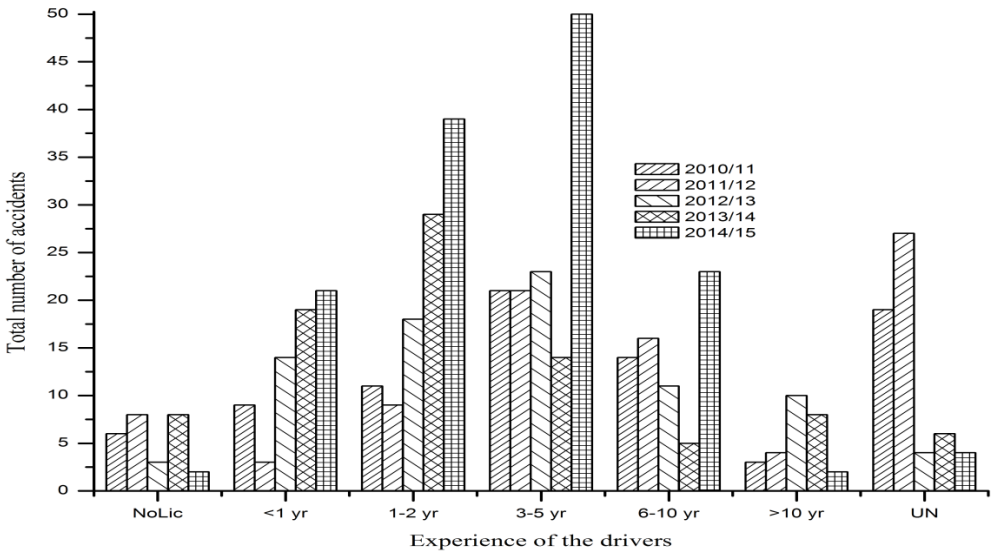

Figure 12 Experience of drivers and RTAs

4.1.4 Nature of Road and Road Traffic Accidents

As indicated in the figure .13below the majority about 62 %of the accidents were happened on the straight road. That means most of the accidents in Jima town always happening on the straight road because of the driver's errorusing a drug like chewing chat while driving a vehicle. Using drug and driving increases both the risk of a traffic accident and the likelihood that death or serious injury will result. Then these drugs are known to cause side effects of sleepiness and fatigue, like the driver is not able to quickly react in certain during situation. Thus, leading to possible occurrence of accident.

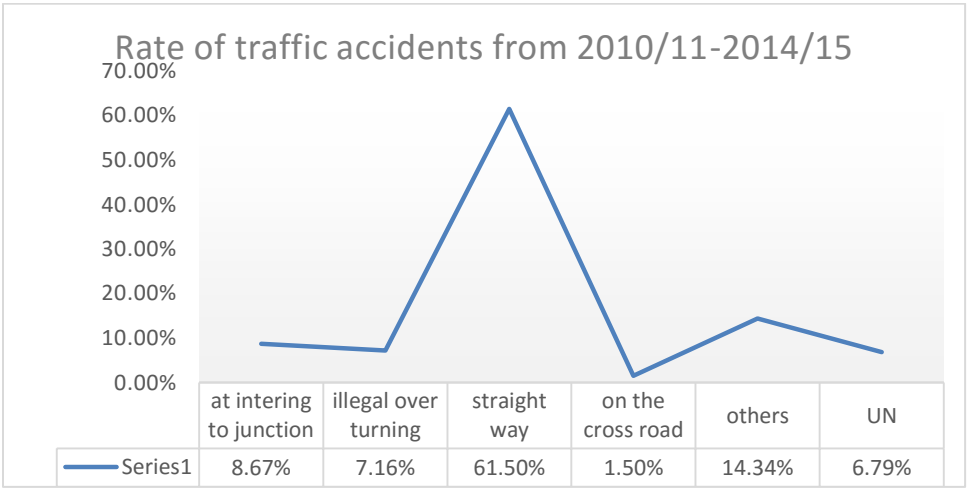

Figure 13 Rate of RTAs from 2010/11-2014/15

4.1.4 Variation in Accidents by Time of Day and Day of Week

The majority of accidents occurred during day light and night hours. Figure14 shows that accidents occur increased rapidly from 2:00_12:00pm. Numbers were more or less uniform until 2:00 pm before which they increased in most cases and again in some extent the number less or more steady after 12.00pm, though not as steeply as the morning increase. A study conducted in Jima town from the traffic documented data the accident was directly related to traffic volume because after 1:00 pm number of vehicles entering to the town is increasing, so this leads to cause the accidents. However, more accidents occurred during 2:00-12:00 hours which is in the afternoon. Most probably, drivers are stressed and fatigued during these hours as a result of hot tropical weather condition. Another reason why the accidents increasing rapidly at this time is most of the drivers are addicted by chewing chat which distorted the thinking ability of a derivers. It should be noted that there was some variability between years, however there was no consistent pattern. The variation in road traffic accidents by time of day reflects variations in traffic volumes, and most accidents on the road occur during daylight. However, the level of severity may not follow the same pattern and needs further in-depth investigation

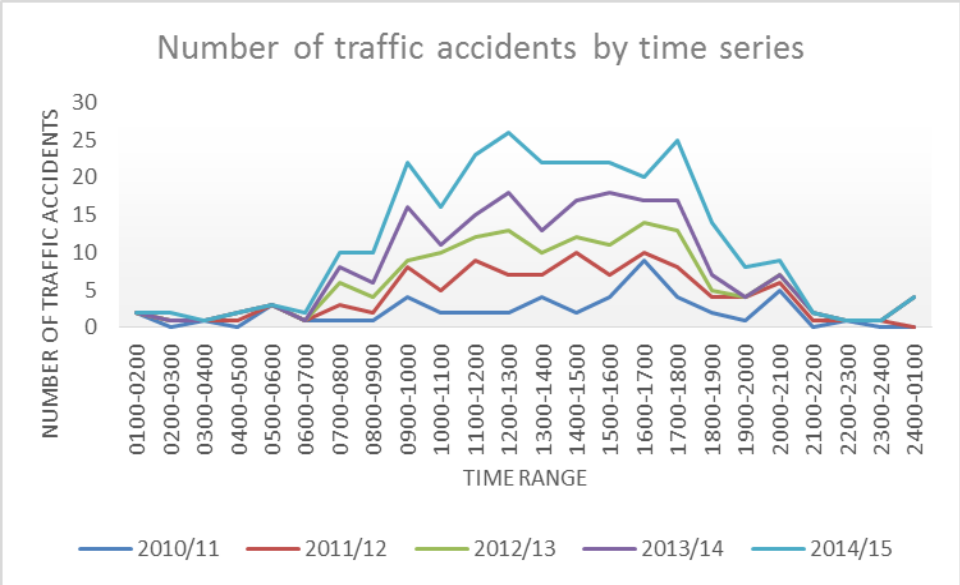

Figure 14 Number of total accidents by time of a day from 2010/11-2014/15

Figure 15 indicates the trends of road traffic accident by day of the week. Most of the accidents occurred on the week of days on Wednesday and Saturday shows uniform growth of rates of traffic accidents. Except in the year 2014/15 Tuesday all Tuesday, Thursday and Sunday accidents are relatively decreased. The cumulative accident trend by day indicates that there is a decrease in accident number

on Thursday, although at all other days the rates are uniform except the year of 2014/15 on Tuesday. From the point of view of the researcher findings stated in figure below the rate of accident or the magnitude of the traffic accident in the year of 2014/15 is very high as compared to the other years. Especially in the day of the week on Tuesday of this year the accident severity is very high. The lowest numbers of accidents were recorded on Thursday, Sunday and Tuesday except in the year of 2014/15. In general, there is a strong correlation between traffic volumes and collision frequency. Because of which directly related to the entering of more vehicles in the Town after noon

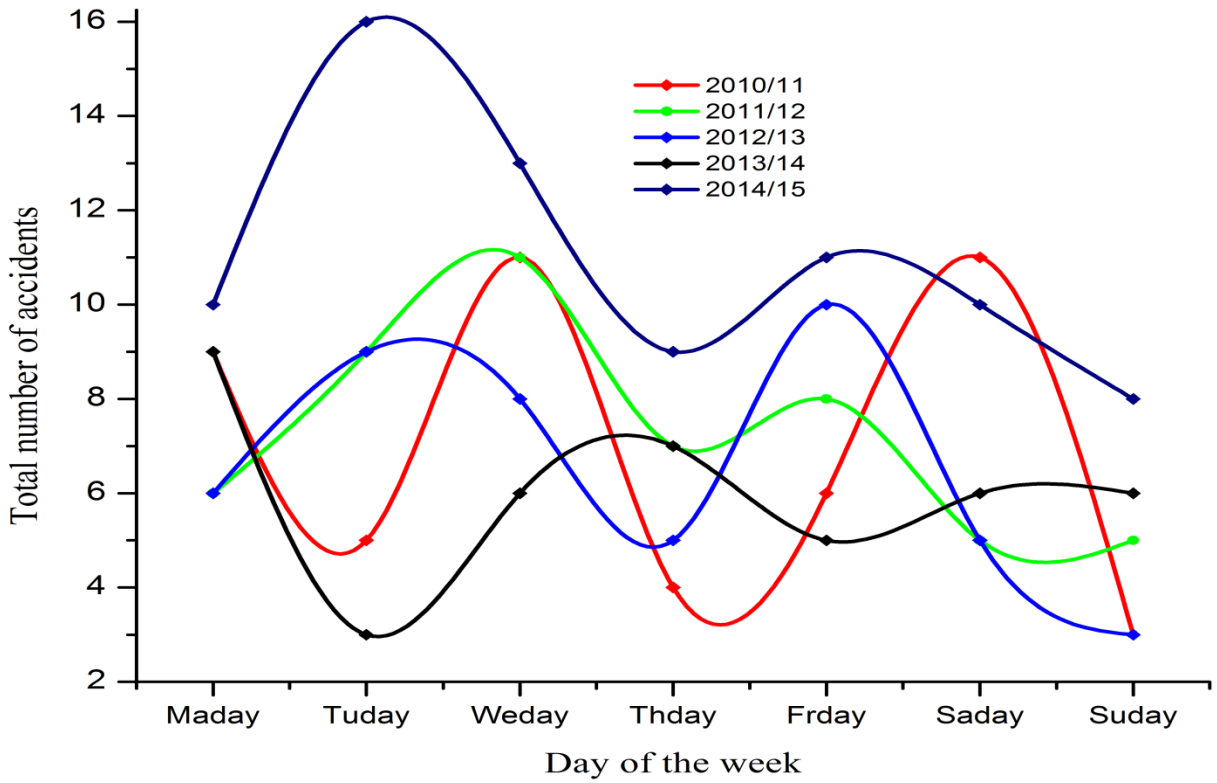

Figure 15 RTA trend by the day of the week from 2010/11-2014/15

4.1.5 Victims of Road Traffic Accidents

4.1.5.1 Classification of accidents causalities by age and sex group

As stated in table 1 below the causality of accident severity in Jima town for male higher risks than for female. That means from the reported accident 75.47 %were male and 24 .53 %were female In the findings of the researcher in the period of the study males were more affected in accidents on the road due to traffic accidents rather than females. Thus, the traffic report from this table told us male risks three-times higher than the Female risks.

Table 1 Number causalities due to RTAs from 2010/11 to 2014/15 by sex

Class of causality	2010/11		2011/12		2012/13		2013/14		2014/15		Total		%	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Fatality	8	1	8	4	8	3	7	1	12	1	43	10	27.04	6.28
Serious	11	3	5	5	4	0	10	2	2	0	32	10	20.12	6.28
Slight	8	3	3	1	9	8	13	2	12	5	45	19	28.30	11.94
Totals	27	7	16	10	21	11	30	5	26	6	120	39	75.47	24.53

4.1.5.2 Victims by Types of Road Users

Table 2 shows the fatal accidents according to male and female road users. The trends for male and female road users in various age categories are different. As mentioned previously, males were more vulnerable to death from road accidents and from this table roughly 4 times as many male drivers are killed compared with females. The difference as marked among passenger and pedestrian fatalities, where male deaths are approximately six times and four times ,respectively higher than female deaths. Among age groups, those aged under 18 account for only 24.53% of fatalities although they make up more than one-fourth the population, such that the 18-30 and 31-50 age groups account for half of fatalities. This is consistent with international reports that indicate that road traffic injuries are the second and third leading causes of death for age groups 15-29 and 30-44 [12].

Table 2 RTA fatalities from 2010/11-2014/15 on road users by gender and age

Age group	Driver		Pedestrians		Passengers		Sub total		Total	%
	M	F	M	F	M	F	M	F		
< 18	0	0	8	3	1	1	9	4	13	24.53
18-30	1	0	9	3	1	1	11	4	15	28.30
31-50	1	0	8	1	8	0	16	1	17	32.08
≥ 51	2	1	3	0	2	0	7	1	8	15.09
Total	4	1	31	9	12	2	43	10	53	100

Source: Office of Jima town police documented report 2010-2015

Also the records in Table 3 show that accidents involving school children contribute a high percentage (23.18%) out of total accidents in Jimma Town. Many factors could be raised to this accidents, lack of awareness about road safety but the major one is inadequate education and training of children on how to use the road safely. The data obtained from the traffic police indicated that more of injured children were pedestrians and more than two- third of injured children were in the age groups of 5-14 years. The risk of school pupils being injured in traffic accidents was 70% higher during school time than during a similar period when it was not a school time. The traffic police data also indicated 20.29 and 14.49% of total accidents were workers and farmers, respectively.

Table 3 Shares of road users in RTAs from 2010/11-2014/15

Vulnerable road users	Fatalities	Serious injury	Slight injury	Totals	%
Students	13	16	3	32	23.18
Workers	8	12	8	28	20.29
Farmers	7	6	7	20	14.49
Unemployed	6	15	5	26	18.84
Young street dwellers	0	3	2	5	3.62
Unknown	12	7	8	27	19.57
Totals	46	59	33	138	100

This trend also applies for all road users killed including drivers. As a developing country the population age distribution indicates that about half the population are aged under 18, however people of working age are more likely to be involved in road accidents. It is likely that, on average, individuals in the workforce make more trips per day by various modes of transportation, especially as pe-

destrians. As a result, the individuals in workforce age spend more time in contact with motorized traffic in a variety of road environments. Thus, unlike other age classes, workforce age group could suffer more injuries and deaths from RTAs.

4.1.6 RTAs by Vehicle Type

The road traffic accidents stated in table.4 below shown the accidents severity varies by types of the vehicles. For example, mini bus, which has up to 12 seats higher severity casualties. That means private cars were involved 19.62%, which inflated the other accidents and followed by the truck, which contribute the accident in Jima town by 15.47%. However, data recorded in Jima a type vehicle which did not involve in the accidents was long vehicle.

Table 4 Number of RTAs from 2010/11-2014/15 by vehicle types

Vehicle type	Fatalities	Injuries	PD	Total	%
Cycle &Motor cycle	3	8	5	16	6.04
Automobile	4	8	5	17	6.41
Station wagon	0	3	3	6	2.26
Pickup 10 Kg loading	1	9	6	16	6.04
Truck 11-40 Kg loading	6	17	11	34	12.83
Truck 41-100 Kg loading	11	12	18	41	15.47
Long vehicle	3	0	3	6	2.26
Long vehicle	0	0	0	0	0
Taxi	6	10	14	30	11.32
Minibus up to 12 seats	6	25	21	52	19.62
Minibus 13-15 seats	3	7	9	19	7.16
Bus up to 46 seats	0	2	4	6	2.26
Earth moving	4	0	1	1	1.89
Other long vehicle	0	0	1	4	0.38
Animal carts	2	0	2	11	1.51
Others	4	4	3	1	4.15
Unknown	0	1	0		0.38
Total	53	106	106	265	100

4.1.7 Severity of Road Traffic Accidents by Land Use

There are different relationship between land use and the occurrence of road traffic accidents. The results show that most of the fatalities and injuries inside and outside the town, particularly in residential areas and the market areas. So the indication of the Table 5 that of 45.28 % and 13.21% fatalities and 29.24 % and 22.64 % total injuries in residential and market areas ,respectively in the last five years periods. Similarly 33.96 % and 24.53 % of property damage due to the accident occurred in residential and market areas. The highly occurred accidents in these areas may explained due to different reasons; high population area, lack of awareness about the road traffic accidents, inaccessibility of pedestrians cross road and so on.

Table 5 2010/11-2014/15 RTAs by land use

RTAS Location	Fatalities	%	Injuries	%	PD	%	Total	%
On the rural road	4	7.55	4	3.77	1	0.94	9	3.39
Out of the rural road	2	3.77	2	1.88	3	2.83	7	2.64
School areas	0	0	6	5.66	12	11.32	18	6.79
Industrial areas	0	0	0	0	0	0	0	0
Church or Mosque	1	1.88	2	1.88	1	0.94	4	1.51
Market areas	7	13.21	24	22.64	26	24.53	57	21.51
Recreational areas	0	0	9	8.49	3	2.83	12	4.53
Hospital areas	2	3.77	4	3.77	1	0.94	7	2.64
Residential areas	24	45.28	31	29.24	36	33.96	91	34.33
Office areas	2	3.77	14	13.21	11	10.38	27	10.19
Others	11	20.75	10	9.43	12	11.32	33	12.45
Total	53	100	106	100	106	100	265	100

4.1.8 Property Damage

The traffic accidents on the road have a great impact on both social and economic values. Property damage is the major economic crisis caused by RTAs. The amount of damage on property usually depends on the magnitude of accidents. The higher the property damage of road traffic accidents causes the higher the economic loss.

As can be seen from Table 6 the total damage on property accidents estimated in birr in the years from 2010/11 to 2014/15 about 2,273,072 birr. Looking at the distribution of wasted property within a year for the last 5 years, one can understand that a picture of huge sum of money is lost each year which have a great impacts on the total budget of Jima town annually**.** But the total number of property damage in the year of 2014/15 is highest as compared to other years through the study period; in this year the number of accident about 47 property damage was recorded , the economic loss is very high which affects the annual budget Jimma town municipality**.**

Figure 16 Property damage due to RTAs near Shenen Gibe Hospital

Table 6 Estimated costs of vehicle damage due to RTAs from 2010/11-2014/15

Year	Vehicle damaged	Estimated cost (ETB)
2010/11	27	298030
2011/12	26	609342
2012/13	21	609800
2013/14	20	57300
2014/15	47	698600

Source: 2010/11-2014/15 RTAs record from Jimma Town Traffic Police Office

Lighting conditions were important. As mentioned below, most of the accidents occurred in daytime with sufficient lighting conditions, which is similar to findings in other research [27]. Table 7 shows that 72.45% of road crashes occurred in daylight. When twilight and sunrise are included with the daylight category, with the crash proportion rises to 95.10% of the total accidents. That means 28.30 and 94.34 % of total accidents were fatality and injury of road accidents. Research elsewhere has found that high rates of pedestrian fatal crashes around twilight and sunrise [26].

Table 7 2010/11-2014/15 RTAs by illumination condition

Light condition	Fatality	Injury	Property damage	Total	%
Day time with sufficient light	9	70	82	191	72.45
Twilight	3	20	14	43	15.85
Sun rising	3	10	5	18	6.76
Night with road sufficient light	0	3	3	6	2.26
Night without sufficient traffic light	0	0	0	0	0
Night without traffic light	1	1	0	2	0.75
Others	1	2	2	5	1.89

4.2 Causes Contributing to Road Traffic Accidents in Jimma Town

4.2.1Major Causes of Accidents from traffic data police report

Accidents on the road have so many causes, of which it stems from a number of adverse circumstances. Traffic offices in our country are responsible to completing the traffic accident forms, which serves as database reflecting accidents on the road network. In the form, it was indicated that codes representing types and causes of accidents containing of about 28 possible causes for traffic accidents were categorized under drivers, pedestrians, road defects and vehicles. Based on the recorded traffic accidents in Jima Town from 2010/11 to 2014/15, it was found that 80% was caused because of drivers' error; 1.88% was caused as a result of pedestrians' error; 0.76% was caused due to road defects: and 3.77% was caused as a result of car defects and the rest 13.58% was caused by unknown factors (Table 8)**.** It is noticed that most of the RTAs reported in the town were caused by driver's errors (Table 9), among which failure to give priority to pedestrians assumed the top position. This indicates the lack of awareness of drivers towards the RTAs, and observance of traffic rules and regulation. Besides, carelessness of the drivers could be one of the causes of road accidents in the town. Carelessness, as noticed in field observation, during driving could include activities, such as using mobile telephone, failing to give priority to pedestrians, driving fast, ignoring traffic rules, chewing chat, emerging from a side road into the path of another vehicle and driving without being trained and licensed. As observed from the secondary data, large proportion of RTAs in the town were also occurred due to unknown causes. Pedestrian's error, road and car defects also contributed to human and property damage recorded in the town.

Table 8 Causes of RTAs reported in Jimma from 2010/11-2014/15

Causes of accidents	Number of accidents	%
Drivers' Error	212	80.00
Pedestrians' error	5	1.88
Road defect	2	0.76
Car defects	10	3.77
Unknown or others	36	13.58

The analysis of the records of RTA from Jimma Town Traffic Police Office shows that the most causes of accidents are related to driver's errors, such as excessive loading, failure to give way for vehicles and pedestrians, improper overtaking, improper stopping, neglecting traffic control, and excessive speed (Table 9). Among the driver's error, failure to give way for pedestrians had largest share, 30.19%. Drive drinking, following too close (close driving) and driving on the wrong side were the among drivers' errors, which respectively caused 2.83, 11.79 and 8.02% of the accidents. However, 5.66 % of the accidents were due to misjudgment during parting.

The severity of accidents due to overloaded vehicles happened because of braking distance, which was due to excessive weight, and because of tire burst by excessive pressure.

Table 9 2010/11-2014/15 RTAs in the Jimma Town by drivers' errors

Driver error	Number of accidents	%
Drink and Drug drive	6	2.83
Driving on the wrong side	17	8.02
Failure to give way for vehicles	24	11.32
Failure to give way for pedestrians	64	30.19
Following to closes	25	11.79
Excessive speed	16	7.55
Improper over taking	5	2.36
Improper turning	30	14.15
Neglecting traffic control	8	3.77
Misjudgment during parting	12	5.66
Improper stopping	3	1.42
Excessive loading	2	0.94
Total	212	100

As indicated in Table 10 out of 265 RTAs, 74.33% was occurred on good-asphalted roads while 14.33% was on distressed asphalt road surfaces. Moreover, the data obtained from records of police traffic in the town show that 219 (around 83%) of accidents occurred on dry conditions of the road and 8.6% accidents were occurred in wet condition on the road.

Table 10 2010/11-2014/15 RTAs by road condition

Road condition	Number of accidents	%
Asphalt	197	74.33
Asphalt with distress	38	14.33
Gravel road	19	7.17
Clear road	11	4.15
Totals	265	100

From the table 11 the main types of road accidents that occur in urban areas related to road layouts are intersections; stretch of roads and along the roads. In the study area out of total accidents 174 (76.65 percent) of all road accidents have occurred at stretches or straight roads while 1.32 % of the

accidents have occurred at round about. Also the accidents about 14.98% were occurred at T and Y junctions. This is followed by cross-junction where 16 (37.05%) of all accidents have occurred.

Table 11 Distribution of accidents on the road layout from 2010/11-2014/15

Layout of road at point of accidents	Number of accidents	%
Stretched road	174	76.65
Round about	3	1.32
Cross road	16	7.05
T and Y junction	34	14.98
Total	227	100

4.3. Factors that contributes to road traffic accidents from questionnaire and site investigation

The objective of analyzing data collected through questionnaire and site investigation is to realize the road traffic accidents report obtained from the traffic police office as well as to identify the main causes of accident or associate the related factors to the road user.

4.3.1 Driver's behaviors

As stated in the *Section 4.2*, from 2010/11 - 2014/15 the main causes of high severity of the road accidents were the errors of the drivers. There are so many factors why the drivers takes a high percentage to the occurrence of road traffic accidents, this factors are the lack of knowledge about the severity of road accidents, lack of experience, under age, carelessness to give attention to road signs and signals and lack awareness in traffic rules and regulations.

To achieve the objective of the research the questionnaire was conducted. Because the researcher or the writer was driver used to identify the level of understanding of about traffic rules and regulations and to categorize the age of drivers involved in the road accidents, and also categorize the severity of accident by drivers depending on their experience involved in accident more (that means who involvedmore in accidents, the driver has less experience or the experienced one) through questions. Thequestions are directly related to Gender, age, level of license, year of experience in driving and educational level of the driver were included. As it indicates in Table 12 the majority of the drivers are male which accounted for 48 (100%) of all the observations in the study area. So, most of the drivers

about 56 % are in the age group of 18-30 years and the next involved driversin driving about 40% are in the age group of 31-50 years. Also educational status of the respondents about 59% of the drivers are from secondary school between 9 and 12 grade). Then most of the level of license involved drivers around 29 % have the 1st level license. Finally, the majority of drivers about 37 % have less or equal to two years driving experiences.

The major problem which enforced the drivers to cause the accidents were driver's education or training fails to teach the knowledge and skills critical for safe driving.

Table 12 Counts of drivers with vehicle types

Driver condition	Vehicle type				Total	%
	2 wheels	3 wheels	4 wheels	> 4 wheels		
Gender						
Male	4	9	21	14	48	100
Female						
Age						
< 18 yr						
18-30 yr	2	8	10	7	27	56.3
31-50 yr	2	1	9	7	19	39
> 50 yr			2	1	3	6.3
Educational level						
Illiterate						
1-4						
5-8		1	5	1	7	15
9-12	2	3	11	12	28	59
≥ Diploma	2	5	5	1	13	27
Level of license						
1st	4	8	2		14	29
2nd						
3rd		1	5	6	12	25
4th			9	4	13	27
5th			5	4	9	19
Driving experience						
< 1 yr		2			2	4.2
1-2 yr	3	5	6	5	18	38
3-5 yr	1	2	5	1	9	19
6-10 yr			3	6	9	19
>10 yr			7	2	9	19

Drivers were also asked to mark when and where traffic accidents frequently happened in the town roads. So as indicated in the table 13 below for the first question (80%) of interviewed driver replied that large number of accidents happened during the day time, while, (20%) indicated at night time. Also the respondents revealed that most of the accidents about 37(84%) happened on the street or on the main road.

Table 13 Magnitude of accidents time and locations

Questions	Responses							
In which time of the day the accidents on the road were highest?	Day time				Night time			
	No	%			No	%		
	20	80			5	20		
Where the number of traffic accidents in the town were the highest?	Residential area		Market area		School area		On main road	
	No	%	No	%	No	%	No	%
	4	9.1	2	4.55	1	2.27	37	84.09

The question raised to driver in respective to the speed, Are you use the recommended speed in the town? What normal speed always you use? 20-30, 30-40, 40-50, 50-60 and > 60 km/h?

For this questions majority of drivers about, 33 (69%) declared that they currently drive within the range of 30-40 km/hr, which is the normal speed or the stated urban speed limit by the Ethiopian traffic regulation. But as the writer observed in the field observation it contradicts this idea because most of the drivers were driving with high speed which is not recommended in the urban area where population is very high.

As stated in the table 14 the majority of drivers respond about 35 (73%) of all responded that they give always priority to pedestrians, about 13 (27%) drivers sometimes give priority to pedestrians and no one driver never give any priority to pedestrians when they cross the road. For the second question the majority about 21 (44%) drivers responded that any pedestrians did not give priority to vehicles. That means drivers confirms with poor ranking the pedestrians in giving priority to the vehicles when it needs. Thus, the drivers highly complained pedestrian's behavior in applying the laws and rules of traffic on the road. To compare the idea discussed in the writer has prepared other questions to study the behavior of drivers by taking sample pedestrians as below." Are drivers slow down/stop in pedestrian cross- walks when you are crossing?" No = 32, Yes = 25 in number. That means the majority about 32 (56%) respondents revealed that" No" and about 25 (43%) said that "Yes" this shows that less number of drivers were prepared to stop or even slow down for pedestrians while crossing roads. In Ethiopia, the regulation and rules clearly indicate drivers should have the respect to give the priority to other road user. For example, when a pedestrians approaching to zebra cross the law said slowdown in driving and if pedestrians are crossing the driver must stop the vehicle and permit the pedestrians to cross the road safely. The third question shown below, large number of drivers interviewed

about, 25 (52%) of all respondents were replied that the traffic police commitment to their duties are poor.

Table 14 Observance of road traffic laws by drivers and pedestrians on the road

Questions	Responses					
Do you frequently give priority to pedestrians as law while driving?	Always		Some times		Never	
	No	%	No	%	No	%
	35	73	13	27	0	
How do you perceive pedestrians in giving priority from incoming vehicles when required?	Good		Medium		Poor	
	No	%	No	%	No	%
	12	25	15	31	21	44
How do you rate traffic police commitments to their duties?	Very good		Good		Poor	
	No	%	No	%	No	%
	5	11	18	37	25	52

As a table below shown that the majority of the surveyed drivers, 37 (65%) of the sample drivers replied “Yes”. This indicates that large numbers of drivers did gain additional training and education by concerned officials after getting their driving license. The rest about 35 % of drivers respond that they did not gain any additional education or training by concerned officials after getting their license. Also the majority of the respondents about 35 (61%) replied that the accidents on the road causes a great problem and about 39% of drivers revealed that the problem of accident on the road in town of Jima is moderate. Thus, the cooperation of the society and the governments (concerned officials) should have work together in order to create the awareness about the road safety rule in the community to reduce or to zero accident in the town.

Questions	Responses					
How do you rate the level of RTAs in the town?	High		Moderate		No problem	
	No	%	No	%	No	%
	35	61	22	39	0	0
Do you get additional education/training on road safety?	Yes		No			
	No	%	No	%		
	37	65	20	35		

Another question raised to the driver, "which one is the most possible role play in causing accidents on the Highway?" Driver behavior 18 (32%), Pedestrians behavior 22 (39%) Absence of road signs 5 (9%) poor road conditions 12 (21%).

As the respond of the drivers indicated that the majority about 22 (39%) were replied that pedestrians behavior involved highly in causing the road accidents in the town. And the second possible in causing the accident was driver's behavior about 21% accidents due to the error of the drivers. The third possible which play a great role in causing the accident on the road about 21% was the problem of road condign and the rest causes of road traffic accidents on the road was un availability the road signs.

4.3.2 Pedestrian's behavior on the road

As a police report indicated in Jima city the most exposure to road accidents were the pedestrians. This means the pedestrians are high risk in accident due to the drives neglecting to give priority to pedestrians. Also pedestrians have their own contributions in the accidents, may be the carelessness in crossing the road, a lack of knowledge about the severity of accidents and lack of giving attention to road safety. As a field observation indicate most of the pedestrian's complains why more pedestrians are vulnerable to the road accidents was no one give attention to the road safety on the highway by the higher Officials.

Table 15 Pedestrians share in 2010/11-2014/15 RTAs

Year	Accidents counts	Causality of pedestrians	Pedestrians share (%)
2010/11	49	27	55.10
2011/12	51	25	49.02
2012/13	46	17	36.95
2013/14	42	20	47.62
2014/15	77	60	77.92
Total	265	149	56.23

As shown in Table 15 the causality of pedestrians every year high percentage in road accident, that means persons who are walking on the road suffered to the accidents. The average annual RTAs for the past five year, 2010/11-2014/15, on the road is 56.23%. In this study, most of the field surveyed pedestrians around 90 % are a young people. This indicates the productive people are affected by road accidents who have great role in economic developments. Indirectly this told us the economic development of the country can be retarded because of the aged people non-productive. In an attempt to presume the knowledge of pedestrians towards the road safety problem in Jima, There were some questions raised to the respondents.

“Have you ever got education about road safety laws by concerned body in the town?” Most of the pedestrians around 58% agreed in the interviewed have not got any education about the road safety. This indicates that the severity of the accident in the town is increasing with alarming rate. But small number of the respondents in the interviewed have got a very few education form the concerned body.” What do you think the level of understanding about the road traffic accidents in your society?” The majority of pedestrians around 60 % were interviewed agree that the current situation of the accidents in Jima city is highly increasing.

Different types of collisions were occurred in the town, from the collisions stated bellow; “which type of collisions were highly dominant or which type of accident was more dominant?”

- Vehicles with vehicles
- Vehicles with pedestrians
- Vehicles with animals
- Vehicles with static objects

Most of the interviewed pedestrians agreed that 45, 25 and 15% collisions were occurred respectively due to collision of vehicles with pedestrians, vehicles with vehicles, and vehicles with static objects.

Table 16 indicates that large proportion of pedestrians, 34 (60%) got education about road traffic rules by concerned officials, whereas 40% of the respondents did not get any education concerning road traffic rules and regulation. For the second question the majority of pedestrians, 24 (54%) have indicated that they have learned how to deal with traffic rules and regulation by traffic police and about 15 (38%) trained in the school. Also 5% indicated the involvements of media, like, radio and television, and 3% of pedestrians indicated the sources of their knowledge in traffic rules were that the knowledge they got from media such as radio, television and newsletter.

The above responses and result demonstrate the almost all any systematic official source for providing the necessary education, training and information related to traffic safety. School also had a wide coverage in town in training and source of knowledge towards traffic safety rules. Thus, necessary mixed safety message may encourage in influencing behavior of road users and their attitudes. However, their pronouncing of road safety education or training is still inadequate and not given much attention. In the third box the majority about 42% of the respondents revealed that most of the community in the town have no any about the effects the traffic accidents on road or the consequences of accidents on the road economic crises.

Table 16 Pedestrian's knowledge of RTAs

Questions	Response							
Have you ever been educated about road safety by the concerned body?	Yes		No					
	No	%	No	%				
	34	60	23	40				
Who is your source of knowledge of the road safety?	School		Traffic police		Media		My self	
	No	%	No	%	No	%	No	%
	15	38	21	54	2	5	1	3
What do you think the level of understanding about road accidents in your society?	Very good		Good		Poor			
	No	%	No	%	No	%		
	14	24	19	33	24	42		

From the field observation, the movement of pedestrians along vehicles road is one of the serious problems that tends to cause road traffic accidents. That means pedestrians are walking on the vehicle road with their back to the traffic or the vehicles follows the pedestrians from the back, which is difficult to leave the vehicle road to control the accidents which happen due to the technical faults.

Table 17 Pedestrian's behavior in road using

Questions	Responses					
While walking on the road, which side of road do you use?	Left hand side		Right hand side		I do not know	
	No	%	No	%	No	%
	32	76.19	3	7.14	7	16.67
While crossing the highway, where do you cross?	At cross road		At zebra		Along any	
	No	%	No	%	No	%
	2	5.00	22	52.38	16	38.09
How do you perceive the level of RTAs in Jima Town?	Big problem		moderate		No problem	
	No	%	No		No	
	15	45.45	14	33.33	4	12.12

As a table 17 indicated in the first question, the pedestrians replied that about 32 (76.19%) used their left side when they were walking along the road vehicles or the majority of pedestrians always walking along the road vehicles with their front or face to the traffic. But, about 7 (16.67%) responded that they walk in the opposite to the direction of traffic follow (they walk with their face to the direction of the traffic). Pedestrians were walking along the roadway vehicles with their back to the traffic. Then this revealed us the severity of the road accidents becomes decreases.

But from my study in field observation the majority around 80% of pedestrians walking along the road vehicles with their back to the traffic. The revealed tendency of the pedestrian leave the sideway walks and walk along the roads increases the risk of pedestrians which exposed to the accidents on the road.

Also in the table above questions raised to the pedestrians," how they cross the road and how they perceive the level of the road traffic accidents in the town". From the respond of pedestrians, most of them using to cross the road were on the zebra cross. And the majority of the pedestrians perception about 15(45.45%) respond that the road traffic accidents on the highway were in a big problem.

Another question raised to the pedestrians, "how much they give an attention to the road signs, road marks and signals in cross and walk on the road?" As indicated from the respond of pedestrians about 70% of all have only aware (give attention). On the other hand the majority about 30% of pedestrians were not give attention or aware of the road signs and marks. So from my field interviewed the pedestrians complains the concerned official who are responsible for road safety audit. Because in Jima town

the road safety is not provided properly on the highway in accessible where it needs. So this is the main problem of the pedestrians why they do have the lack of awareness to the road signs and road marks.

As the table below stated that he pedestrians were asked they observe whether the road traffic accidents happen in their journey or not, from the interviewed pedestrians about 38 % respond that they observed road traffic accidents on the highway and about 50 % of them faced one times and the others observe two times, some of them more than two times in their journey of the town. And from the perception of the pedestrians the majority of the accidents were happen on the curve road about 40 percent, on the cross road about 32% and sometimes at roundabout.

Questions	respond							
Have you observe road traffic accident in your journey	yes		No					
	No	%	No	%				
	15	37.5	25	62.5				
For how many times you faced?	Once		2 times		3 times		>3 times	
	No	%	No	%	No	%	No	%
	11	50.0	8	36.36	3	13.64		
In your perception where the severity road accident were happen many times	on cross road		On zebra road		On the curve		On roundabout	
	No	%	No	%	No	%	No	%
	6	31.58	1	5.26	9	40.90	3	13.64

Question presented to pedestrians from the driver error rank order the following from most to least in terms of endangering your safety

- High speed of vehicles---------- 30 (53%)
- To give priority to pedestrians ------- 15 (26%)
- Absence of Zebra cross---------- 7 (12%)
- Lack of knowledge of drivers--------- 5 (8%)

As the above responds stated the majority of the traffic accidents on the road about 30(53%) replied that drivers driving with high speed. And the second most casuals of road traffic accidents on the road in Jima city about 15 (26%) indicated that the drivers failing to give priority to pedestrians on the

highway. Also lack of knowledge of drivers and absence of zebra cross as a respondent replied that regularly involved in causing the road accidents. In relating revealed from the questionnaires'' response to the traffic police statistics from 2010/11-2014/15 shown in the table 18 the severity of pedestrians traffic accidents by pedestrians actions on the road. The occurrence pedestrian's traffic accidents about 43% when pedestrians were crossing the road and about 37% replied that on side walk of pedestrians.

Table 18 2010/11-2014/15 RTAs severity by pedestrians' deeds

Pedestrians' deeds	Severity of accidents				
	Fatality	Serious injury	Slight injury	Totals	%
Pedestrians on cross	14	25	15	54	42.86
Pedestrians on the side walk	21	12	14	47	37.30
Pedestrians playing on the road	0	0	0	0	0
Pedestrians walking on the road	1	1	3	5	3.97
Pedestrians sleeping on the road	1	0	0	1	0.79
Pedestrians stopping on the road	1	0	0	1	0.79
Others/unknown	8	5	5	18	14.29
totals	46	43	37	126	100

4.3.3 Condition of vehicles

The majority of the vehicles in the town are very old, that is from the field observation about 80% of the vehicles seen on the highway were served fore along time. Thus, the periodic maintenance and inspection are very important factors that safe while driving**.** Although police as the cause of traffic accidents rarely identifies vehicle defects, the contribution could be quite considerable due to the fact that the condition of vehicles is generally very poor. Most of the vehicles in the fleet are very old without proper maintenance. In addition so many old vehicles are on the roads because of the socio- economic problem and lack of implementing the laws. From the report of the traffic police in Jima town in 2010/11–2014/15 due to the vehicle defects there were the severity of accidents on the road.

4.3.4 Factors that contribute to Traffic Accident based on existing Road condition.

The existing road conditions in Jima town are somewhat poor conditions. The poor condition of the road network was due to in adequate maintenance and the feeder roads which are not safe for transport in order to connect to main roads because they are not suitable for mobility. It was observed that most of the roads are under construction, so this may leads road traffic accidents.

The traffic segregation (separation) is not considered due to no classification of traffic according to their function, space they use and time. Although these parameters may causes the traffic accidents on the road. It could be noted that vehicles are usually parked on the pedestrian's walkway, which tends the pedestrians to walkways. Therefore, all vehicles use all routs without limitation, which enforce to traffic collision between vehicles to vehicles, vehicles to animals, vehicles to pedestrians. Then to solve this problem there should be traffic classification on the road.

Also in Jima town due to heavy mix of traffic follow, no safe vehicles and pedestrians facilities on the road network.

As the observation from this road section it is not maintained for a long time so it is in serious problem because the road is under destruction due to high traffic volume that means large truck uses the road because the area is highly under construction. So due to the road condition may be the accidents at this area is increasing

Figure 17 Photo taken from the field observation of the road section which connects Kochi to Ajip.

4.4.1 Walkways or side walks

So as field survey through observation was conducted the segregations of vehicles and pedestrians or the facility of safety on the road, like pedestrians crossing, barriers, paved sidewalks, fences for separating roads and pedestrians walkway, road signs and markings, speed claiming facilities, traffic signals at intersections and light on the road are in adequate. Even on the majority of the road totally no facilities provided.

Also during the field observation a visit was made on the road sections. During the site visit, the following problems were observed. There was no properly constructed side walk. Pedestrians mostly use outside lanes as a side walk. Besides, pedestrians do not have knowledge about traffic regulations. Illegal crossing, walking along the road and crossing between parked vehicles were common practices. Heavy vehicle are usually parked on the road side for a long time until the time of restriction to enter the Town is over. With Regard to road marking, the road was painted during the construction of the road. However, even the available road markings were faded with no sign to road users.

Also during site inspection there is the place where the busy area in the town which leads to cause the road traffic accident. For example the identified busy area which serious for road accident causal is around markato area on Hawetu Bridge and Qochi near palm cafe bridges. Because of high volume traffic and pedestrians. Then diverting pedestrian's movements to safer location and keep pedestrians off roadway at busy area. Alternatively, providing the fence to separate pedestrian's walkway from main road. For example, the identified busy area, which serious for road accident causal is around markato area on Hawetu Bridge. Then pedestrian's side walkway should be constructed with concrete or steel structure at side of the bridge which is available at Markato Bishishe and Qochi near palm cafe bridges. Before improvement, the section of road around Bishishe Markato and Palm Café looks like the one shown in Figure 18.

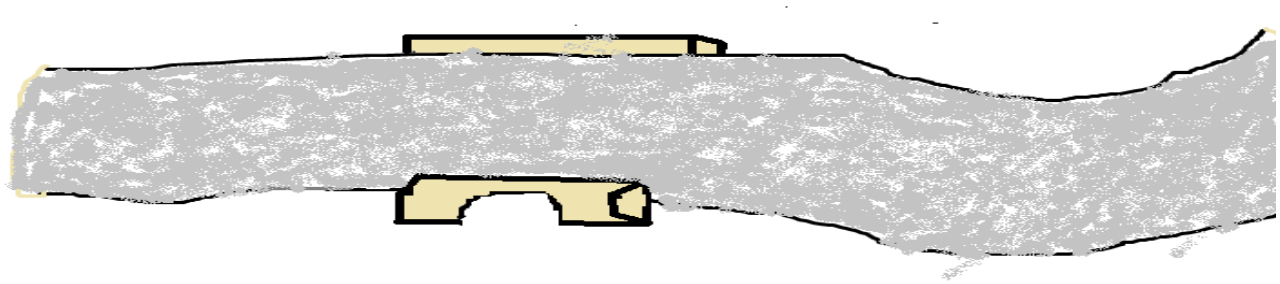

Figure 18 Road section at the Bridges around Markato Hawetu and in front of Palm café

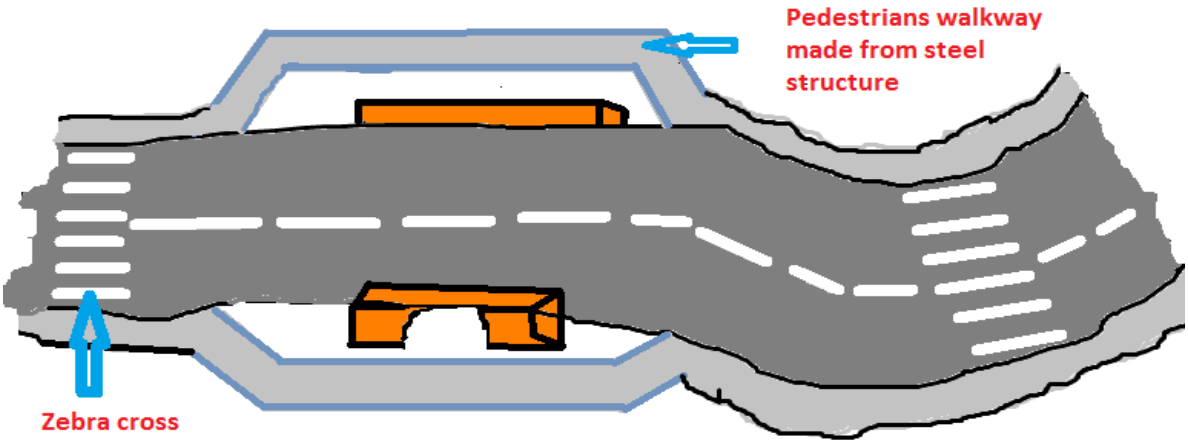

Figure 19 The road section at the bridge after improvement

4.4.2 Intersection or Carriage ways

Traffic channelization aims at reducing conflicts between vehicles and vehicles and pedestrians. It facilitates correct trajectory selection, capacity increase and traffic control and maximizes driver/road communication. It also reduces the number of decisions that a driver must deal with at a certain place, giving him time to think on the next decision and then act accordingly.

But, the environments of the road in Jimma town there is a lack of road safety facilities which is used to guide how to use road. For example, facilities at intersection point's, median barrios, lane dividers, traffic signals at junctions and road signs where they needs are not available. Therefore, the traffic accidents on the road rising with high rate due to the absence of those facilities. Also very narrow bridge were observed with a very small width about 4.5 meters. During the inspection time, vehicles were operating above the speed limits especially Bajaj's and motorcycles. Volition of speed limits in town along this road was confirmed by the National Safety Coordination Office's pilot study. Many Minibuses and taxes which were used for public transport vehicles carry passengers over the legal limit.

Also during field observation: At the time of observation, some of taxes or transport vehicles used the junction for dropping and picking of passengers. Most of the drivers of in Jima did not respect traffic rules at the spots. At all there were no traffic signs and signals in Jima town around the junction also vehicles operated above the speed limits. In general, for the under *Section 4.4* and sub *Subsections* 4.4.1 and *4.4.2* the identified problems were discussed, these problems needs a solutions to overcome those problems. For example the main road where the pedestrians over crowded especially around Markato area and Jima University the road facility is not provided totally. So it needs especial improvement because of the highest number of pedestrians and traffic volume available there.

So depending the above situations and by identifying causes of the problem the following appropriate engineering measures are provided to suggest solutions to the problem. The study road incorporates

Therefore, what researcher recommend those facilities in partial should be improved like its shown below with its initial conditions

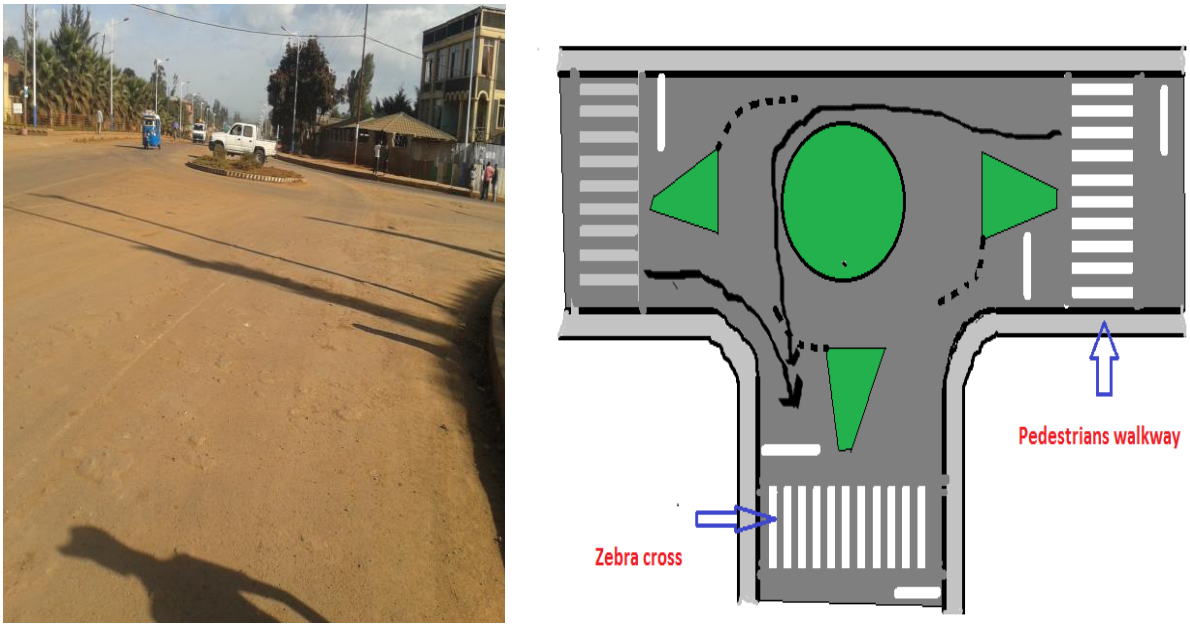

Figure 20 Photo taken from field observation of road section around Aramaic Hotel

At this road intersection during the site inspection observed in Figure 20 no any channelization except roundabout and road features, like constructing island areas, road markings, speed limits, providing pedestrians cross road (zebra cross), which are provided in order to minimize or reduce the road traffic accidents at this site, it is high volume of traffic area because of this road section which connects Addis Ababa to Jimma Town, so the accidents may alarming in this area.

Therefore, it needs the improvement to this road section, so after improvement traffic channelization should be made to reduce collision at points. This increases the visibility of the area in order to segregate traffic follows, Prohibition of parking signs should be placed and provided off road parking facilities, speed limit should be provided near the area.

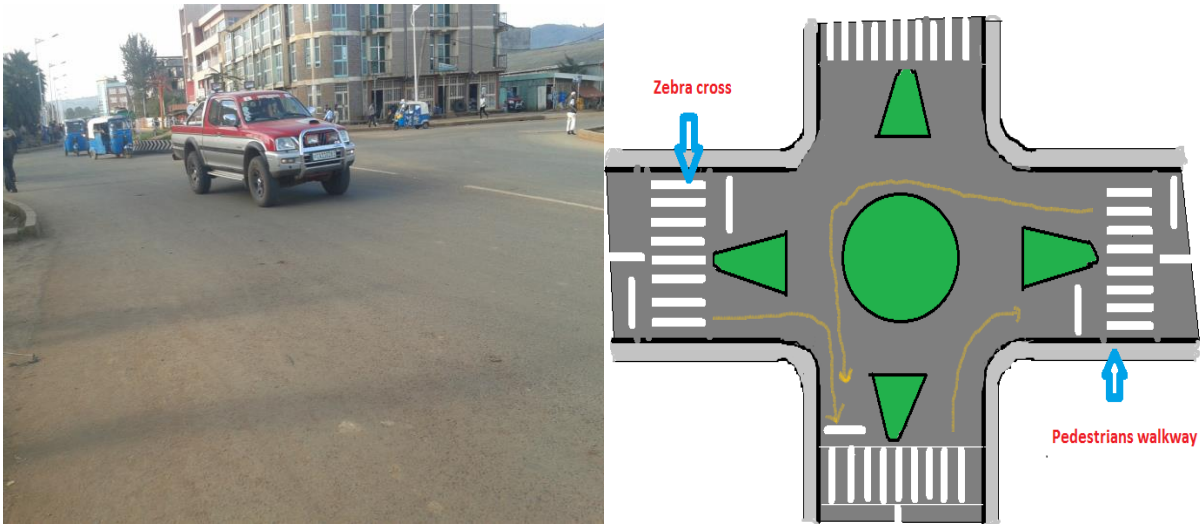

Figure 21 Photo taken during field observation of the road section near Jimma Town Bus Station

The road section beyond Bus station during the site inspection observed in Figure 21 no any channelization except roundabout and road features ,like constructing island areas, road markings, speed limits, providing pedestrians cross road (zebra cross) and pedestrians walkway which were made in order to protect or reduce the road traffic accidents at this site, it is high volume of traffic area because of this road section which connects different main cities Addis Ababa to Jimma Town and Bonga to Jimma Town so the accidents may alarming in this area.

Therefore, it needs the improvement to this road section, so after improvement traffic channelization should be made to reduce collision at points. This increases the visibility of the area in order to segregate traffic follows, Prohibition of parking signs should be placed and provided off road parking facilities, Speed limit should be provided near the area and Pedestrian's side walk should be provided.

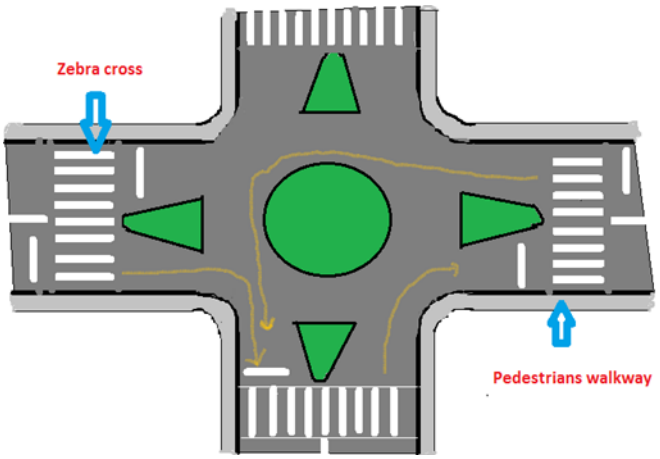

Figure 22 Photo taken from the field observation of road section in front of Wegagen Bank

The road section in front of Wegagen Bank during the site inspection observed in Figure 22 no any channelization , roundabout and road features ,like constructing island areas, road markings, speed limits, providing pedestrians cross road (zebra cross) and pedestrians walkway which were made in order to protect or reduce the road traffic accidents at this site, its population density is very high because due to it is market area and since this area is the back bone the town because any daily activities of all peoples is here in order to sustain their daily life, so number of pedestrians in this area are high and high volume of traffic area, so the accidents may alarming in this area. The following counter-measures are proposed to reduce focused on reducing accidents at this area

Therefore, it needs the improvement to this road section ,so after improvement traffic channelization should be made to reduce collision at points, The roundabout should be furnished reflective chevron on island . This increases the visibility of the area in order to segregate traffic follows, Prohibition of parking signs should be placed and provided off road parking facilities, speed limit should be provided near the area and Pedestrian's side walk should be provided. Pedestrian refugee should be provided by widening of the sites in order to have safer crossing, zebra crossings for pedestrian should be provided in every 45-50 meters because of highly populated area and Sets of rumble stripes should be furnished before every zebra crossing, strict enforcement should be implemented in the town and campaigns for Road uses should be performed during market days because of it is populated area.

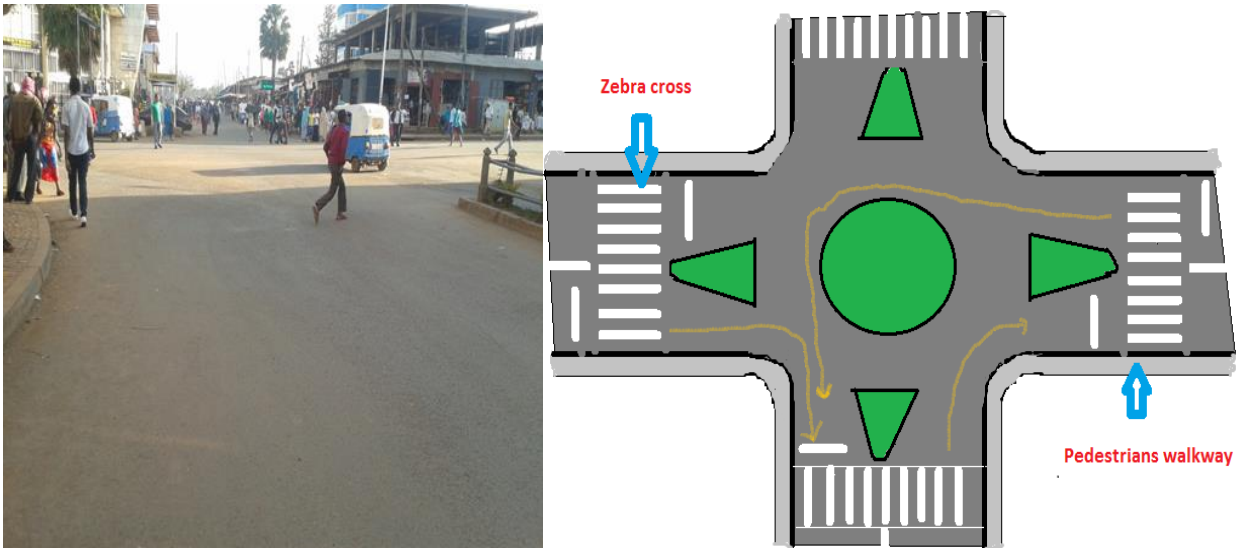

Figure 23 Photo taken during field observation in front of Hermata Branch, CBE

The road section in front of Hermata Branch, CBE during the site inspection observed in Figure 23 no any channelization , roundabout and road features, like constructing island areas, road markings, speed limits, providing pedestrians cross road (zebra cross) and pedestrians walkway which were made in order to protect or reduce the road traffic accidents at this site, its population density is very high because due to it is market area and since this area is the back bone the Town because any daily activities of all peoples is here in order to sustain their daily life, so number of pedestrians in this area are high and high volume of traffic area , so the accidents may alarming in this area. The following counter-measures are proposed to reduce focused on reducing accidents at this area.

Therefore, it needs the improvement to this road section ,so after improvement traffic channelization should be made to reduce collision at points, the roundabout should be furnished reflective chevron on island . This increases the visibility of the area in order to segregate traffic follows, Prohibition of parking signs should be placed and provided off road parking facilities, speed limit should be provided near the area and Pedestrian's side walk should be provided. Pedestrian refugee should be provided by widening of the sites in order to have safer crossing, zebra crossings for pedestrian should be provided in every 45-50 meters because of highly populated area and Sets of rumble stripes should be furnished before every zebra crossing, strict enforcement should be implemented in the town and campaigns for road uses should be performed during market days because of it is populated area.

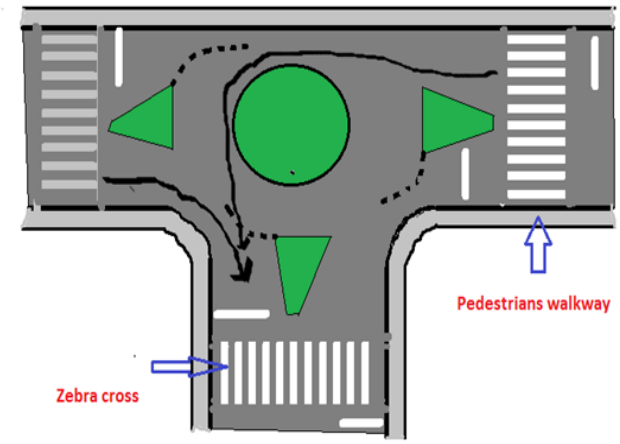

Figure 24 Photo taken from field observation of road section around Hawetu area

At this road intersection during the site inspection observed in Figure 24 no any channelization , roundabout and road features, like constructing island areas, road markings, speed limits, providing pedestrians cross road (zebra cross) which was made in order to minimize or reduce the road traffic accidents at this site, it is high volume of traffic area, so the accidents may alarming in this area. The following countermeasures are proposed to reduce focused on reducing accidents at this area.

Therefore; it needs the improvement to this road section ,so after improvement pedestrian refugee should be provided by widening of the sites in order to have safer crossing, prohibition of parking sign should be placed, Traffic channelization should be made to reduce collision at points. This increases the visibility of the area in order to segregate traffic follows, zebra crossing should be provided at each leg of the junction before 50 meters and 1-2 sets of rumble stripes should be furnished at each leg before zebra crossing.

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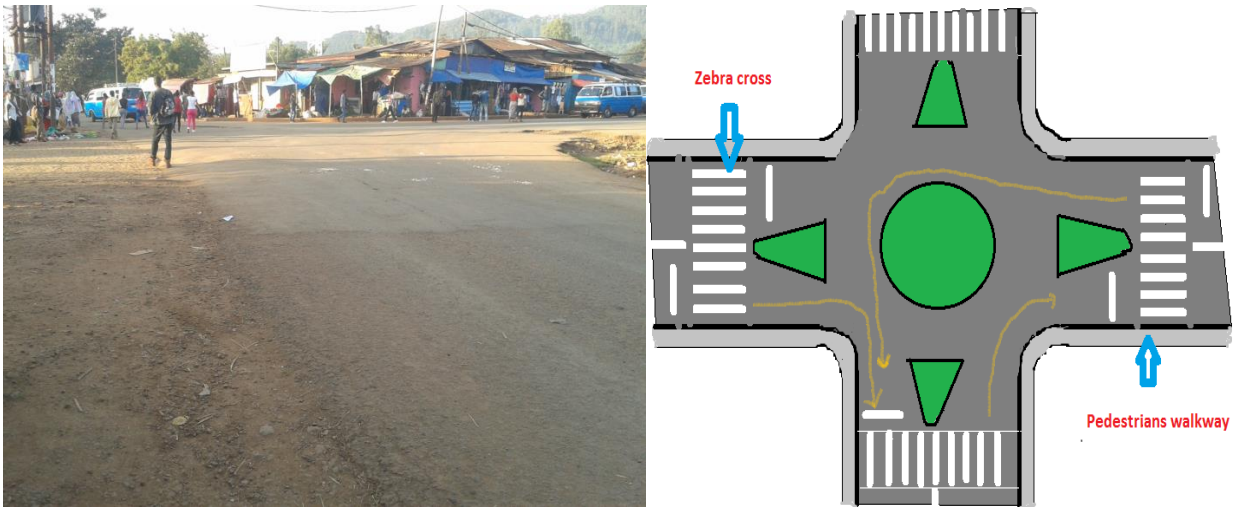

Figure 25 Photo taken during field observation in front of Jiren Branch, CBE

At this road intersection during the site inspection observed in Figure 25 no any channelization, roundabout and road features ,like constructing island areas, road markings, speed limits, providing pedestrians cross road (zebra cross) and pedestrians walkway which were made in order to protect or reduce the road traffic accidents at this site, its population density is very high because due to the three higher institution, two high school and tow elementary school, so number of pedestrians in this area are high and high volume of traffic area , so the accidents may alarming in this area.

Therefore, it needs the improvement to this road section ,so after improvement traffic channelization should be made to reduce collision at points, The roundabout should be furnished reflective chevron on island. This increases the visibility of the area in order to segregate traffic follows, Prohibition of parking signs should be placed and provided off road parking facilities, speed limit should be provided near the area and Pedestrian's side walk should be provided. Pedestrian refugee should be provided by widening of the sites in order to have safer crossing, zebra crossings for pedestrian should be provided in every 45-50 meters because of highly populated area and sets of rumble stripes should be furnished before every zebra crossing.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATION

5.1. Conclusions

The results obtained throughout the investigation of the traffic police report and field survey through questionnaire and observations the data in chapters Four indicated that road traffic accident is a serious problem in the Jima Town. The numbers of road traffic accidents revealed an increasing trend throughout the study year period, and the rate of road traffic accidents increase rapidly.

Traffic police statistics greatly underestimated in reporting accident situations; that is the number of reported accidents in the same document are vary under different reports. The variation of the accidents statistics in the same document indicates the carelessness of concerned officials. These are indications that more accidents were unreported, and that the statistics compiled are not always reliable.

Based on the analysis from the accident statistics and the results of the study, the following conclusion are drawn;

- From the statistics of traffic police, accident reports and cases analyzed about 82% of the total accidents in Jimma town had been caused by human errors (driver and pedestrian's error). Of these road accidents caused by human errors, it should that the drivers were responsible of about 80% of all cases. The main causes of accidents are failure to give way for pedestrians, failure to give way for vehicles, following to close and over speeding of indicated from police report.
- The behavior of pedestrians was also causing loss of lives and for property damage. Due to the lack of awareness how to act the road safety and have less experience to rules and regulation of traffic ,the society who use road give less attention to traffic. This is very alarming due to severity of the accidents
- In Jima, pedestrians are the road users most affected by road traffic accidents. About 56% causality of all road accidents are pedestrians. In the report revealed that majority vulnerable to the road accidents about 23% of all pedestrians were students (schoolchildren). Drivers and passengers were also frequently involved in road traffic accidents. Results also show that the risks are higher among males, particularly those age group 18-50 years who are more productive and play a great role in economic development of the country. Thus ,there are two possible reasons why male drivers more involved in road traffic accidents; one is the professional driving are dominated with male drivers for any jobs in remote areas or those that involve all time driving,

especially night time and secondly more kilometers traveled per annum by female drivers are most probably lower than male drivers.

- The educational background of the drivers was key factor in causing road traffic accidents. So most accidents about (30.19%) were caused by drivers whose educational level is elementary school and also this indicted that the more the drivers educated the less the occurrence of the accidents.
- From the report obtained the time (peak period) of the day the majority of accidents between 2:00 p.m. and 12:00 p.m. This was observed when all the road users and vehicle traffic and pedestrian volume increased. While the day of Tuesday indicated that accidents are more frequent.

In general, there are so many factors, which increase the road traffic accidents. These are inadequate provision of pedestrians facilities(inaccessible of pedestrians walkway), inadequate public transport, road conditions like poor maintenance and inadequate of road network, poor enforcement of traffic regulation traffic, poor RSA, inaccessibility of road signs and signals and lack of adequate training and testing for drivers. The main causes of RTAs in Jima Town can thus be arranged in their priority as failure to give way for pedestrians, improper turning, following to close, failure to give way for vehicles, excessive speeding, undisciplined behavior of drivers and unskilled drivers, poor road conditions, and violating the traffic law.

5.2. Recommendations

- The traffic police office under the jurisdiction of Jimma Town Municipality should strictly follow the correct procedures on how to record and file of traffic accidents in order to obtain reliable data when another group of researchers will conduct related undertakings. Therefore, well data recording system should be developed in order to identify successful and cost effective interventions in RSA works.
- In the field survey, it was observed that some of concerned officials did not give any attention for traffic rules and regulations, and the safety to transport system which are leads the drivers to violate traffic rules. The violation any traffic laws may be escalating due to road traffic accidents. So, there should be a cooperative effort between national and regional governments in order to alleviating this problems by formulating a safe transport system and traffic management policy to prevent or reduce the traffic accidents, these should be done by
    - including the traffic rules and regulation in the educational curriculum

- any drivers should have trained before gating license
- prohibition of on road the side parking where it needs.
- creating the awareness about road traffic to the community of Jima town in order to save the loss of lives and property damage due to the road traffic accidents.
- creating public awareness road safety and self-protective driving.
- establishing and implementing reduced speed limit for vehicles around, schools, market and residential areas.
- providing infrastructures to separate road users; separate traffic lanes for motorcycles and side walkway for pedestrians.
- providing special crossing patrols for school children where it needs.
- diverting pedestrian's movements to safer location and keep pedestrians off road way at busy area; or providing the fence to separate pedestrian's walkway from main road. For example, the identified busy area which serious for road accident causal is around markato area on Hawetu Bridge. Then pedestrian's side walkway should be constructed with concrete or steel structure at side of the bridge which is available at Markato Bishishe and Qochi near Palm Cafe bridges.

❖ Traffic channelization and roundabout should be made at identified location to prevent collisions or conflicts at those points. Zebra crossings for pedestrian should be marked in every 50-55m interval in the town.

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APPENDEX I

JIMMA UNIVERSITY JIT, CIVIL ENGINEERING DEPARTMENT,HIGHWAY STREEM

Questionnaire prepared for sample population

A questionnaire is prepared for an academic purpose for the fulfillment of MSc Degree in Highway Engineering Stream . The objective of the study is to assessing the causes and Effects for road traffic accidents in Jima town. Your response is very important for the success of the study. Hence you are requested kindly to give your response by circling your answer among the alternative choice by your opinion. I would like to thank you helping me.

I. A Questionnaire to be responded by selected pedestrians in Jima Town

1. Address 1. Jima wereda 01
   2. Jima wereda 02
2. Sex 1. Male
   2. Female
3. Religion 1. Muslim
   2. Protestant
   3. Orthodox
   4. Wakeffata
   6. Others

3. Age
   1. < 18yr
   2. 19-30yr
   3. 31-50yr
   4.> 50yr

4. Educational level

1. Illiterate
2. Read and write (1-4)
3. Primary education (5-8)
4. Secondary education (9-12)
5. Higher institution

5. Occupation 1. Students
2. Unemployed
3. Business man
4. Office worker
5. Others

6. Have you ever been trained about road safety rules?

1. Yes
2. No

7. If the answer to Q. # 6 is "Yes" where have you been trained?

1. at public schools
2. at private school
3. at religious places
4 community meeting area
5. Iddir area
6. at work place

8. Who is your source of knowledge about road safety rules and regulations?

1. Teacher
2. My self
3. Media (TV, Radio and Newspaper)
4. Traffic police

9. While walking on the road, do you use your

1. Left hand side
2. Right hand side
3. I do not know

10. While crossing the highway, where do you cross?

1. across road
2. at Zebra cross
3. along any possible way

11. Have you observed road traffic accident in your journey?

1. Yes
2. No

12. If Yes to Q # 11, for how many times?

1. one times
2. two times
3. > two times

13. From your observation where would be road traffic accident frequently occur? Order from most frequently to least frequently occurring site.

1. on cross road
2. on zebra road
3. on curve road
4. on the roundabout

14. What type of causes the road traffic accidents?

1. public vehicles
2. Commercial vehicle
2. Motor cycle
4. Bajaj
5. Horse cart
6. Cycle

15. Which type of collision or accidents was highly dominant?

1. Vehicles with vehicles
2. Vehicles with pedestrians
3. Vehicles with animals
4. Vehicles with static objects

16. How do you perceive the level of road traffic accident in Jimma town?

1. Highly problem
2. Medium
3. Not a problem

17. Rate the main causes for road traffic accidents on road network according to their severity.

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1. Unlimited speeding
2. Road condition
3. Carelessness of drivers
4. Carelessness of pedestrians
5. Absence of road safety rules

18. While you are crossing along Zebra crossing, do the drivers drive slowly or stop their vehicle to allow the pedestrians?

1. Yes
2. Not

19. From the driver error rank order the following from most to least in terms of endangering your safety.

1. High speed of vehicles
2. Failure to give priority to pedestrians
3. Absence of Zebra cross
4. Lack of knowledge of drivers
5. Absence of road safety rules

20. What you perceive the level of understanding of the society about the accidents on the road in Jima town?

1. Very good
2. Good
3. Poor
4. I do not know

21. How much you give an attention to the road safety rules in crossing and walking along the road?

1. Good awareness
2. Less awareness
3. Poor

22. Do drivers breach traffic rules in the presence of traffic police?Would be punished for their law effective?

1. Yes
2. Sometimes
3. Not all

23. If "yes" to Q# 22, what will be the measure taken by the traffic police for the observance of the traffic rules and regulations?

1. Advice and worn the deriver
2. Fine them
3. Take the driving license from the driver
4. Untie the number plat from the car

II. Questionnaire for drivers

1. Address 1. Out of Jima town
   2. in Jima town
2. Sex 1.male
   2.Female
3. Age 1. Less than18 yr
   2. 17-30yr
   3. 31-50yr
   4.above 50 yr
4. Educational level
   1. Illiterate
   2. Read and write (1-4)
   3. Primary education (1-8)
   4. Secondary education (9-12)
   5. Higher institution
5. Level of License
   1. No license
   2. 1st level
   3 2nd level
   4. 3rd level
   5. 4th level
   6. 5th level
6. How long have you been driving in this city?
   1. Less 1 yr
   2.1-2 yr
   3. 2-5 yr
   4. 5-10 yr
   5. >10 yr

7. Which type of vehicle do you normally drive?

1. two wheel
2. three wheel
3. four wheel
4. more than Four wheel

9. Where do you often parking your vehicle?

1. on the road
2. on the parking
3. Residential area
4. around commercial
5. Office area

10. When you drive, what is your normal speed in the town?

1. 20-30 km/h
2. 30-40 km/h
3. 40-50 km/h
4. 50-60km/h
5. above 60km/h

11. When you drive, have you give way priorities to pedestrians as law?

1. Always
2. Sometimes
3. Never give

12. How do you perceive pedestrians respect ion for vehicles in giving priorities if it needs?

1. Good
2. Medium
3. Poor

13. How do you rate the level of road accidents problems in your town?

    1. High
    2. Medium
    3. None

14. Are you faced or observed accidents while driving in the town roads?

    1. Yes
    2. Not yet

15. If you are involved in accidents how many times?

    1. Once
    2. two times
    3. More than two times

16. If you are involved or observed in accidents have it reported with traffic police?

    1. Yes
    2. Not yet

17. How do you imagine the traffic police commitment to their duties?

    1. Very Good
    2. Good
    3. Poor

18. Have you got additional educational training about road safety by concerned officials?

    1. Yes
    2. No

19. Suggest some possible role most important role, medium role, least important role, not any role Played on the causes of accidents of the Highway? (Tick as many as applies).

No		(1) Most Im-portant	(2) Medium Important	(3) least Im-portant	(4) No any role Important
1	Driver behavior.				
2	Pedestrians behavior				
3	Lack of proper and sufficient parking				
4	Poor road condition				
5	Absence of sufficient road lights and signs.				
6	Others				

20. How would you describe the traffic laws and regulations of the city? It is:
    1. Excellent
    2. Very Good
    3. Good
    4. Fair
    5. Unsatisfactory
21. Do you favor the present testing and training of drivers? Do you:
    1. Most favorable
    2. Favorite
    3. Less favorable
    4. Not favorable
22. Have you done this year's vehicle annual inspection?
    1. Yes
    2. No

23. How do you feel about laws that require stopping using cell phone while driving? Do you:

1. Favor a lot
2. Favor some
3. Not favor at al

24. Do you favor road side check points? It provides law enforcement to monitor and check drivers' licenses, vehicle registration, vehicle equipment etc.

1. Favor a lot
2. Favor some
3. Not favor at all

25. Do you favor sobriety check points? These are points where law enforcement officials Evaluate drivers for signs of alcohol or drug impairment at certain points on the roadway.

1. Favor a lot
2. Favor some
3. Not favor at all

Section III. Accident Condition

26. Have you ever been injured in a motor vehicle accident while driving? Only count injuries that required medical attention.

1. Yes
2. No

27. How many times has this happened to you?

1. one times
2. two times
3. three times
4. >three times
5. not at all

28. What were you in that accident?

1. Passenger
2. Pedestrian
3. Bicyclist
4. Others