THE CAUSES OF ROAD TRAFFIC ACCIDENTS AND SAFETY EVALUATION IN WOLKITE CITY, ETHIOPIA

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Declaration

We, the undersigned, declare that this thesis is our original work performed under the supervision of our research advisor Inst. Desta Moshe and it has not been presented as a thesis in any other university and institutes. All sources of materials used for this thesis have been fully acknowledged.

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Acronyms

AADT: Annual average daily traffic

ADT: Average daily traffic

CSA: central statics authority

ERA: Ethiopian road authority

RTA: Road Traffic Accident

RTASE: Road accident safety Evaluation

UN: United nation

WHO: World health organization

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Abstract

Road traffic accidents (RTA) are a major global socio-economic problem, affecting all people of the world regardless of age, sex, wealth etc. This study has the major objective of assessing

and analysing the causes of road traffic accident in wolkite city and recommend safety measures to create a safer transport system in the city in order to reduce the road traffic accidents. Both primary and secondary data sources were used. Cross-sectional survey with utilization of both qualitative and quantitative approaches was used. Wolkite city, being the largest city, enjoys the city's major road compositions as well as local and international gate ways with high standard roads. Unfortunately, it has recorded the worst accident and safety record in the city as well. The study tries to identify the major causes of RTAs in wolkite city, with people who are likely to cause RTAs in the city. Drivers who do not give priority to the pedestrians, Pedestrians problems during crossing of zebra and Comfortability of wolkite city pavement roads were also identified as causes of RTAs. Aggressive driving behaviour was the most unsafe driving behaviours and included speeding, not using indicators and jumping red traffic lights. Using mobile phones as a pedestrian while crossing roads and crossing roads from undesignated places also contributes to road traffic accidents in the city. Finally the research tries to recommend the Municipality of the city and the Government to give the possible solutions to the causes of road traffic accidents in the city by Educations like, adequate provision of Road safety education, offering of definite land use policy, Quality drivers' training, and testing, standardized and prerequisite criteria for drivers with regard to their educational background and good behaviour ,traffic signals , traffic lights and their frequent technical failure should be solved, raised zebra crossing, marking zebra crossing, prohibit overtaking, constructing side walkway, widening of the pavement, streetlights, installation of marking and signs, and some areas also consider adequate median road marking, redesign and providing additional-way movement have been forwarded to alleviate the problems

1. INTRODUCTION

1.1 General Background

Every year more than 1.17 million people die in road traffic accident around the world. The majority of these deaths, about 70 percent occur in developing countries. Sixty-five percent of deaths involve pedestrians and 35 percent of pedestrian deaths are children. Over 10 million are crippled or injured each year. It has been estimated that at least 6 million more will die and 60 million will be injured during the next 10 years in developing countries unless urgent action is taken" (World health organization).

The safety that all transport facilities provides is primary consideration when it comes to geometric road design. While constructing roads, certain projects are specifically made to tackle existing safety hazards. It is important that all projects do eventually results in facilities that are extremely safe for its users. Conducting corridor safety audits and crash record analysis are a great way to discover any hidden safety hazards. It is important for designers to pick project design elements according to their expected characteristics while operating and according to historic performance when it comes to safety

Accidents occur due different factors such as lack of maintenance of the roads, geometric design problems and personal problems, pedestrian's lack of knowledge and others. In order to reduce these problems, certain measurements should be taken.

Generally, the paper will clearly define problems and shows their consequences on safety and finally recommends the mitigation measures for the problems.

1.2 Statement of the Problem

Ethiopia is one of the developing countries in the world loses 36.3 billion of Birr each year due to road accident (which was 3.3 billion Birr / years, in the past 11 years) (ministry of finance and economic cooperation). This doesn't 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 authoritative showing a very hazardous situation; however, there doesn't seem a sufficient work being done to reduce this alarming rate.

Nowadays it is common to see pedestrian's queues along zebra crossing for a long period of time than usual on wolkite city asphalt roads. The drivers are driving with slight reduction from their free flow speed at these crossings.

The drivers tend to pass the crossing so as to eliminate the delay at the point. The pedestrians similarly tend to cross the road for the same purpose.
Further, the sounds of warning of vehicles are creating noise which is the indication of the existence of safety threats on the roads. The volume of motorcycles and three wheel vehicles are increasing with larger rate than ever and will reach its boom point within short period of time if continued with the same trend.

Some institutions do not have their own parking area. Instead they use the road as parking for their clients and staffs. It is common to see the vehicles parked on the road way that the vehicles use to give the service On some parts of the roads, the two-way traffic flow on a lane that is not divided by any means of separation.
That means, there is no median between the roads nor traffic markings to separate the traffic flowing in either direction. This shows that the geometric design of roads poses safety threat to the road users. This results in safety threat to the road users.

In addition, the shoulders of some roads have been eroded. As a result, the shoulder width, if they exist, and the lane width of the roadway is reduced. The erroneous vehicles share the existing narrow lane with the flowing traffic.

In general, the major transport associated problems in Wolkite City includes like, Shortage and low quality of transport services and facilities, Poor quality of roads, pedestrian walkways, High rate of congestion at peak hours and hence high rate of traffic accidents, Lack of lane for bicycle, Traffic road signs / signals invisibility and lack of planned maintenance, Drivers and pedestrians behaviours and knowledge on road safety, Poor and traditional procedures of vehicle maintenance, mostly in independent workshops.

The above listed problems necessitated us to conduct a study on causes of road traffic accidents in wolkite city. Our proposed paper is intended to identify whether improvement is required for existing asphalt roads to reduce road traffic accidents, and the requirement of additional separate lanes for three-wheel vehicle and motor cycles. It also assesses the existing traffic control systems and the need for additional control systems so as to improve safety of the users. The paper also intended to recommend the city's Municipality Authority to revise its land use legislation and regulations, and incorporate the parking space, additional lane construction, traffic control systems and safety of users.

1.3 Research Questions

This research was conducted to answer the following Basic questions.

1. What characterizes Road Traffic Accidents in wolkite City?
2. Where do frequent Road Traffic Accidents occur in wolkite City?
3. What is the trend of Road Traffic Accident occurrence in wolkite City?

1.4 Objectives

1.4.1 General Objective

The general objective of the research is to analyse the causes of road traffic accidents in Wolkite City, Ethiopia.

1.4.2 Specific Objectives

Specific objectives of the study include: -

- To assess the nature or characteristics of road traffic accidents in wolkite city.
- To identify the major causes of road traffic accidents in wolkite city.
- To investigate the possible solutions for the road traffic accidents in wolkite city

1.5 Scope of the Study

The study is mainly concerned on the identification of the main causes of road traffic accidents in Wolkite city and evaluates roadway problems on safety of Wolkite city asphalt roads. It also includes the driver problems on safety of the city's asphalt roads. Furthermore, the study assesses maintenance and construction of roadway segments design elements, additional traffic control systems and their timely maintenance to reduce the road traffic accidents in Wolkite city.

1.6 Significance of the Study

The paper is aimed to analyse the causes of road traffic accidents in wolkite city and increase safety of users of wolkite City Asphalt roads and the results of the discussions can be used as an input for the designers and the road management stake holders to reduce the traffic road accidents occur due to the geometric design elements.

Being a city with large number of bicycles and motorcycles, the study initiates the study of the necessity of motor lanes for the city. The study may also be used as an input for the improvement and additional installation of the traffic markings and signals at any segment of the city’s roads.

The study is mainly concerned to increase comfort to the pedestrians and vehicle drivers. That

means, to increase the safety confidence of the drivers and pedestrians when using the roads. The improvement of wolkite City asphalt roads to reduce the road traffic accidents is the main concern of the study.

Therefore, the study can be used for the improvement activity of these roads.
The volume the vehicles passing through the city and serving the city is high and anticipated to be more in future.
The city is a node for large number of journey (high number of production and attraction from and to the city). These cars depart on the roadway for loading and unloading. The study assesses the need of sufficient parking space for these vehicles and local vehicles.

2. LITERATURE REVIEW

2.1 Introduction

As the number of people who reside and work in urban areas increases, so do the needs and demands placed on the infrastructure. This has led to severe congestion in many European cities, a situation which affects not only the environment in terms of pollution, but most notably levels of traffic safety. In Europe, tens of thousands of people are killed in road traffic accidents, and more than 1 million are injured each year at a cost, which is estimated to exceed the total European Union budget by a factor of two.

Traffic safety research has shown a biased interest in the problems associated with motorway and rural areas in the past. There are many reasons, which advocate a greater interest in urban areas, in particular, those related to the safety of unprotected road users. In urban areas the traffic system context is more complex, where a mixed road user environment prevails and greater perceptual and cognitive demands are placed on road users. In the past, many of the more successful safety countermeasures have focused on designing the roadway to meet the needs and limitations of road users. These solutions have, however, proved to be very costly.

Every day, thousands of people are killed and injured on road by traffic accident. It is the leading cause of death, disabilities and hospitalization, severe socioeconomic costs, across the world. According to the (WHO 2009), it has been estimated that RTA takes the lives of nearly 1.3 million each year, as a result; nearly 3,500 people die each day. In addition, the people who suffer serious injuries including disability are about 20 to 50 million worldwide.

The last century of the second millennium has seen vast improvements in the living conditions and economic wealth of the industrialized nations of the world, and consequently a large growth in population, particularly in urban areas. The growth of cities and towns has also led to an increase in the need for mobility, and a consequent increase in the numbers and types of vehicles occupying the road infrastructure.

RTAs injuries are becoming public health issues, disproportionately affecting vulnerable group of the road users, including the poor. More than half the people who die in traffic crashes are young adults with age between15 to 44.

In the world, nearly half (46%) of all RTAs involve pedestrians, motorcyclists and cyclists (vulnerable) road users. The economic consequences due to RTAs have been estimated between1% to 3% of GNP of the world countries. In 2004, (WHO) RTAs were the 9th leading cause of death and the study forecasts that at current rates by 2030, the RTAs will rise to 2.4 million deaths each year and will be the third leading cause of death overtaking diabetes and HIV.

Ethiopia stands as one of the worst countries with respect to road safety performance in terms of traffic accident fatalities per 10,000 vehicles (95 in 2007/8. However, it is one of the best when the same is expressed in terms of traffic accident fatalities per 100,000 populations (2.84 in 2007/8). This has been cited in different local and international studies.

An assessment of road accidents made in Ethiopia highlighted that the country has one of the world's worst accident records, 170 fatalities per 10,000 vehicles. On the other hand, the fatality risk per head of population was one of the lowest, at 3 per 100,000 populations in 1994/5, due to the low level of motorization. The accident cost analysis made during the study gave an estimate economic cost of traffic accident between 340-430 million ETB which is 0.8 -0.9 % of the gross domestic product in 1999.

The occurrence of traffic accidents in the country is increasing as the exposure to this risk increases with rapid motorization (without appropriate regulation), rapid population growth, and increase in the road network coupled with poor attitude and safety culture of road users.

2.2 Operational Definition of Key Concepts /Words.

Road Traffic Accident; A collision involving at least one vehicle in motion on a public or private road that results in at least one person being injured or killed

Road Traffic Management: It is planning, coordinating, controlling and organizing traffic to achieve efficiency and effectiveness of the existing road capacity.

Traffic Accidents are defined as major problems in both developed and developing countries, albeit related to different historical reasons and circumstances. The single, clear, common feature is the impact caused by the use the automobile. Or traffic accident are major public health problems which are leading causes of death for males aged 15-44 and fifth greatest cause of death for women of the same age group.

Road Traffic; A Movement of people, animals and vehicles from one place to another along roads and streets.

Road Is defined as a good network for rapid growth of the city for its existence. As parks, gardens, open spaces are “lungs “so also roads are arteries of the city.

Road Traffic Management System a road traffic management system is defined as a system or plat forms which has innovative solution for the dynamic supervision, regulation and control of traffic on motor ways, highways, in tunnels and at junctions.

Black-Spot: A location on the road network where a high number of casualties and crashes have occurred.

Traffic Composition: - Form and structure of different modes of transport which are motorized and non-motorized, that share the same road network.

Transport: it is a means of moving people and goods from place to place It is understood that transport systems are rail, road, metros, air etc.

But in this study, the term transport is used to denote the road transport.

Road Traffic Injuries: fatal or non-fatal injuries incurred as a result of road traffic crash.

Road Traffic Fatality: A death occurring within 30 days of the road traffic crash.

Vulnerable Road Users: Road users most at risk in traffic, such as pedestrian, cyclists and public transport passengers. Children, old people, and disable people are also included in this category.

Traffic Mix: Form and structure of different modes of transport, motorized and non-motorized, that share the same road network.

Transportation System: it is defined as a system consisting of the fixed facilities, the flow of entities and the control system that permits people and goods to overcome the fraction of geographical space efficiently in order to participate in a timely manner in some desired activity.

2 .3 Few Causes of car accidents

Every year, car accidents result in hundreds of thousands of injuries and loss of human life around the world. In fact, traffic collisions are the leading causes that can be preventable. Thus, it is important to have an understanding as to the leading factors contributing to car accidents. A list of the leading causes of traffic accidents is provided below.

1. Speeding while driving and Reckless Driving: Failing to follow the speed limit is the most common cause of traffic accidents.

2. Use of Mobile Phone – Texting While Driving: The proliferation of mobile phone use has resulted in an increased level of danger on the roads. In response national and state legislatures have passed strict anti-texting laws; while the judicial system has begun to charge individuals whose texting while driving resulted in deaths, with manslaughter.

3. Other forms of Distracted Driving - There are numerous types of distracted driving. Some of the most common types of distractions resulting in high incidences of traffic accidents include, eating, smoking, listening to loud music or changing the dial, reaching for objects in the vehicle, and looking or talking with other passengers in the vehicle.

4. Driver Fatigue – Falling Asleep on the Wheel – According to recently published data driver fatigue is the cause of 2.5-3.0 percent of all roadway related fatalities. Individuals who have a history of falling asleep at the wheel should be prosecuted for a criminal offense.

5. Drunk Driving – and Driving While under the influence of a Narcotic Substance: According to studies driving while under the influence of alcohol results in a 900% increase in the probability of an accident.

2.4 Road Safety in Road Infrastructures

The road agencies in Ethiopia, the Ethiopian Roads Authority, Regional Rural Road Authorities, and City Roads Authorities, generally considers safety in road design, construction, and maintenance works as their routine task of making allowance for designing road elements, posting road signs and pavement markings. The Two Year Action Plan with respect to introducing road safety in the road sector has not been realized. Road safety improvements works based on detailed accident black spot studies are generally very limited. The road infrastructure generally lacks due consideration of safety. One can observe easily unsafe sections of the road network due to lack of appropriate safety considerations during design, construction, and/or maintenance. Consequently, the contribution of unsafe road environment in causing road traffic accidents or worsening the severity of traffic accidents is significant.

Safety audit of the existing and new roads is very essential. This will help to consider safety during the design stage for new roads and provide safety features such as barriers, traffic signs

and markings, pedestrian facilities, self-enforcing speed controlling devices and others wherever demanded on existing roads. A draft road safety audit has been prepared by ERA, but this has not been finalized and implemented. Safety improvement works for existing roads can also be made with detailed black spot studies. This however, requires improving the traffic accident reporting and data management system.

Road transport in urban areas, particularly in the main cities is characterized by high traffic congestion and accidents due to mainly inadequate traffic management and unsafe road network infrastructure facilities with poor planning control and hierarchical system. As a result of inadequacy in controlling urban master plans, major developments are made linearly adjacent to the arterial road network without any form of access control and considerations of pedestrian and parking facilities.

The capacity of the existing road infrastructure is not optimally availed due to improper use, misuse, and abuse. Although a huge investment is being made on expanding and upgrading the road infrastructure, poor traffic management coupled with inadequacies in controlling the master plan and the existing road network has made Addis Ababa a city with increasing traffic congestion and accidents.

One of the main problems with respect to safety of road infrastructures in Ethiopia is that main roads pass through built -up areas with little or without any safety considerations. According to ERA design standard, the typical urban cross-section is four lanes (the outer lanes for parking). Commonly, this is provided without any physical means of delineating parking lanes and sidewalks from the travelled ways. Such wide cross-section without any types of self-enforcing physical means of reducing speed encourages the through traffic to pass urban areas with a speed higher than the speed limits. This unsafe road environment creates conflicts between the through and local traffic which coupled with unsafe attitude and behaviour of road users creates the worst traffic safety situation in built-up areas.

Recognizing the importance of road transport for the socio -economic development of the country, the Government of Ethiopia is implementing Road Sector Development Programs since 1997. The assessment made in this case study on the existing institutional organization and safety performance in the country shows that the road safety works and its management system is not coping with the magnitude of traffic accident problems and the worsening situation related to the rate of road network expansion, population, and motorization.

This requires the Government and all stakeholders to immediately understand the situation and start taking measures to address the problem in sustainable way.

2.5 Effect of Road Way Segment Elements on Road Safety

2.5.1 Lane Width on Safety of Urban Roads

Highway design policies for arterial roadways indicate a preference for the use of 3.6-m (12-ft) lane widths, but also indicate flexibility for use of narrower lanes where 3.6-m (12-ft) lanes are infeasible or impractical.

The geometric design practices related to lane width must consider the needs of motor vehicle, pedestrian, and bicycle traffic. The AASHTO Policy on Geometric Design of Highways and Streets, commonly known as the Green Book, offers guidelines on the selection of appropriate lane widths on urban and suburban arterials considering primarily the needs of motor vehicle traffic. In Chapter 7 of the Green Book, lane widths from 3.0 to 3.6 m (10 to 12 ft) are addressed along with specific circumstances for which each width should be considered.

The "conventional wisdom" of most highway engineers is that use of narrower lanes in the design of a roadway will result in more crashes if other design characteristics of the roadway remain unchanged. This has been demonstrated for lane widths on rural two-lane highways, but there is no definitive research on the safety effect of lane widths for urban and suburban arterials. If narrower lanes can be used on urban and suburban arterials without affecting safety negatively, there may be many other benefits to highway agencies and highway users.

The use of narrower through-traffic lanes may have advantages in some situations on arterials because this may reduce pedestrian crossing distances and may provide space for additional through lanes, auxiliary lanes, bicycle lanes, buffer areas between travel lanes and sidewalks, and placement of roadside hardware. However, the use of narrower lanes has been accompanied by concerns that reducing lane widths could increase crash frequencies. Highway agencies would be reluctant to look for benefits from using narrower lanes if crashes would be increased, but there are no definitive studies in the literature that address the relationship between lane width and safety for midblock segments of urban and suburban arterials.

A number of past studies have been conducted to determine the traffic safety effects of lane width, but the results of these studies are varied.

Despite the extensive research that has been conducted on the effect of lane width on motor vehicle safety, it is difficult to draw any definite conclusions about the relationship. (Ingrid B. Potts, Douglas W. Harwood, and Karen R. Richard, n.d.)

In the past, wider lanes have been assumed to be beneficial to safety for two reasons. First, wider lanes should increase the average separation between vehicles in adjacent lanes. This may provide a wider buffer to absorb any deviation of vehicles from their intended path. However, drivers adapt to the road they see. Wider lanes tend to induce somewhat faster travel speeds (as evident in the relationship between lane width and free flow speed, and may induce closer following. Whether this complex adaptation to wider lanes increases or decreases safety cannot be determined using intuition or engineering judgment.

Second, wider lanes may provide more room for driver correction in near-accident circumstances. For example, on a roadway with narrow lanes, a moment in attention may lead a vehicle over the pavement edge-drop and onto a gravel shoulder, but if the lane is wider and the shoulder paved, the same inattention will provide greater opportunity to maintain the vehicle on the paved surface. In these near-accident circumstances, it will be difficult to separate between the effect of lane width, shoulder width, shoulder paving, edge-drops, etc. It is likely that lane width plays a somewhat different role in single and multi-lane roads. The lane width requirements for single-lane roads were originally derived from the observation of driver behaviour.

The lane width at which drivers did not feel the need to shift to the right when meeting an oncoming truck was deemed appropriate. The same criterion may apply to the inner lane of an undivided multi-lane lane road, but it may not apply to the other lanes or to divided roads (Hauer, 2000).

When road sections differ in lane width they tend to differ also in other important respects. This makes the isolation of the safety effect of lane width difficult. There is, however, one issue on which opinions differ. Most early researchers found that the safety benefit of lane widening bottoms out somewhere between 11 ft and 12 ft. Further widening seemed to be to the detriment of safety.

Later researchers, using perhaps better data and methods of analysis, unfortunately choose to use in their models a functional form that can never reach a „bottom“. Nor is there any evidence in their work that before choosing this functional form they examined whether their data

indicated an increase in crashes for wider lanes.For this reason, in Hauer's opinion, the weight of the extant empirical evidence indicates that there is little safety benefit to be obtained from widening lanes beyond 11 ft and that widening beyond 12 ft may be to the detriment of safety (on two-lane roads) (Anon., n.d.).

There is some empirical evidence about the safety effect of reducing lane width on urban arterials and freeways when the aim is to add a lane to increase capacity. This evidence is difficult to interpret in terms of the safety effect of lane width because when a lane is added (even when no other changes are made) the flow/lane is significantly changed (Anon., n.d.).

It is generally recognized that narrower lanes are associated with poorer safety performance than their wider lanes counterparts. One way the published literature has addressed safety assessment is through the use of crash modification factors (CMFs). A CMF is a multiplicative factor that represents the predicted influence a change may have on the number of crashes. A value of 1.0 indicates that little, if any, changes in safety performance can be expected for a specific treatment or combination of treatments (multiplying by a value of 1.0 would not alter the number of predicted crashes). A CMF value greater than 1.0 represents an increase in the number of crashes. For example, a CMF with a value of 1.11 represents an 11 percent increase in crashes

table 2. 1:- Lane width CMF values for Texas Urban Freeways (Injury and Fatal Crashes)

Lane width(ft.)	Number of through lane (in one direction)			
	2	3	4	5
10	1.07	1.06	1.06	1.07
10.5	1.06	1.05	1.05	1.05
11	1.04	1.03	1.03	1.03
11.5	1.02	1.02	1.02	1.02
12	1.00	1.00	1.00	1.00
Base condition lane width of 12 ft				

Source: developed from procedures presented in the roadway safety design workbook (bonneson and pratt,2009)

Wikipedia states that, certain types of crashes, termed "lane departure crashes", are more likely on roads with narrow lanes. These include run-off-road collisions, sideswipes, and head-on collisions. For two-lane rural roads carrying over 2000 vehicles per day, the expected increase in crashes is as shown below.

2.6 Safety Effects of Alignment

2.6.1 Horizontal Alignment

The horizontal alignment is the route of the highway, defined as a series of horizontal tangents and curves. Horizontal curve is the curve in plan to change the direction of the canter line of the highway. The geometries of horizontal alignment are based on an appropriate relationship between design speed and curvature and on their joint relationship with super elevation and side friction.

Wikipedia gives the following formula to assess the safety effects of horizontal curves, length of curve, curve radius and super elevation of road way. The safety of a horizontal curve is affected by the length of the curve, the curve radius, whether spiral transition curves are used, and the super-elevation of the roadway. For a given curve deflection, crashes are more likely on curves with a smaller radius. Spiral transitions decrease crashes, and insufficient super-elevation increases crashes (Anon., n.d.). A safety performance function to model curve performance on two-lane roads is: Where AMF = Accident modification factor, a multiplier that describes how many more crashes are likely to occur on the curve compared to a straight road, Lc = Length of the horizontal curve in miles, R = Radius of the curve in feet, S = 1 if spiral transition curves are present or 0 if spiral transition curves are absent.

2.6.2 Vertical Alignment

2.6.2.1 Effect of Shoulder Width on Safety

Vertical alignment is the longitudinal section of a roadway to provide easy and safe change of gradient. It is defined as a series of gradients and vertical curves. Gradient is the rate of rise or fall with respect to the horizontal along the length of a road expressed as a percentage or as The main purposes of paving shoulders are: Accommodate stopped vehicles so that they do not encroach on the travelled lane, Facilitate roadway maintenance, Facilitate access by emergency vehicles, Protect the structural integrity of the pavement, Provide space for slower vehicles to

move over and allow faster vehicles to pass (in some driving cultures) and to protect the physical road structure from water damage, to protect the shoulder from erosion by stray vehicles, and to enhance controllability of stray vehicles. As a by-product of these purposes, the paved shoulder provides a fairly even and obstacle free surface.

It follows that the net safety effect of shoulders is a sum of several possibly opposite tendencies the beneficial effect of allowing for the safe recovery of stray vehicles, and the detrimental tendencies of inviting some voluntary shoulder stops, faster travel, the possibility of steeper roadside slopes, and shoulder use for travel.

Several factors make it difficult to extract the safety effect of shoulder width and shoulder paving from empirical evidence. For example, narrow lanes, narrow unpaved shoulders, and an unforgiving roadside often go hand-in-hand. This tendency comes about for three reasons. First, many geometric design standards relate to the amount of traffic. Roads with little traffic tend to have narrower lanes and shoulders, steeper side-slopes, sharper curves, shorter sight-distances, etc. Second, if a cross-section has to fit within a given right-of-way width, making the shoulder wider must mean that the side-slope will be steeper or the lane narrower.

The third reason for the close association between road features is temporal. There has been a historical evolution towards more generous highway design standards. Thus, older roads tend to have narrower lanes and shoulders than newly designed roads (Adapted from Hauer, n.d.)

Shoulders placed adjacent to travel lanes accomplish several functions including emergency stop and pull off, recovery area for driver error, and pavement edge support (AASHTO, 2004). However, the use of shoulders to provide an area for a stopped vehicle poses a hazard since past research has shown that 11% of fatal freeway crashes are related to vehicles stopped on shoulders (Agent, K. R., et al.).

There are also some evidences that wider shoulders may encourage higher operating speeds because they may communicate to the driver the presence of wider space for correcting errors. Finally, number of lanes, lane width, and shoulder width are all somewhat interrelated, and the geometric value choice for any of these elements typically has an effect on the other elements

table 2. 2:- recommend AMFS for average shoulder width (ft.)

Category	Average shoulder width(ft.)^2						
	0	3	4	5	6	7	8
Undivided	1.22	1.00	0.94	0.87	0.82	0.76	0.71
Divided	1.17	1.00	0.95	0.90	0.85	0.81	0.71

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2.6.2.2 Effect of Median Width and Absence on Safety

The principal purposes of providing medians are to: Separate opposing traffic streams; Provide a recovery area for out-of-control vehicles; Provide a place where vehicles can stop in emergencies; Allow for the accommodation of left-turn lanes and openings for left or U-turn manoeuvre's; Reduce oncoming-vehicle headlight glare (median barrier); and, Serve as a reserve for additional future travel lanes.

Additional benefits from medians include the provision of recovery area for errant drivers, accommodation of left-turn movements, and the provision for emergency stopping. Median design issues typically address the presence of the median, along with type and width. There is some research on these issues and their implications on safety. A review by Hauer indicated that it was not possible to identify AMFs for median width but rather noted three safety trends: (1) cross-median crashes (i.e., opposing vehicles) are reduced with wider medians; (2) median related crashes increase as the median width increases with a peak at about 30 ft. and then decrease as the median becomes wider than 30 ft; and (3) the effect of median width on total crashes is questionable.

The study conducted by Hadi et al. using negative binomial models showed that the median width has an influence on multilane roadways, and they produced two models based on the traffic volume range and number of lanes. This is the only study that has examined the effect of median width on safety for multilane roads since the several studies reviewed by Hauer and the NCHRP Project 17-27 Interim Report deal with freeway median width (Anon., 2009).

Medians are paved or landscaped areas in the middle of roadways that separate traffic travelling in opposite directions. Medians should be provided whenever possible on multi-lane arterial roadways. A restrictive median with well-designed median openings is one of the most important tools to create a safe and efficient highway system. The design and placement of median openings is an integral component of a corridor that manages access and minimizes conflicts.

Research has shown that restrictive medians have a significant safety benefit. In 1993, an evaluation of urban multilane facilities in Florida revealed that the crash rate for corridors with restrictive medians is 25% lower than those with centre turn lanes (Gary Long, Ph.D., P.E., Cheng-Tin Gan, Bradley S. Morrison, n.d.)

Although medians have significant benefit for vehicle operations, they are also beneficial for pedestrians. Pedestrians are permitted to travel along all non-limited access facilities. Restrictive medians provide a refuge for pedestrians crossing the highway. Fewer pedestrian injuries occur on roads with restrictive medians.

When pedestrian crossing treatments are incorporated into restrictive medians, a complete pedestrian network is provided resulting in improved connectivity. Pedestrians, transit riders, and cyclists are all users of all non-limited access facilities. Note that bicyclists, for design purposes, are considered vehicles when operating within the roadway and pedestrians when operating within the sidewalk area. When conflict points are well managed as part of a comprehensive approach, all users of the roadway benefit from improved safety and operations. Other research has shown that the presence of restrictive medians makes the environment safer for pedestrians.

Pedestrians were nearly half as likely to be involved in a mid-block crash on facilities with restrictive medians (Brian Lee Bowman, Robert L., 1994). Midblock locations account for more than 70 percent of pedestrian fatalities. This is where vehicle travel speeds are higher, contributing to the larger injury and fatality rate seen at these locations. More than 80 percent of pedestrians die when hit by vehicles travelling at 40 mph or faster while less than 10 percent die when hit at 20 mph or less. Installing such raised channelization on approaches to multi-lane intersections has been shown to be especially effective.

Medians are a particularly important pedestrian safety countermeasure in areas where pedestrians access a transit stop or other clear origins/destinations across from each other. Providing raised medians or pedestrian refuge areas at marked crosswalks has demonstrated a 46 percent reduction in pedestrian crashes. At unmarked crosswalk locations, medians have demonstrated a 39 percent reduction in pedestrian crashes. Therefore, considerations for pedestrian safety and mobility should be included in median design decisions.

Pedestrian crashes account for about 12 percent of all traffic fatalities annually. Over 75 percent of these fatalities occur at non-intersection locations. On average, a pedestrian is killed in a motor vehicle crash every 120 minutes and one is injured every 8 minutes (NHTSA, 2009).

2.7 Effects of Traffic Control Devices on Safety

The majority of accidents involving injury occur within urban areas often at junctions, while the number of fatalities outside these areas is greater, largely as a result of higher speed. The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a temporary traffic control zone must be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents (Work Zone Standard of America).

Road user and worker safety and accessibility should be an integral and high priority element of every project from planning through design and construction. Road user movement should be inhibited as little as practical. Motorists, bicyclists, and pedestrians should be guided in a clear and positive manner. To provide acceptable levels of operations, routine day and night inspections of the work zone should be performed Attention should be given to the maintenance of roadside safety during the life of the work zone good public relations should be maintained.

3. MATERIALS AND METHODS

3.1 Description of the Study Area

3.1.1 Location

Wolkite is a city and separate woreda in south-western Ethiopia. The administrative centre of the Gurage Zone of the Southern Nations, Nationalities and Peoples' Region (SNNPR), this town has a latitude and longitude of 8°17′N 37°47′E and an elevation between 1910 and 1935 meters above sea level. It is surrounded by Kebena woreda and it is part of former Goro woreda.

Since the city is in the midway on the road between Addis and Jima, trade is the major economic activity employed in the town, which most passengers who passes through the city use it as a transit and involved in various transactions. Hence, the residents of the city are primarily depending on retail and whole sale trade.

The volume of vehicles is directly proportional to the population of the city. Being the city of large population, special consideration should be given to safety of the road users in order to reduce the road traffic accidents.

3.1.2 Population

Based on the Central Statistical Agency (2007) report, this town has a total population of 28,866, of whom 15,074 are men and 13,792 women. The plurality of the inhabitants practiced Ethiopian Orthodox Christianity, with 48.17% of the population reporting that belief, while 42.31% are Muslims, 7.86% are Protestants, and 1.34% is Catholic.

3.1.3 Geographical Configuration

Astronomically wolkite city is located at a latitude and longitude of 8°17‟N, 37°47‟E and an elevation between 1960 and 1935 meters above a see level.

3.1.4 Topography

Topography of the town is characterized by flat table land, slightly inclined in all directions. There are four rivers surrounding the town flowing in different directions, these are Wabe, Gibe, Walga and Rebu. The town has also elongated shape that extends from northeast to southeast direction and it covers a total area of 10.3km2 and the area increased to 79.84km2 as it is integrated with Gubre town (Wolkite town municipality, 2012). The principal natural constraints for the physical expansion of the town are hills, plains, gorges and steep slopes and its manmade constraints are illegal settlements (Wolkite town municipality, 2012)

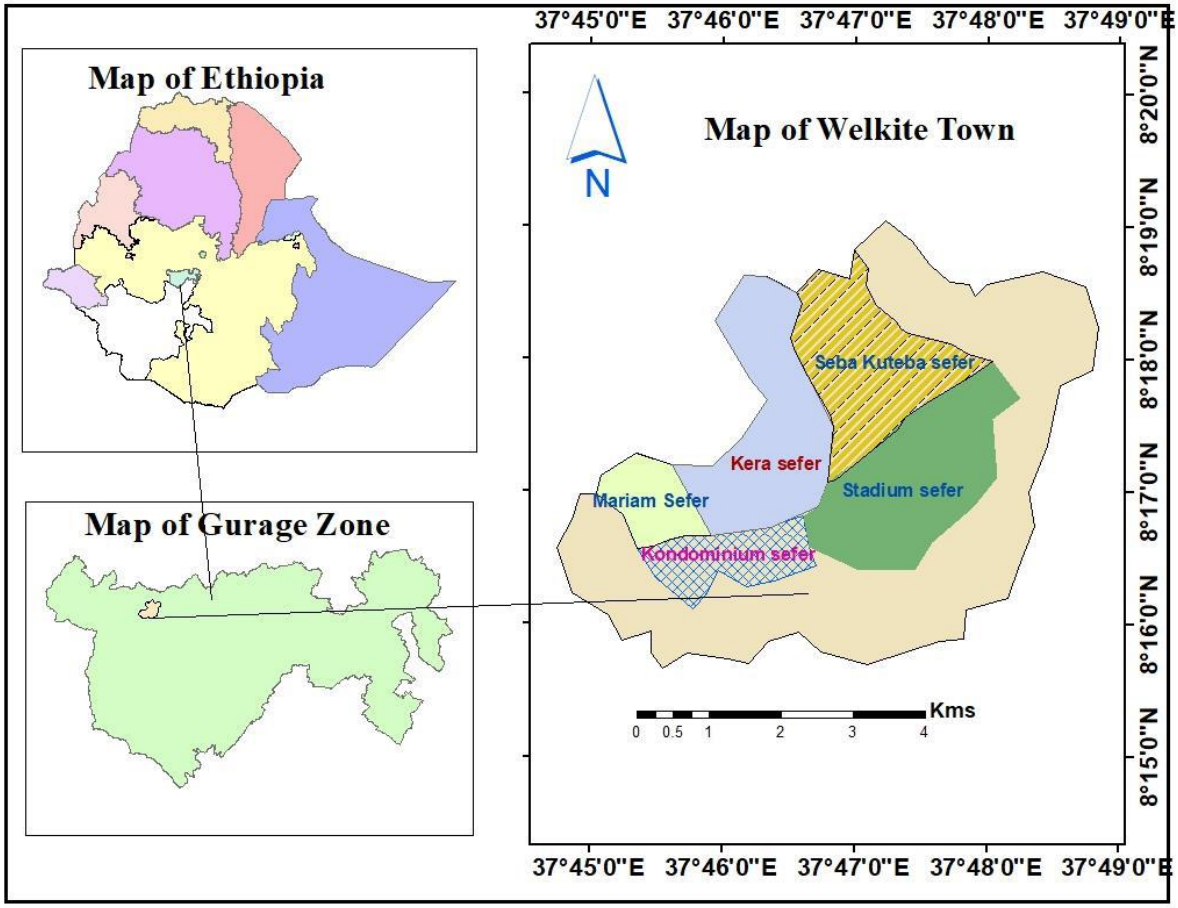

figure 3.1. Location map of wolkite town (Google map)

3.2 Methods of Data collection

The study uses observation to collect valuable data. The study also uses quantitative data which were collected from wolkite city administration police office. The data for lane width, shoulder width and median width may be collected through field measurement. The segment of the road is selected and the lane width, shoulder width and median width will be measured at several points.

The data is presented in table. For traffic control devices, the length of the selected road segment without traffic markings and signs are measured. Then the average value will be calculated and presented in table. For traffic signals, since the data needed is observational, observation will be used to collect the data.

3.2.1 Data Collection procedure and source of data

In order to achieve the objectives of the study, both primary and secondary data were used. The primary data were obtained from three different questionnaires that were distributed to all vehicle drivers and pedestrians who were around and traffic police officers.
The secondary data were collected from, wolkite city traffic police office.
The data collected is presented by table and graph to ease the understanding of the data and analysis.
For the purpose of analysing of safety problems and suggesting countermeasures, information is needed on crashes or accidents, and it is desired to relate crashes to exposure. Some measure of traffic volumes is also necessary; therefore, the necessary reliable data that were collected are accident data, road data, traffic data, and field observations.

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3.2.2.1 Road accident data

Road accident data wear collected from Wolkite city traffic Police office booklet. compiled by traffic police officers during 2011-2013 and from wolkite city traffic Police office.

From these, the collected data includes; Location, name and classification of the road & intersection; Location type of the area that is nearest for college, religious, recreation, office complex, hospital and others by Date, month, years, day of the week, time.
Light conditions (day light, dark hour) Classification of the accident (fatal, serious injury, light injury, property damage only); Type of the vehicle and manufacture years; Involvement (pedestrian, animal and other objects); Nature of the accident (over turning, head-on collision, rear-end collision); Name, sex, age, education, address of the driver, type and license number,

Vehicle involved (load, vehicle defect / brake, steering tires and other); and

Other than drivers involved in accidents (age, status).

3.2.2.2 Road data

The road data collected from Wolkite City municipality and field observation includes;

Road way (number of lanes, lane width, surface condition): Vertical Alignment (sight distance (m)); Shoulder width (m), surface condition (good / bad); and Traffic control (Guide sign, Lighting, Marking), and Median (median width (m).

3.3 Methods of Data analysis

This research shows briefly the review of the study of road traffic accidents analysis done on the previous 3 years' data from Wolkite City traffic Police Office and Questionnaires collected from Wolkite city pedestrians, vehicle drivers and traffic police officers.

4 RESULT AND DISCUSSIONS

4.1 Analysis of Road Traffic Accident in Wolkite city

The data collected may be analyzed to provide the desired output by either correlation analysis or regression analysis developed elsewhere with appropriate caution. The calculation is analyzed with respect to standards acceptable for our country. After the analysis is finished, the output of the analysis shall be presented by model. It means that, graphical model shall be prepared to indicate the interaction of variables with each other.

4.2 Distribution of Road Accidents by Day and Year

The following chart shows detail road traffic accident data distribution for daily amount of traffic. Accident that occurred in the past 3 years in each day. According to this chart, there are a large number of accidents occurring every day throughout a weak and year. This is because wolkite is center city to all neighbor city. Therefore, we can see the overall traffic accident of day today throughout a year in the following table.

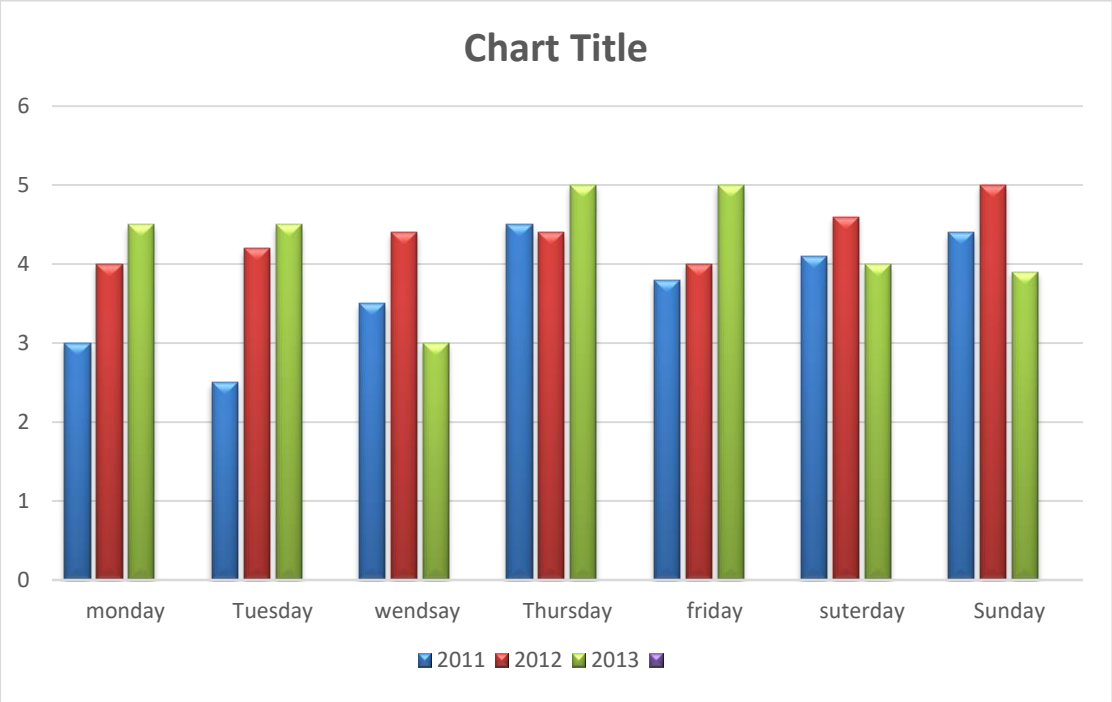

Figure 2. Distribution of Road Accidents by Day and Year

4.3 Distribution of Road Accidents by Age Group

The following charts shows there is a higher number of accidents by adult people under age group of 18-30 years, on this age group, most of adult people participate in a society actively and due to this reason they put their life in danger among all group of people. and also young people are more emotional for many things so they got accident more frequently than other people.

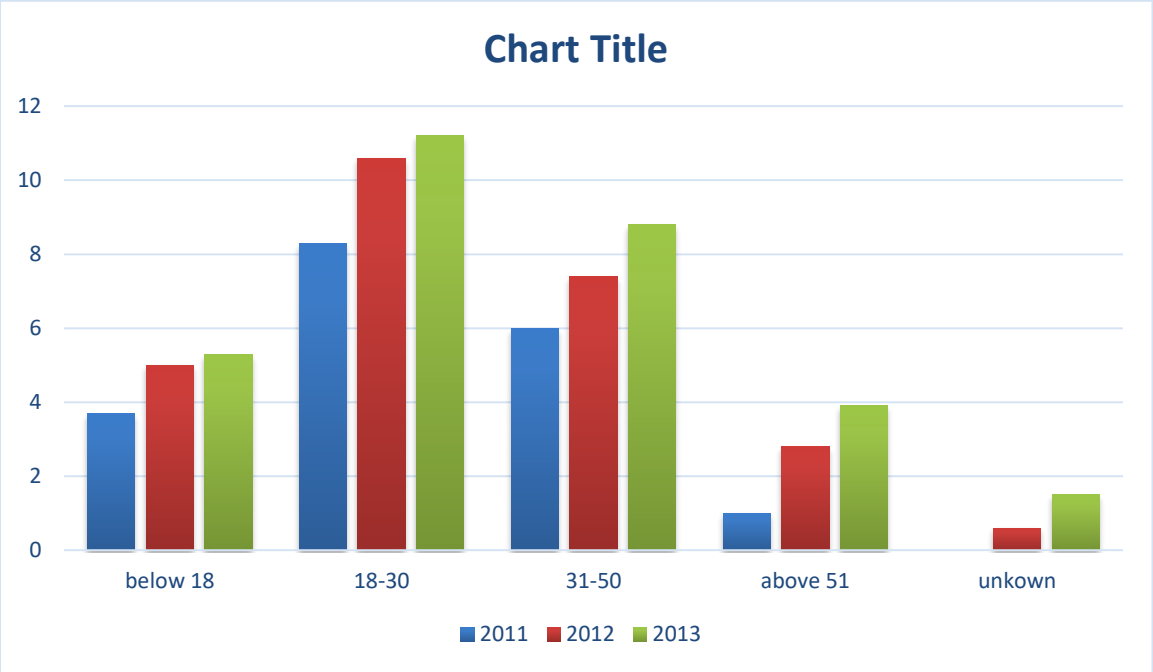

Figure 3. Distribution of Road Accidents by Age Group

4.4 Distribution of Road Accidents by Gender

The following chart shows that, males are more vulnerable to accident than females, and this is because the number of male drivers are greater in number compared to females. The other reason is females are more protective than males during driving. so male drivers cause more traffic accident than female.

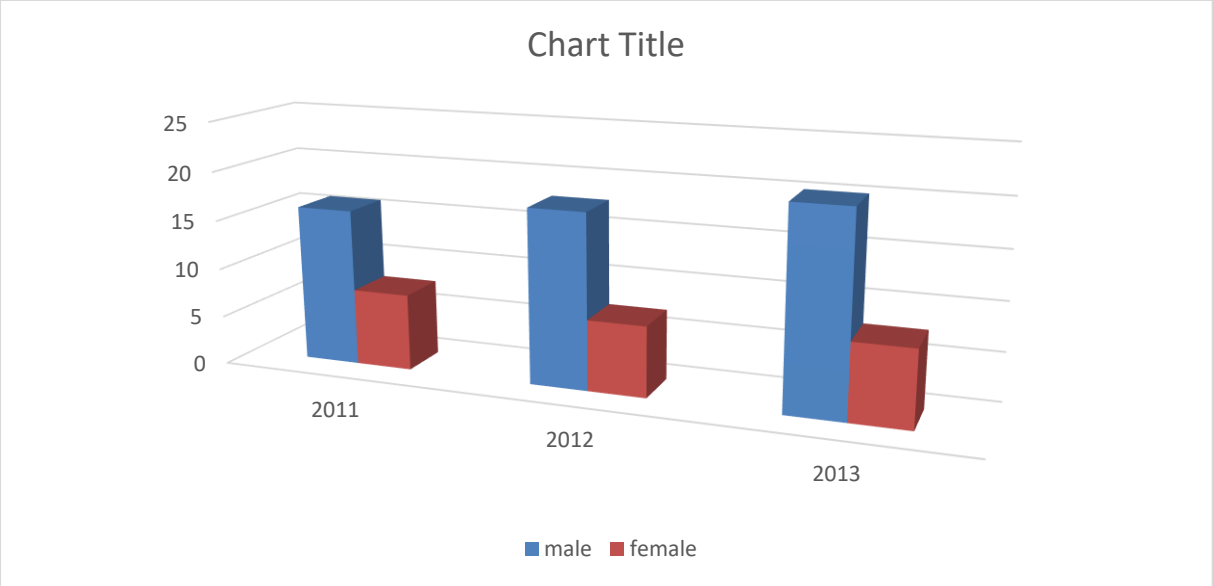

Figure 4. Distribution of Road Accidents by Gender

4.5 Distribution of Road Accidents by Hours

The next chart shows, distribution of traffic accident with time difference throughout a day and the chart shows the most critical time for traffic accident is from morning 2:00-3:00 local time and 11:00-1200 local time because this two times are the class entrance or work entrance times and the releasing from work place times so accidents are most common.

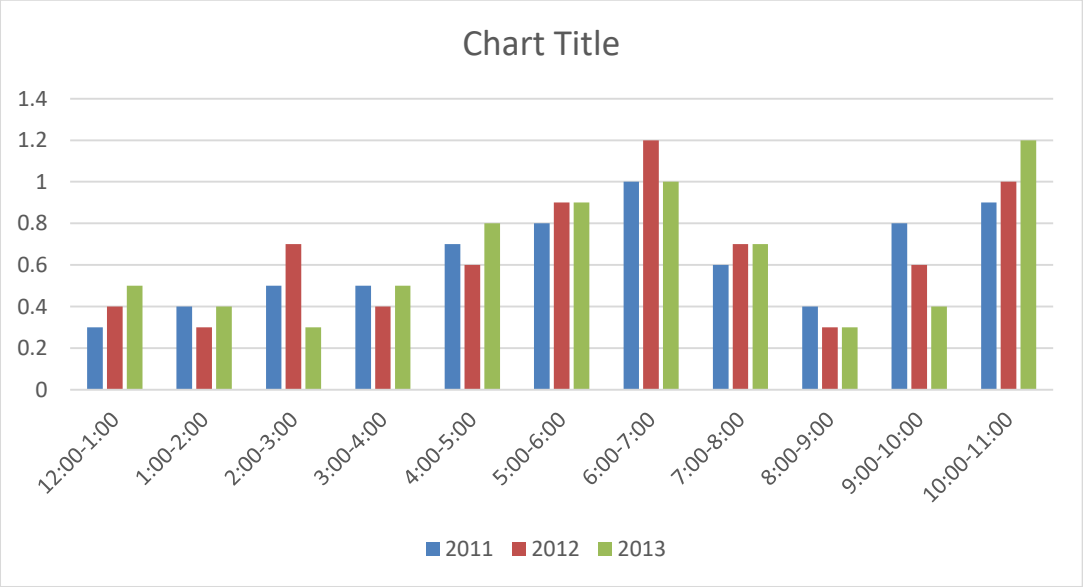

Figure 5. Distribution of Road Accidents by Hours

4.6 Distribution of Road Accidents by Accident Location Area

Analyzing the most potential different traffic accident location is important to assess its priority, to know the place and put black spot marking for this location. According to wolkite city traffic police office, the traffic accident allocation indicated most of the accidents happen at the school place and market area.

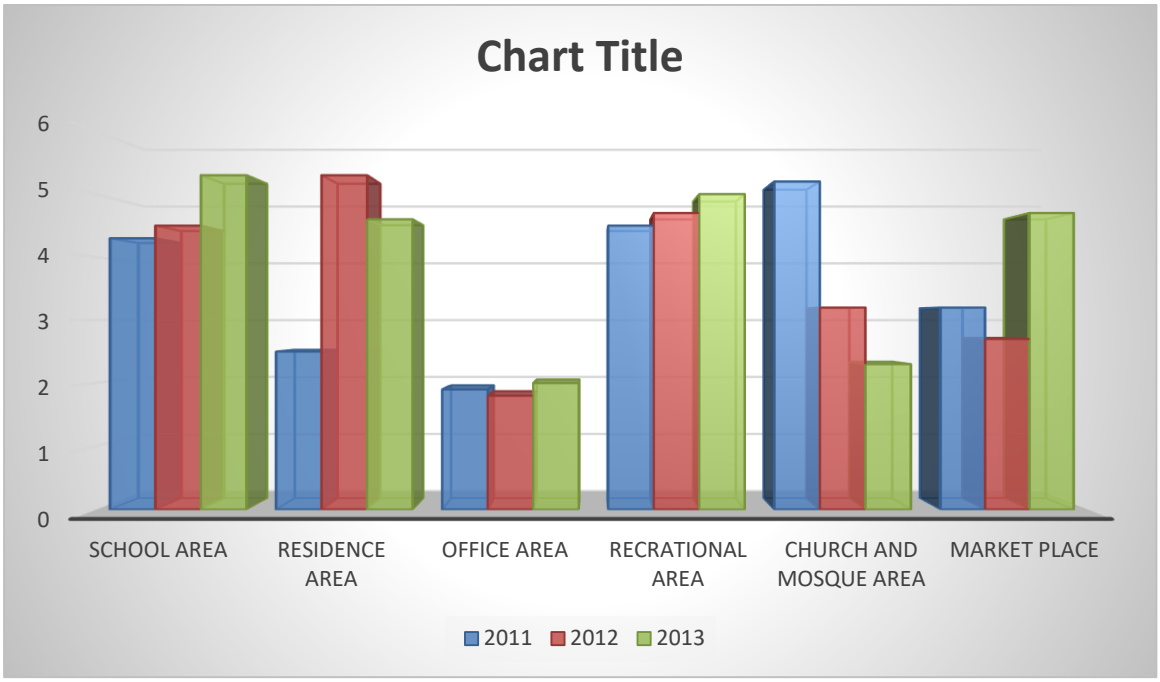

Figure 6. Distribution of Road Accidents by Accident Location Area

4.7 Analysis of Interview and Questionnaires

A total of 25 questionnaires were distributed equally for drivers, pedestrian and traffic police. 23 questionnaires were returned back with complete answer for each question. On other hand to full fill the gap of population which is not returns the questioners form, the study conducts an interview for the pedestrian, police officer, driver to full fill this gap.

Questionnaire for pedestrians

table 4. 1: - pedestrian compiled questioners respond about RTA in wolkite city

Items	**Questioner for pedestrians**	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Do you Agree the amount of traffic accidents in wolkite city is greater compare to other cities?	2	4	1	2	1
2	Do you Agree you and other pedestrian follow the traffic regulations like crossing road using on zebra crossing to protect from traffic accidents in wolkite city?	3	3	1	2	1
3	Do you Agree most of the traffic accidents occurs in wolkite city is b/c of drivers do not given apriority to a pedestrian?	3	4	2	1	0
4	Traffic safety education and training about traffic accidents is given for drivers and pedestrian is adequate in wolkite city?	2	0	3	4	1
5	Do you Agree most of the traffic accidents occurs in wolkite city is at the same location and is that necessary to put a black spot location?	3	4	0	2	1
6	Is there adequate number of traffic police? traffic regulation, traffic sign and road environment available to reduce traffic accident in wolkite city?	2	3	2	2	1
7	Are you comfortable walking and crossing zebra without any	3	2	1	2	1

	problems using wolkite city pedestrian road pavement?					
8	Do you think available traffic rules and regulations can reduce traffic accidents?	4	3	0	2	1

Questionnaire for drivers

table 4. 2: - Drivers compiled questioners respond about RTA in wolkite city

Items	**Questioner for pedestrians**	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Do you Agree the amount of traffic accidents in wolkite city is greater compare to other cities?	1	1	3	5	0
2	Do you Agree you and other pedestrian follow the traffic regulations like crossing road using on zebra crossing to protect from traffic accidents in wolkite city?	2	1	0	4	3
3	Do you Agree most of the traffic accidents occurs in wolkite city is b/c of drivers do not given apriority to a pedestrian?	0	3	1	4	2
4	Traffic safety education and training about traffic accidents is given for drivers and pedestrian is adequate in wolkite city?	1	2	5	2	0
5	Do you Agree most of the traffic accidents occurs in wolkite city is at the same location and is that necessary to put a black spot location?	2	2	1	3	2

6	Is there adequate number of traffic police? traffic regulation, traffic sign and road environment available to reduce traffic accident in wolkite city?	1	3	0	4	2
7	Are you comfortable walking and crossing zebra without any problems using wolkite city pedestrian road pavement?	2	5	1	1	1
8	Do you think available traffic rules and regulations can reduce traffic accidents?	4	4	1	1	0

Questionnaire for traffic police

table 4. 3 :-Traffic police compiled questioners respond about RTA in wolkite city

Items	**Questioner for pedestrians**	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Do you Agree the amount of traffic accidents in wolkite city is greater compare to other cities?	0	0	0	1	2
2	Do you Agree you and other pedestrian follow the traffic regulations like crossing road using on zebra crossing to protect from traffic accidents in wolkite city?	0	1	1	1	0
3	Do you Agree most of the traffic accidents occurs in wolkite city is b/c of drivers do not given apriority to a pedestrian?	1	1	0	1	0

4	Traffic safety education and training about traffic accidents is given for drivers and pedestrian is adequate in wolkite city?	1	1	1	0	0
5	Do you Agree most of the traffic accidents occurs in wolkite city is at the same location and is that necessary to put a black spot location?	0	1	0	2	0
6	Is there adequate number of traffic police, traffic regulation, traffic sign and road environment available to reduce traffic accident in wolkite city?	1	1	0	1	0
7	Are you comfortable walking and crossing zebra without any problems using wolkite city pedestrian road pavement?	0	1	0	2	0
8	Do you think available traffic rules and regulations can reduce traffic accidents?	1	2	0	0	0

4.8 Analysis of field observations

4.8.1 Lane width, shoulder width and median width

The following data was collected regarding the lane width, shoulder width, and median presence and absence and its width if it exists.

table 4. 4 :-Mariam sefer –yaberus secondary school road segment data

Stations	Lane width (meter)			Shoulder width (meter)		Median width
	Left	Right	Total	Left	Right	No
1	7	7.1	14.1	0	0	No
2	7.2	7.1	14.3	0	0	No
3	6.9	7	13.9	0	0	No
4	6.8	6.9	13.7	0	0	No
5	7	7	14	0	0	No
Average	7	7	14.1	0	0	_

From the table-, the roads considered have no shoulder constructed to give services for the intended purpose. There is no median on the segment but only white line is provided. The lane width has average width of 7 on the left and 7 on the right. When the pedestrian walk way of thickness 2.5 is reduced from it, these values become 4.5m and 4.5m respectively

table 4. 5:-camp safer - gubre square road segment data

Stations	Lane width (meter)			Shoulder width (meter)		Median width
	Left	right	Total	Left	Right	
1	3.3	3.3	6.6	0	0	No
2	3.2	3.4	6.6	0	0	No
3	3.3	3.2	6.5	0	0	No
4	3.25	3.3	6.5.5	0	0	No
5	3.4	3.3	6.7	0	0	No
Average	3.2	3.3	6.6	0	0	No

table 4. 6:- gubre square – Atat mezorya road segment data

Stations	Lane width (meter)			Shoulder width (meter)		Median width
	Left	right	Total	Left	Right	
1	7	7	14	2.5	2.5	No
2	6.9	7	13.9	2.4	2.4	No
3	7.1	7.2	14.3	2.5	2.4	No
4	6.8	6.9	13.7	2.4	2.3	No
5	7	7.1	14.1	2.5	2.4	No
Average	7	7	14	2.45	24	No

table 4. 7: - camp safer –Mariam sefer

Stations	Lane width (meter)			Shoulder width (meter)		Median width
	Left	right	Total	Left	Right	
1	6.7	6.6	13.3	0	0	2.0
2	6.6	6.6	13.2	0	0	2.0
3	6.8	6.7	13.5	0	0	2.0
4	6.8	6.9	13.7	0	0	0
5	6.7	6.8	13.5	0	0	0
Average	6.7	6.75	13.45	0	0	2

4.8.2 Traffic signs

In general, traffic signs fall into one of three major categories:

- **Regulatory signs -** convey information concerning specific traffic regulations.

  Regulations may relate to right-of-way, speed limits, lane usage, parking, or a variety of other functions.

- **Warning signs -** are used to inform drivers about upcoming hazards that they might not see or otherwise discern in time to safely react.
- **Guide signs -** provide information on routes, destinations, and services that drivers may be seeking. Some roads in wolkite city have no Traffic signs.

During data analysis step we organized the data that obtained from wolkite city traffic Police office, from Questionnaires, Interviews and Field observation. After that we analysed the data to meet our major objective. Now in Result and Discussion we are going to present the result obtained from the data analysis and then we discuss every points in this step. From our data analysis we can obtain the road traffic accident by day and year, by gender, by age group, by hour, by location area.

i. By day and year

Obviously it is difficult to pick a single day that we think it is a day more accident may occur this is because as we mentioned above the accident caused is nearly equal all over the weak since similar activities done every it is difficult to pick one.

ii. By age group

According to statistical data from wolkite city traffic Police Office Traffic Regulation department age grouped of 18- 30 are very sensitivity and commits large number of accident for the past 3 years. These age groups are mostly young people and active in the society because of their age fast thinking they create seriously large number of traffic accident.

iii. By gender

From the chart above male people create more accident than female ones and this is because the male drivers are more than that of female drivers. In our society males are considered as more responsible than females. There for mostly the society prefer male drivers than female so the number of male drivers increase the number of accidents created by male drivers will increase.

iv. By location area

Traffic accident in wolkite city is critical on some specific areas. Those are school areas and recreation areas. As we can see on above chart this area are very critical and large number of accidents are recorded. This is because around school areas a number of students are present and these students are very young and they are exposed to road traffic accident. Around recreation areas mostly young people use drugs and get drunk and commit traffic accident.

v. By hour

From the above chart we can observed that from the day time 2:00 -3:00 and 11:00-12:00 are the most critical times in which large no accidents are recorded. This is because mostly in the morning students may go to school and workers may start to move for their personal issues. At the evening time every people may start to come back to their residence so traffic congestion occurs, so it facilitates traffic accident.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The statistical analysis in this study clearly shows that the road traffic accident is at a higher risk. Although the rate varies from year to year, there is an average cumulative growth of accident.

This study suggested a method to prediction accidents by considering physical and traffic characteristics of each road. For this, we analysed road-characteristic causes to accidents of roads and selected road-characteristics causes affected accidents analysing the relations between causes and accidents.

From the research and the inferential statistics test results indicates that drivers are the prime responsible agents to cause road traffic accidents in wolkite city than pedestrians vehicles maintenance problems, absence or improper fixation of traffic and road signs, environmental problems and road engineering, and any other.

The second major cause for the occurrence of road traffic accident in wolkite city is High rate of congestion at peak hours, at spot black location like the school place and recreational centres and hence high rate of traffic accidents. The other major cause for the occurrence of road traffic accident is the geometric design elements and some roads have been eroded. The roads considered have no shoulder constructed to give services for the intended purpose. There is no median on the segment but only white line is provided.

The last determining factor for the occurrence of road traffic accident in wolkite city is speedy driving, Poor quality of roads, pedestrian walkways, Lack of lane for bicycle and cart, Traffic road signs / signals invisibility and lack of planned maintenance.

5.2 Recommendations

According to the analysis of traffic police accident data, the majority of the contributing factors for the occurrence of road traffic accidents in the city are driver fault followed by pedestrians. This is an issue which needs high level of attention and political commitment. So, the government with its lower concerned bodies like the Ethiopian Road and Traffic Authority in collaboration with other NGOs should advise a mechanism to reach each individual to address the problem. One of these strategies could be education: educating all stakeholders especially drivers, pedestrians or the people as a whole about road safety. using Medias (TVs, Radios, Newspapers, magazines etc.) or in formal organizations in schools and other governmental and non-governmental organizations, in religious institutions like churches, mosques using religious fathers and in informal public associations.

Second, setting a national road safety policy, laws and regulations with high level of political commitment and dedication to enforce the laws and regulations and also fulfilling infrastructural setups for traffic police that can facilitate their duties like motor cycles, speed radar, a mechanism to punish violent pedestrians and reorganizing the existing organizational arrangement in a new way so that good behaviours could be rewarded and bad behaviours punished. Example giving the officer or traffic police a promotion in rank with salary increment for his excellence at his/her job) and penalizing the other for his/her ill act.(3)

Finally, we recommend the city's Municipality Authority to revise its land use legislation and regulations, and incorporate the parking space, additional lane construction, traffic control systems and safety of users.(4)

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Appendices

Questionnaire Form

Questionnaire Form for Individual Vehicle Driver

SECTION ONE: - **Personal details**

1. Age in years

(a) Below 18 ☐

(b) 18-30 ☐ (c) 30 - 40 ☐

(d) 40 - 50 □ (e) 50 above ☐

2. Sex: (1) Male. ☐ (2) Female ☐

3. Occupation: labour☐

Civil servant ☐

Businessman/woman☐

others (specify) ☐

4. Residence: (1) Wolkite city ☐ (2) Outside Wolkite city ☐

5. Driving experience in years

(a) Below 1 ☐

(b) 1 – 5 ☐ (c) 5 - 10(d) 10 - 20 □ (e) 20 above □

Q.1.Do you think traffic accidents are very important problem in Wolkite city?

(a) Yes ☐ (b) No ☐

Q.2. Do you agree the amount of traffic accidents in Wolkite city is greater compare to other cities?

(a) Strongly agree ☐ (b) agree ☐ (c) neutral ☐d) disagree ☐ (e) Strongly disagree ☐

Q.3. Do you agree the pedestrian follow the traffic regulations like crossing road using on

zebra crossing to protect from traffic accidents in Wolkite city?

(a) Strongly agree ☐ (b) agree ☐ (c) neutral ☐ (d) disagree ☐ (e) strongly disagree ☐

Q.4.Do you Agree most of the traffic accidents occurs in Wolkite city is b/c of drivers do not

given a priority to a pedestrian?

(a) Strongly agree ☐ (b) agree ☐ (c) neutral ☐ d) disagree ☐ (e) strongly disagree ☐

Q.5. Do you Agree most necessary traffic safety education and training about traffic accidents is given for drivers and pedestrian is adequate in Wolkite city?

(a) Strongly agree ☐ (b) agree ☐ (c) neutral ☐ d) disagree ☐(e) strongly disagree☐

Q.6. Do you Agree most of the traffic accidents occurs in Wolkite city is at the same location and is that necessary to put a black spot location?

(a)Strongly agree ☐ (b) agree☐ (c) neutral ☐(d)disagree ☐ (e)strongly disagree☐

Q.7.Is there any problems facing on traffic police working for reduction of the traffic accident

has Occurred? (a) Yes☐ (b) No ☐

If yes, what are the problems? ----------

Q.8. Is there adequate number of traffic police, traffic regulation, traffic sign and road environment available to reduce traffic accident in Wolkite city?

(a) Strongly agree ☐(b) agree ☐ (c) neutral ☐ (d) disagree ☐ e) Strongly disagree ☐

Q.9.Are you comfortable driving and maintain with allowable speed using Wolkite city road than other city road?

a) Strongly agree☐ (b) agree☐ (c) neutral ☐ (d) disagree☐

e) Strongly disagree ☐

Q.10.Did you have any traffic accident problems happen in your previous driving experience?

(a) Yes ☐ (b) No ☐

If yes, due to whose fault the accidents happen?

a) Driver ☐ (b) pedestrian ☐ (c) road factor ☐ (d) traffic sign ☐

Q,11 Do you have any recommendations and opinions on strategies of reducing the traffic

accidents in Wolkite city. (a) Yes ☐ (b) No ☐

If yes, what are your recommendations? ----------

Q.12. Are there any problems on implementing traffic safety measures in Wolkite city

(a) Yes ☐ (b) No ☐

If yes, what are the problems? ----------

Q.13. Who do you think the most responsible for traffic accident?

(a) Driver ☐ (b) pedestrian ☐ (c) government ☐(d) traffic police □

Q.14. Do you think available traffic rules and regulations can reduce traffic accidents?

(a) Strongly agree ☐ (b) agree ☐ (c) neutral ☐ (d) disagree ☐e) Strongly disagree ☐

Q.15. what factors do you think facilitate the occurrence of road traffic accident in Wolkite city?

In terms of Vehicle ☐

In terms of (environment) road network ☐

In terms of Peoples behaviour ☐

In terms of legislation and regulations ☐

Questionnaire Form for Individual Pedestrian

SECTION ONE

Personal details

1. Age in years

(a) Below 18 ☐(b) 18-30☐ (c) 30 - 40 ☐

(d) 40 - 50 ☐ (e) 50 above ☐

2. Sex: (1) Male ☐ (2) Female ☐

3. Occupation: labour ☐

Civil servant☐

Businessman/woman ☐

Others (specify) □

4. Residence: (1) Wolkite city ☐ (2) Outside Wolkite city ☐

Q.1.Do you think traffic accidents are very important problem in Wolkite city?

(a) Yes ☐ (b) No ☐

Q.2. Do you agree the amount of traffic accidents in Wolkite city is greater compare to other cities?

(a) Strongly agree☐ (b) agree ☐ (c) neutral☐ (d) disagree ☐ (e) strongly disagree ☐

Q.3. Do you agree the you and other pedestrian follow the traffic regulations like crossing road

using on zebra crossing to protect from traffic accidents in Wolkite city?

(a) Strongly agree☐ (b) agree ☐ (c) neutral☐ (d) disagree ☐ (e) strongly disagree ☐

Q.4.Do you agree most of the traffic accidents occurs in Wolkite city is b/c of drivers do not given a priority to a pedestrian?

(a) Strongly agree☐ (b) agree ☐ (c) neutral☐ (d) disagree ☐ (e) strongly disagree ☐

Q.5. Do you Agree most necessary traffic safety education and training about traffic accidents is given for drivers and pedestrian is adequate in Wolkite city?

(a) Strongly agree☐ (b) agree ☐ (c) neutral☐ (d) disagree ☐ (e) strongly disagree ☐

Q.6. Do you agree most of the road have comfortable pedestrian road pavement for normal person and disable person?

a) Strongly agree ☐b) agree ☐ c) neutral ☐d) disagree ☐e) strongly disagree ☐

Q.7. Do you agree most of the road have comfortable and adequate pedestrian road crossing? structures and zebra crossing for normal person and disable person?

(a) Strongly agree ☐ (b) agree ☐ (c) neutral ☐d) disagree ☐ (e) strongly disagree ☐

Q.8. Is there adequate number of traffic police, traffic regulation, traffic sign and road environment available to reduce traffic accident in Wolkite city?

(a) Strongly agree ☐ (b) agree ☐ (c) neutral ☐ (d) disagree□

(e) Strongly disagree☐

Q.9. Are you comfortable walking and crossing zebra without any problems using Wolkite city pedestrian road pavement than other sub city pedestrian road pavement.

(a) Strongly agree ☐ (b) agree ☐ (c) neutral ☐ (d) disagree□ (e)strongly disagree ☐

Q.10.Did you have any traffic accident problems happen in your previous life experience?

(a) Yes ☐ (b) No ☐

If yes, due to whose fault the accidents happen?

a) Driver☐ (b) pedestrian ☐ (c) road factor ☐ (d) traffic sign ☐

Q. ll. Do you have any recommendations and opinions on strategies of reducing the traffic?

accident in Wolkite city? (a) Yes ☐ (b) No☐

If yes, what are your recommendations? ----------

Q.12. Are there any problems on implementing traffic safety measures in wolkite city?

(a) Yes ☐ (b) No ☐

If yes, what are the problems? ----------

Q.13. Who do you think how should be the most responsible for traffic accident?

a) Driver ☐b) pedestrian ☐ (c) government ☐ (d) traffic police

Q.14. Do you think available traffic rules and regulations can reduce traffic accidents?

a) Strongly agree ☐b) agree ☐ (c) neutral ☐d) disagree ☐e) strongly disagree

Q.15. what factors do you think facilitate the occurrence of road traffic accident in Wolkite city?

In terms of Vehicles ☐

In terms of (environment) road network ☐

In terms of Peoples behaviour ☐

In terms of legislation and regulations ☐

Questionnaire Form for Traffic Police Officers

SECTION ONE **Personal details Date ----------**

Rank ----------

1. Age in years

(b) Below 18 ☐

(b) 18-30☐ (c) 30 - 40 ☐

(d) 40 - 50 ☐ (e) 50 above ☐

2. Sex: (1) Male ☐ (2) Female ☐

3. Occupation:

labour ☐

Civil servant ☐

Businessman/woman ☐

Others (specify) ☐

4. Residence: (1) Wolkite city ☐ (2) Outside Wolkite city ☐

Q.1.Do you think traffic accidents are very important problem in Wolkite city?

(a) Yes ☐ (b) No ☐

Q.2. Do you agree the amount of traffic accidents in Wolkite city is greater compare to other cities?

(a) Strongly agree☐ (b) agree ☐ (c) neutral☐ (d) disagree ☐ (e) strongly disagree ☐

Q.3. Do you agree the you and other pedestrian follow the traffic regulations like crossing road

using on zebra crossing to protect from traffic accidents in Wolkite city?

(a) Strongly agree☐ (b) agree ☐ (c) neutral☐ (d) disagree ☐ (e) strongly disagree ☐

Q.4.Do you agree most of the traffic accidents occurs in Wolkite city is b/c of drivers do not given a priority to a pedestrian?

(a) Strongly agree☐ (b) agree ☐ (c) neutral☐ (d) disagree ☐ (e) strongly disagree ☐

Q.5. Do you Agree most necessary traffic safety education and training about traffic accidents is given for drivers and pedestrian is adequate in Wolkite city?

(a) Strongly agree☐ (b) agree ☐ (c) neutral☐ (d) disagree ☐ (e) strongly disagree ☐

Q.6. Do you agree most of the road have comfortable pedestrian road pavement for normal person and disable person?

a) Strongly agree ☐(b) agree ☐ c) neutral ☐d) disagree ☐e) strongly disagree ☐

Q.7. Do you agree most of the road have comfortable and adequate pedestrian road crossing structures and zebra crossing for normal person and disable person?

(a) Strongly agree ☐ (b) agree ☐ (c) neutral ☐d) disagree ☐ (e) strongly disagree ☐

Q.8. Is there adequate number of traffic police, traffic regulation, traffic sign and road environment available to reduce traffic accident in Wolkite city?

(a) Strongly agree ☐ (b) agree ☐ (c) neutral ☐ (d) disagree☐(e) Strongly disagree☐

Q.9. Are you comfortable waking and crossing zebra without any problems using Wolkite city pedestrian road pavement than other sub city pedestrian road pavement.

(a) Strongly agree ☐ (b) agree ☐ (c) neutral ☐ (d) disagree☐ (e)strongly disagree ☐

Q.10.Did you have any traffic accident problems happen in your previous life experience?

(a) Yes ☐ (b) No ☐

If yes, due to whose fault the accidents happen?

a) Driver☐ (b) pedestrian ☐ (c) road factor ☐ (d) traffic sign ☐

Q. ll. Do you have any recommendations and opinions on strategies of reducing the traffic

accident in Wolkite city? (a) Yes ☐ (b) No ☐

If yes, what are your recommendations? ----------

Q.12. Are there any problems on implementing traffic safety measures in Wolkite city?

(a) Yes ☐ (b) No ☐

If yes, what are the problems? ----------

Q.13. Who do you think how should be the most responsible for traffic accident?

a) Driver ☐b) pedestrian ☐ (c) government ☐ (d) traffic police ☐

Q.14. Do you think available traffic rules and regulations can reduce traffic accidents?

a) Strongly agree ☐b) agree ☐ (c) neutral ☐d) disagree ☐e) strongly disagree ☐

Q.15. what factors do you think facilitate the occurrence of road traffic accident in Wolkite city?

In terms of Vehicles ☐

In terms of (environment) road network ☐

In terms of Peoples behaviour ☐

In terms of legislation and regulations