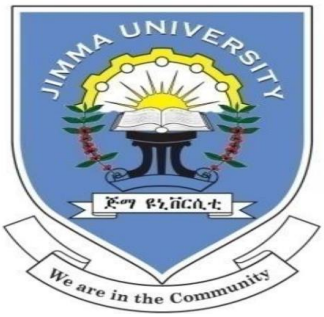

Jimma University

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Blackspot Identification and the Possible Countermeasures: Case Study in Addis Ababa to Ambo Road

A thesis submitted to the School of Graduate Studies of Jimma University in Partial fulfillment of the requirements for the Degree of Masters of Science in Civil Engineering (Highway Engineering)

By

Eyob Mekonnen

February, 2016
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Main Advisor: Prof. Emer T. Quezon (Associate professor)
Co-Advisor: Engr. Murad Mohammed (MSc.)

February, 2016
Jimma Ethiopia

SCHOOL OF POST GRADUATE STUDIES

JIMMA UNIVERSITY

As members of the examining board of the final MSc. open defense, we certify that we have read and evaluated the thesis prepared by Eyob Mekonnen entitled: Blackspot Identification And The Possible Countermeasures: Case Study In Addis Ababa Ambo Road, recommended that it be accepted as fulfilling the thesis requirement for the degree of masters of science in highway engineering.

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Declaration

I ,the undersigned, declare that this thesis entitled "Blackspot Identification And The Possible Countermeasures: Case Study in Addis Ababa To Ambo Road." is my original work, and has not been presented by any other person for an award of a degree in this or other University, and all sources of material used for thesis have been duly acknowledged.

Candidate:
EYOB MEKONNEN KEBEDE
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As Masters research advisors, we hereby certify that we have read and evaluated this MSc. Research prepared under our guidance, by EYOB MEKONNEN KEBEDE entitled: Blackspot identification and the possible countermeasures: case study in Addis Ababa to Ambo road.

We recommend that it can be submitted as fulfilling the MSc. Thesis requirements.

Prof. Emer T. Quezon	_____	_____
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Engr. Murad Mohammed, MSc.	_____	_____
Co-Advisor	Signature	Date

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Abstract

Over 1.2million peoples die each year on the world roads, and between 20 and 50 million suffer non-fatal injuries. In most regions of the world this epidemics of road traffic injuries is still increasing [17]. The main objective of this thesis work is to identify the most hazardous location and provide possible countermeasures that will minimize the traffic accident at the identified locations.

The scope of the study was limited to Ambo Ginchi Addis Ababa road, which starts from Addis Ababa which is 24 kilometers near to Menagesha and points up to Awaro at the entrance to Ambo town which is 111km from Addis Ababa with a total length of 87km.

In order to conduct the research, the data that were collected are accident records from September 2012-2015 by each Wereda police stations. Then these data are analyzed using Priority value for Ejere Wereda and Holota town and accident frequency for Ambo wereda,Dendi wereda and Welmera wereda to rank blackspot locations. Based on the analysis made, 13 locations of the stretch were found to be blackspots. Out of these blackspots, 3 of them are in Ambo Wereda, 2 in Ejere wereda, 1 in Welmera wereda and 7 in Holota town. The duration of time when most of the accidents occurred is from 12:00am-3pm in the afternoon and the major causes of the accidents were over speeding, driving without attention and some unidentified causes. This study also shows that the drivers' age group who caused most of the accidents is from 25-34, the younger age group.

From the study it is concluded that, there is an increase in the number of accidents in the afternoon, during day time and the number of accident is decreasing or minimal during night time. Young drivers are believed to cause more accidents than the older once. The major causes for the occurrence of accidents were over speeding and driving without attention.

From the findings of the research the following recommendations are provided: increment of lane width of the road, provision of climbing lane, installation of road side delineator, provision of road side improvements, installation of traffic signs and repainting pavement markings should be done by ERA. Concerned traffic bodies should also seriously consider the time of the day between 12:00am-3pm in the afternoon as most of the accidents happen during this time. Similar traffic accident recording database should also be prepared region wide. Finally the research implies that there is a need for clear and Standardized Blackspot identification methodologies to decrease the fatality rate due to traffic accidents at the federal level.

Key words: *Priority value, Accident frequency, Accident Blackspot*

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Acronyms

WHO	World Health Organization
TRL	Transport research laboratory
PDO	Property damage only
GIS	Global information system
RSDP	Road sector development program
UK	United Kingdom
ERA	Ethiopian road authority
RSA	Road safety audit
ETB	Ethiopian birr

CHAPTER ONE

INTRODUCTION

1.1 Background

Road transportation provides benefits both to nations and to individuals by facilitating the movement of goods and people. It enables increased access to jobs, economic market, education, recreation and health care, which in turn have direct and indirect positive impacts on health of populations. However, the increase in road transportation has also placed a considerable burden on people's health in the form of road traffic injuries, respiratory illness, and the health consequences that ensure from a reduction in physical activity. There are also additional negative, economic, social and environmental consequences that arise from the movement of people and goods on the roads- such as air pollution, greenhouse gas emissions, and consumption of finite resources, community severance, and noise. For instance According to WHO's Global Burden of disease project for 2004, road traffic crashes caused over 1.27 million deaths that year which is a similar number to those caused by many communicable disease. While road traffic death rates in many high-income countries have stabilized or declined in recent decades, data suggest that in most regions of the world the global epidemic of traffic injuries is still increasing. It has been estimated that, unless immediate action is taken, road deaths will rise to the fifth leading cause of death by 2030, resulting in estimated 2.4 million fatalities per year [26].

Road construction and maintenance is an important desire for the development especially in developing countries. Reviewing the Ethiopia's road sector development (RSDP) in the past 16 years has revealed that the total road network expansion of the country has reached 85,966km. As part of the transformation plan of the country, Ethiopian government states that it will construct 82,500km of roads across the nations with cost of 122 billion birr during the specified period of time [19].

In connection to this, even though the Ethiopia is going forward towards constructing the road infrastructure, the country is losing billions of dollars due to traffic accidents. For instance, From 2001/02-2004/5, the traffic accident death rate was in the range of 129 and 145 per ten thousand motor vehicles [17].

Furthermore, Ethiopia has a relatively high accident records despite having low road network density and vehicle ownership. Road traffic injury which is a physical damage of a person as a result of road traffic crash is the major cause for traffic fatalities (any person killed immediately or dying within 30 days as a result of road traffic injury crash). Road traffic injuries are the eighth leading cause of death worldwide [25].

Various studies done on road traffic accidents in Ethiopia have shown the escalation of the problem at the national level. Road traffic injury is high in Ethiopia, at least 70 people die for every 10,000 vehicle accidents annually [8].

According to Road Transport Authority report, 1,800 people died and 7,000 injured in 2003 across the country. In 2007/8, a total of 15,082 accidents occurred in the country. Of them the number of people killed was 2,161 while 7,140 experienced non-fatal injuries [20].

Even though the traffic accident rate is growing spontaneously from time to time in Ethiopia, the idea of road safety is applied lately throughout the country. So that it showed that the lack of proper study on the accident suspected areas and also the absence of application of proper counter measures provided in order to mitigate the effects.

For instance According to the report of Association for Safe International Road travel list of dangerous Ethiopian roads, Ambo to Addis road is one which is suspected to the occurrence of accidents and also it is very congested road [1]. So that this black spot study is proposed to be undertaken to propose the possible counter measures that will decrease the occurrence of accidents.

1.2 Statement of the Problem

Road traffic accidents—the leading cause of death by injury and the tenth-leading cause of all deaths globally—now make up a surprisingly significant portion of the worldwide burden of ill-health. An estimated 1.2 million people are killed in road crashes each year, and as many as 50 million are injured, occupying 30 percent to 70 percent of orthopedic beds in developing countries hospitals.[1] and if present trends continue, road traffic injuries are predicted to be the third-leading contributor to the global burden of disease and injury by 2020 [2].

Developing countries bear a large share of the burden, accounting for 85 percent of annual deaths and 90 percent of the disability-adjusted life years lost because of road traffic injury [3]. The World Bank estimates that road traffic injuries cost 1 percent to 2 percent of the gross national product (GNP) of developing countries, or twice the total amount of development aid received worldwide by developing countries [12].

According to review of the accident data reported by West Showa Zone for the year 2003 and 2004, there is a high increase in the rate of accidents .In connection to this, according to this report more than 50% of the accidents were happened on the road from Ambo to Addis Ababa.

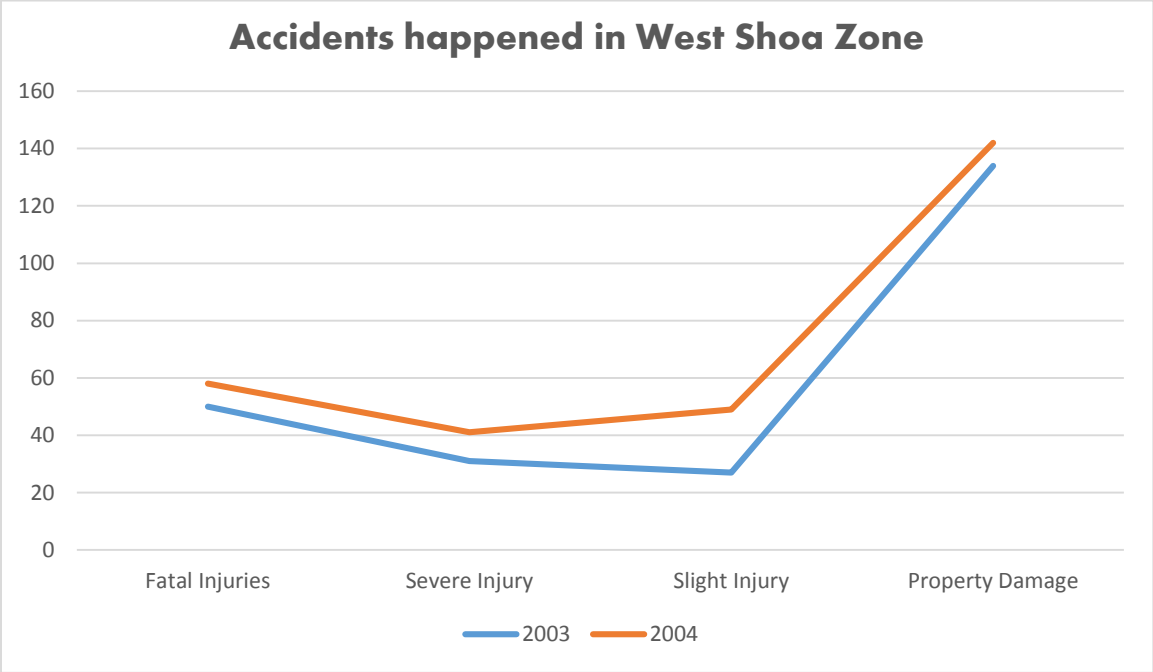

Figure 1.1 Accidents happened in West Shoa Zone from September 2010-2011

Considering the status of 2010/2011, there is dramatic increment of the accidents. Therefore, this shows that there is lack of proper study on the accident black spot. In this research the accident prone locations were deeply studied and the possible counter measure was provided by undertaking road safety audit and also by studying the causes of the accidents.

1.3 Research questions

1. Which location of the road is highly suspected to the occurrence of accidents?
2. What are the major causes of the accidents?
3. At what time of the day that most of the accidents happened?
4. What type of countermeasures or remedial measures are going to be provided?

1.4. Objectives of the Research

1.4.1 General objective

- The general objective of this thesis is to identify the Black spot or hazardous locations and to provide the possible countermeasures on the road from Addis Ababa to Ambo.

1.4.2 Specific objectives

1. To identify the road stretch that is highly suspected to the occurrence of the accidents.
2. To determine the causes of the accidents.
3. To identify the time of the day at which most of the accidents happened.
4. To provide countermeasures or remedial measures in order to address the issues.

1.5 Scope of the Research

The scope of the study was limited to Ambo Ginchi Addis Ababa road, which starts from Menagesha town which is about 24km's far from Addis Ababa and points up to Awaro at the entrance to Ambo town which 111km from Addis Ababa . The study area is with total length of 87km.

The study identifies the road stretch that is suspected to the occurrence of the accidents by applying suitable blackspot identification method, identifies the causes of the accidents based on the traffic data, investigates time of the day at which most of the accidents happened, and finally states the proper countermeasure that should be applied after undertaking road safety audit based on the prepared check list at the identified blackspot locations.

1.6 Significance of the study

The study provided clues on how to decrease the rate of occurrence of accidents by identifying the causes of accidents as the hazardous locations are clearly identified. Related with this, it identified the time of the day at which most of the accidents

happened, so that this thesis would help Ethiopian roads authority as a guide to apply the countermeasure at the traffic prone areas or hazardous locations either to reduce or eliminate the occurrence of accidents.

1.7 Organization of the Research

The report is organized in to five chapters. Chapter one is an introduction to the paper and contains back ground to the problem, statement of the problem, research questions, objectives, scope, and organization of the report and limitation of the research.

Chapter two reviews prior studies under taken on the subject under study. This chapter review different black spot a program still used worldwide and identifies the hazardous sites by comparing and identifying the best method that will be applied in our country, secondly touches the cause of accidents identified in different literatures in different countries, thirdly the time of the as accident contributing factor were reviewed and finally states methods to prepare check list for site inspection of hazardous locations.

In chapter 3, the materials and method s are fully described. In this chapter firstly the study area is clearly explained and then study area map is drawn, secondly method to be used in order to collect the traffic data and road condition data is clearly stated ,and finally the method used in order to analyze the collected data is clearly described.

In chapter four results and discussion section, firstly the characteristics of road traffic accidents along the road were described, then fatal accidents, injury accidents are analyzed based on vehicle type, time of the day and drivers age while property damage is analyzed based on cost of accidents and vehicle type. Secondly the accident prone areas were prioritized based on the priority value and accident frequency value. Thirdly the cause of the accidents was identified based on the traffic data. Finally the countermeasures to be applied were identified by undertaking road safety audit and also by site visiting the black spot location.

The final chapter is chapter five. In this chapter conclusion and recommendation was made based on the analyzed result.

1.8 Limitation of the Research

The data obtained from the traffic police station were not complete that is why it was difficult to compare different accident blackspot identification principles worldwide and analyze the data in different dimension with regards to the study area.

Some of the traffic police officers found in respective Wereda were not responsive and were also not willing to give the accident data .In connection to this, most of the data obtained were blank or not filled with the required information. The result of the study showed that most of the cases were unidentified, so it creates an impact on the value of the analyzed variables.

The road design data was not available in Ethiopian roads authority. This situation created difficulties for comparing the actual geometrical design characteristics with that of the as built data from the road.

The budget provided by ERA was not sufficient to fully pay the per dime dues for the personal investigator and police inspectors, so it hinders from fully undertaking the research without fear of financial constraints.

CHAPTER TWO

LITERATURE REVIEW

2.1 Background

As the Cambridge dictionary defines, black spot is the place on road that is considered to be dangerous because several accidents have happened there.

Rokyatova' defines black spot as locations that are generally classified after an assessment of the level of risk and likely hood of crash occurring at a location [16].

Accident black spot on a National highway in Norway is defined as any place with a maximum length of 100 meters, where at least four injury accidents have been reported to the police during a four year period [4].

According to The Bureau of Transport and Regional Economics of Australia**,** locations are in general classified as black spots after an assessment of the level of risk and the likelihood of a crash occurring at each location. At certain sites, the level of risk will be higher than the general level off risk in surrounding areas. Crashes will tend to be concentrated at these relatively high-risk locations .Locations that have an abnormally high number of crashes are described as crash concentrated, high hazard, hazardous, hot spot or black spot sites. Sites with potentially hazardous features are sometimes described as grey spots [18].

The total road network of the country at the beginning of Road Sector Development Program (RSDP) in 1997 was about 26,550 km with a road density of 0.46 and 24.14 per 1000 people and square km of area respectively. Due to the construction of new gravel and regional roads during 9 years of RSDP, the total road network has increased to 37,018 km in 2005 with an average annual growth rate of 4.2% percent. With a total land area of 1.1 million sq. km, the 2005 population of 75,067,000 and a road network of 37,018 km, the current road density becomes 33.6km per 1000 sq. km and 0.49 km per 1000 people, indicating an increment of about 9.5 km and 0.03km from 1997 with respect to area and population respectively.

Ethiopia has experienced high rates of road traffic accidents, as the road is the major means of transportation. From 2001/02-2004/5, the traffic accident death rate was in the range of 129 and 145 per ten thousand motor vehicles [17].

Every month, around 400 people are killed or hospitalized by road accidents. An estimate by a Study (TRL & Ross Silcock, 2001) reveals that, in addition to the above fatality rate, road accidents cost the Ethiopian economy between 350-430 million birr per year [8].

2.2 Theoretical Review/Conceptual Frame work

2.2.1 Different Black Spot Identification Methods World wide

1. Serbia Black Spot programs

i) Objective method

It is the method based on the analysis of traffic accidents and their consequences and in addition to this it is the method based on the road and the traffic characteristics. The following parameters are used in the identification: Corrected collective risk of accidents, Collective risk of causalities, and Collective risk of fatal and seriously injured and Collective risk of fatally injured.

ii) Subjective method

It is the method based on the analysis of the experts, which means based on the opinion of the representative of road managers (public company "putevi srbije", police officers and public road inspectors. The first step included the interviews with experts per regions aimed at identification of "Black spot" candidates (potential black spots), the second step uses Verification of the noticed hazardous sites/spots by experts of the traffic safety department, road managers and other stake holders and The third step is setting up of a database on hazardous sites /spots on public road network.

The main advantages of this method are: the results obtained are very fast, uses simple application, acceptable in conditions of poor available data and stimulates coordination and cooperation in work of different stake holders in traffic safety. In connection to this the main dis advantages of this method are: Quality depends on expertise and commitment of the interviewed experts, in particular the interviewed experts don't identify hazardous sections where the above number of accidents happens under good road conditions. Despite loud denials within recent years the objective identification method is has been widely applied in many countries. The main characteristics of this method include the fact that traffic accidents are still considered the best indicator of black spots on the roads [7].

2. Australian Black spot programs

i) Model based

Are rated as the best practice for black spot identification, because they takes into account systematic variation determined by general road design and traffic volume as well as random variation. The methods used under this category are: Empirical Bayes technique, Traditional approaches and Category analysis.

The advantage of this method is that it takes into account systematic variation determined by a general road design and traffic volumes as well as random variation and the main dis advantages is it Requires comprehensive and connected crash, road and traffic data, Tend to detect more sites with higher traffic volumes and is highly resource intensive and may be unrealistic.

ii) Non model based methods

Is easy to use and doesn't require integrated crash, road and traffic data. The methods used under this category are: Crash frequency rate, Crash rate, Crash frequency and Crash number.

3. Canada Black Spot Programs

Identify projects through non model crash rate method (Crashes per vehicle kilometers as well as using "Crash type" type method that involves examining patterns of particular road user crashes including those involving pedestrians and cyclists.

4 .Kentucky Black Spot Programs

Uses non- model identification method to set a minimum "Crash number" of 14 crashes over 3 years in urban areas and 5 crashes over 3 years in rural areas. In addition model based method is used to calculate a critical rate factor.

5. Colorado Black Spot Programs

Uses non model based methods to set a minimum "Crash number" for funding of seven PDO or casualty crashes or 3 fatal crashes within 3 years.

6. Texas Black Spot Programs

Uses GIS technology to spatially analyze serious crash locations including injuries, fatalities or property damage where at least one vehicle is towed. Projects are prioritized based on "Crash rate" Method.

7. Belgium Black Spot Programs

GIS technology and "Crash rate" method is used. The minimum crash criteria is three or more fatal or injury crashes over 3 years at intersection or 100m road segment.

8. Black spot programs in Serbia

Objective and subjective type of black spot identification methods are applied. Objective method of identification of hazardous sites/spots is based on the analysis of traffic accidents and their consequences, and road and traffic characteristic. The following indicators were used in the process of identification of hazardous sites/spots.

Collective risk of occurrence of accidents and their consequences (CR), which represents the number of accidents and their consequences per road kilometer. This indicator does not take into account a different traffic scope on certain road sections. During the study we identified the following 4 evaluation criteria:

1. Corrected Collective Risk of Accidents - KRsn* (corrected by the gravity of accidents)

$$KRsn* = \frac{\sum_{i=1}^{G} PBSN * i}{G * L} * (\frac{Accidents *}{Km * year})$$

$$PBSN* = (n1 * 1 + n2 * 20 + n3 * 150) * (1 + (\frac{POG}{LTP + TTP + POG})$$

where: n1 - number of traffic accidents with damaged, n2 - number of traffic accidents with injuries, POG - number of fatalities, TTP - number of seriously injuries, LTP - number of light injuries, G - number of years, L - lengths of the section considered (km).

2. Collective Risk of Casualties - KRS(corrected by the gravity of consequences)

$$KRs = \frac{\sum_{i=1}^{G} PBNi}{G * l} * \frac{Casualities}{km * year}$$

$$PBN = 1 * LTP + 5 * TTP + 50 * POG$$

3. Collective Risk of the Fatal and Seriously Injured - KRP+TP

$$KR\,P + IP = \frac{\sum_{i=1}^{G} (POG + TTP)i}{G * L} * (\frac{Fatalities + serious\ injuries}{Km * year})$$

4. Collective Risk of the Fatal Injured - KRP

$$KRp = \frac{\sum_{i=1}^{G} ПОР}{G * L} * (\frac{fatalities}{Km * year})$$

b) Subjective method of identification of hazardous sites/spots

It is based on the analyses of experts: representatives of road managers (Public Company "Putevi Srbije"), police officers and public road inspectors. The first step included the interviews with experts per regions aimed at identification of "black spot" candidates (potential black spots), The second, much more complex step in the process of identification of hazardous sites/spots, included verification of the noticed hazardous sites/spots by experts of the Traffic Safety Department, road managers and other stakeholders and The third step included the setting up of a database on hazardous sites/spots on the public roads network. The advantages of this method is the results are obtained very fast, Simple application, It is acceptable in conditions of poor available data, namely low quality data on traffic accidents and It stimulates co-ordination and co-operation in the work of different stakeholders in traffic safety. The main weaknesses of this method are reflected in the following: The quality depends on expertise and commitment of the interviewed experts, the interviewed experts recognize equally the sites of elevated risk (where there are a lot of traffic accidents) and sites of a reduced service level (where no accumulation of traffic accidents has been registered due to the risk compensation), They do not identify some very dangerous sites on the roads; in particular, they do not identify hazardous sections where the above average number of accidents happens under good road conditions [11].

8. Black Spot Programs in Turkey

The method used by KGM is called Rate – Quality – Control Method. It is a statistical method for identifying black spots. A statistician at the Swedish National Road and Transport Research Institute (Mats Wiklund) has scrutinized the method. The theory part of this paper is based partly on his comments. The Rate – Quality – Control Method consists of calculating three different parameters for each road section. In Turkey, a road section is defined as one kilometer of road.

The three parameters are:

- Accident rate,
- Accident frequency,

- Severity index.

Each of these values is compared with a critical value. Thus the accident rate is compared with one critical value, the accident frequency with another critical value and the severity value with a third critical value. If a certain road section shows higher values than the critical ones for all these three parameters, the section is considered to be a black spot.

i) Accident rate

In the following sections necessary parts of statistical theory are explained. In addition, comparisons with the formula used by KGM and suggestions for improvements are given.

Statistical theory

A_j = Number of accidents on section j during a certain time period.

m_j = Number of vehicle kilometers in millions on section j during the same time period.

$Rj = \frac{Aj}{mj}$ Is the accident rate on section j during that time period.

R_c is the critical value for accident rate.

Section j is considered to be a black spot from the accident rate point of view, if:

$R_j > R_c$ where R_c = is the critical value for accident rate.

$R_j > R_c$,where $R_c = \lambda + k_a \sqrt{\lambda/m_j} - 0.5/m_j$

$\lambda = \frac{1}{n}\sum_{i=1}^{n} \frac{mi}{m} Ri$ Is the estimated average accident rate for sections belonging to the same population. It is assumed that there is n such sections.

-0.5/mj is the correction factor for continuity when approximating with the normal distribution.

ii) Accident frequency

Statistical theory

A road section is considered to be a black spot, from the accident frequency point of view, if:

$$Aj > Ac\ , where\ Ac = Fav + K\alpha\sqrt{\frac{Fav}{Lj}} - \frac{0.5}{Lj}$$

Ac is the critical value for accident frequency (= number of accidents)

L_j is the length of the road section. Here, L_j is assumed to be 1km.

F_{ave} is the average accident frequency for all road sections.

iii) Accident Severity

Statistical theory

The severity value for road section number j is $Sj = I\ f, j * 9 + Ib, j * 3 + Id, j * 1$, or more clearly:

Severity = number of fatalities (f)*9 + number of injured persons (b) *3 + number of damaged vehicles (d) *1

This value can be divided by a suitable value. One such value could be the number of accidents. The relative severity value is then $Qj = \frac{Sj}{Aj}$, which means severity per accident. Here the assumption of poisons – distribution cannot be used. The average value is estimated with:

$$Qav = \frac{\sum_{i=1}^{n} Si}{\sum_{i=1}^{n} Ai}$$

And the variance σ^2 is estimated with:

$$\sigma 2 = \frac{1}{n-1}\sum_{i=1}^{n}(Qi - Qave)2$$

The road section is considered to be black spot, from the severity point of view, if:

$$Qj > Qc, where\ the\ critical\ value\ Qc = Qave + K\alpha\sqrt{\sigma 2} - 0.5$$

2.2.2 Comparison between Black Spot Identification Methods

First and for all there is no integrated crash, road and traffic data in Ethiopia, and in connection this when the road under consideration is assessed, the traffic data collected from the respective police station is not full enough to apply model based method. Because of this, it is not applicable to apply model based method. So that in this study

non -model based method is used for study. From non-model based method the accident severity will be used in order to determine the hazardous location. So that in this study three different countries are selected in order to decide the formula for the accident severity determination. The first is turkey the revised KGM method being used, the second one is Belgium and the third is TRL method. While comparing these three different black spot identification methods the Belgian method is more preferable in order to select the sites with highest accident occurrence. So that in this study Belgian method is used.

To determine the most 'dangerous' accident sites, the Flemish government analyses the accident data that are obtained from the Belgian "Analysis form for Traffic Accidents" ,This form should be filled out by a police officer for each traffic accident that occurs with injured or deadly wounded casualties on a public road in Belgium. Based on these data, the following criterion is used. First, each site where in the last three years three or more accidents have occurred is selected. Then, a site is considered to be dangerous when its priority value (P), calculated using the following formula, equals 15 or more [10].

$P = X + 3*Y + 5*Z$, where

X = total number of light injuries

Y = total number of serious injuries

Z = total number of deadly injuries

2.3 The Cause of road traffic accidents

In Thailand Road accident has long been one of the major problems causing economic and social losses. Studies show that the total annual traffic accident cost reaches 3 percent of the country's GPD or about 120 billion baht.

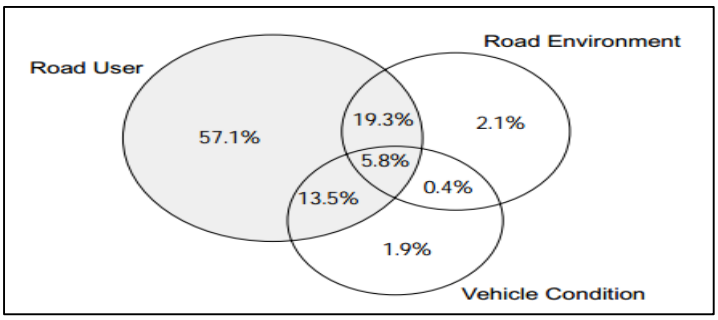

Fig 2.1 Causes of Road Accidents in Thailand

The major causes of road accidents are road user, vehicle condition, and road environment as shown in the figure above.

So that this study showed that the main causes of accident occurrence when ranked first is road user while the road and vehicle condition Contribute small percentage [14].

While considering the research undertaken in India, The common behavior of humans which results in accident points are:-

A) Over Speeding

Most of the fatal accidents occur due to over speeding. It is a natural psyche of humans to excel. If given a chance man is sure to achieve infinity in speed. But when we are sharing the road with other users we will always remain behind some or other vehicle. Increase in speed multiplies the risk of accident and severity of injury during accident. Faster vehicles are more prone to accident than the slower one and the severity of accident will also be more in case of faster and also the severity of accident will also be more in case of faster vehicles. At high speed the vehicle needs greater distance to stop i.e. braking distance. A slower vehicle comes to halt immediately while faster one takes long way to stop and also skids a long distance due to law of notion. A vehicle moving on high speed will have greater impact during the crash and hence will cause more injuries.

B) Drunken Driving

Consumption of alcohol to celebrate any occasion is common. But when mixed with driving it turns celebration into a misfortune. Alcohol reduces concentration. It decreases reaction time of a human body. Limbs take more to react to the instructions of brain. It hampers vision due to dizziness. Alcohol dampens fear and incites humans to take risks. All these factors while driving cause accidents and many a times it proves fatal. For every increase of 0.05blood alcohol concentration, the risk of accident doubles.

C) Distraction to Driver

Though distraction while driving could be minor, but it can cause major accidents. Distractions could be outside or inside the vehicle. The major distraction now a day is talking on mobile phone while driving. Act of talking on phone occupies major portion of brain and the smaller

Part handles the driving skills. This division of brain hampers reaction time and ability of judgment. This becomes one of the reasons of crashes.

D) Avoiding Safety Gears like seat belts and helmets

Use of seat belt in four-wheeler is now mandatory and not wearing seat belt invites penalty, same in the case of helmets for two wheeler drivers. Wearing seat belts and helmet has been brought under law after proven studies that these two things reduce the severity of injury during accidents. Wearing seat belts and helmets doubles the chances of survival in a serious accident. Safety Gears keep you intact and safe in case of accidents [23].

Reviewing the Paper Prepared for Mid-term Review of RSDP II April 2005 by Ethiopian roads authority the causes of accidents at Operation phases of the projects are clearly stated as follows: During operation phase of construction most accidents occur as a result of drivers' error, the road and its accessories also contribute to accidents. The major factors or causes related to roads for the occurrence of accidents are:- factors related to traffic signs and posts which include absence of traffic warning sites on sharp curves, high fills, steep gradients, Damage to the traffic signs by vehicles and individuals in the respective areas, Stealing (theft) of the traffic signs , Fading of existing traffic signs, absence of guide posts and barriers , Damage to guideposts by vehicles and individuals taking off the reflexives on guideposts b) Factors related to roadway which includes Inadequate sight distance on horizontal curves , Inadequate sight distance on vertical curves , Steep gradients in mountainous terrain that is difficult for heavy vehicles to negotiate, Inadequate roadway width (especially in towns), Very long straight section (tangents) of roads, Improper design of junctions and intersections, absence of foot paths (pedestrian walkways) and Lack of timely and regular road maintenance [24].

The research undertaken on roads of UK showed that, since 2005 official accident records have included information on contributory factors. A total of 77 categories of contributory factors, grouped together under 9 headings have been established. The headings are: Driver/ rider error or reaction, injudicious action, behavior or experience, road environment, pedestrian only, impairment or destruction, vision affected, special codes and vehicle defects [22].

Table 2.1 Contributory factors reported in accident occurrence in UK

Contributory Factors Reported in Accident				
	Fatal	**Serious**	**Slight**	**All Accidents**
Driver / Rider Error or Reaction	65.30%	61.80%	68.60%	67.50%
Injudicious Action	31.40%	25%	26.10%	26%
Behavior or Inexperience	28%	25.80%	24.40%	24.70%
Road Environment	10.90%	13.30%	15.60%	15.10%
Pedestrian Only	18.20%	20.40%	11.50%	13.00%
Impairment or Distraction	19.60%	14.20%	11.10%	11.70%
Vision Affected By	7.50%	9.20%	10.50%	10.30%
Special Code	6.10%	5.20%	4.50%	4.60%
Vehicle Defects	2.80%	2.20%	1.90%	1.90%

Considering the Ethiopian case, according to the road safety report reported by united nation and according to the police reports, more than 90 per cent of the traffic accidents are caused by human errors. Of these accidents, drivers are indicated as responsible causes in about 8 to 9 per cent. Table 2 - 3 shows the causes of traffic accidents as identified during police investigation.

Table 2.2 Road safety report of Cause of traffic accidents in Ethiopia

Cause of Traffic Accidents	**Degree of severity**					
	Fatal	**Serious Injury**	**Slight Injury**	**Property Damage**	**Total**	**%age**
Influence of alcohol or drug	51	7	17	193	268	2
Failure to respect right hand rule	110	129	131	856	1226	8
Failure to give away for vehicles	20	65	112	1507	1704	11
Failure to give away for Pedestrians	598	661	728	2058	4045	27
Following too closely	39	77	69	161	346	2
Improper overtaking	44	52	78	547	721	5
Improper Turning	37	71	98	1317	1523	10
Over speeding	426	436	295	852	2009	13
failure to respect Traffic sign	16	27	11	123	177	1

Driving with fatigue	30	20	20	23	93	1
Driving without attention	10	18	15	9	52	0
Improper parking/moving from parking	52	62	81	772	967	6
Excess Loading	76	135	88	43	342	2
Failure in vehicle	79	73	110	171	433	3
Defective road environment	12	13	19	62	106	1
Pedestrian Error	34	164	29	17	244	2
Others	81	81	162	240	564	4
Unidentified	87	65	60	54	266	2
Total	1802	2156	2123	9005	15086	100

Data source: Federal Police Commission; compiled by consultant

Accordingly, the major causes of traffic accidents are failure to give way for pedestrians, followed by over speeding and failure to give way for other vehicles in that order . However, the major causes of fatal accidents in their order of importance are failure to give way for pedestrians, over speeding, failure to respect right hand rule. The causes of driver errors are many which include inadequate training, driving under the influence of alcohol, drug or Chaat, and others. It is important to note here that, Chaat used to be one of the critical problems in the Eastern part of the country. However, its influences are currently expanding throughout the country. The traffic accident statistics in 2007/8 also indicate that over 5 % of the fatal accidents [21].

Looking at the study undertaken in Amhara National regional state from the factors leading to road traffic Accidents in at regional level, almost 84% of road traffic accidents were faults attributed to the drivers while vehicles and pedestrians faults' accounted for 7.6% each and the environment shared only 1%. From drivers' faults, the five major accident factors, in order were: failure to give priority to pedestrians (32.1%), speeding (31.5%), driving on the wrong side of the road (10.7%), failure to maintain distance between vehicles (4.1%) and failure to give priority for other vehicles (3.8%). Together these five causes accounted for 83.8% of all road traffic accidents [13].

In connection to this, the study undertaken on the road from Addis Ababa to Shashemene indicates that 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. 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 [15].

2.4 Time of the Day as Accident Contributing Factor

According to the National Highway Traffic Safety Administration (NHTSA), in 2009 there were 30,797 fatal crashes. Most of the victims were drivers (17,640), with passengers accounting for 6,770 deaths and 64 being unknown.

The majority of fatal crashes occurred between the hours of 6 p.m. and 9 p.m. (4,988). The second-deadliest time of the day was 3 p.m. to 6 p.m. (4,944), and the fewest deadly crashes occurred between 3 a.m. and 6

The following is a breakdown of the days of the week and the deadliest times for fatal car accidents to occur:

- Sunday – midnight to 3 a.m. (1,072);
- Monday – 3 p.m. to 6 p.m. (687);
- Tuesday – 3 p.m. to 6 p.m. (677);
- Wednesday – 3 p.m. to 6 p.m. (663);
- Thursday – 6 p.m. to 9 p.m. (680);
- Friday – 9 p.m. to midnight (892); and
- Saturday – midnight to 3 a.m. (1,024).

Clearly, the later hours of the weekend prove to be the deadliest. Late afternoon to evening tend to be the riskiest times for driving during the week. Statistics also show that during the week, most fatal accidents occurred between 5:00 and 5:59 p.m. During the weekend, it was between 2:00 and 2:59 a.m. [5].

According to the study undertaken on the road from Addis Ababa to Shashemene, the monthly distributions of accidents showed that, most of the accidents that happened were in the wet season and less in dry season. For instance, accidents registered were higher in the months of Sene (June), Hamle (July), Nehase (August), Meskerem (September), and as well as in Tikimt (October).

Looking at the variation of accidents during this period, there is no significant variation between them. However, a higher value is recorded during the week-end days i.e.

Saturday and Sunday. This is due to the fact that many of the residence of Addis Ababa spent their week-ends in resort or recreational centers along this route.

Peak frequency of accidents corresponds with morning and afternoon traffic volume peaks. However, more accidents occurred during 1500-1800 hours which is in the afternoon. Most probably, drivers are stressed and fatigued during these hours as a result of hot tropical weather condition.

Figure 2.2, 2.3 and 2.4 respectively shows the accident distribution by month in built up area, Accidents Distribution by days of a week in built-up areas and Accidents Distribution by hours a day in built-up areas [17].

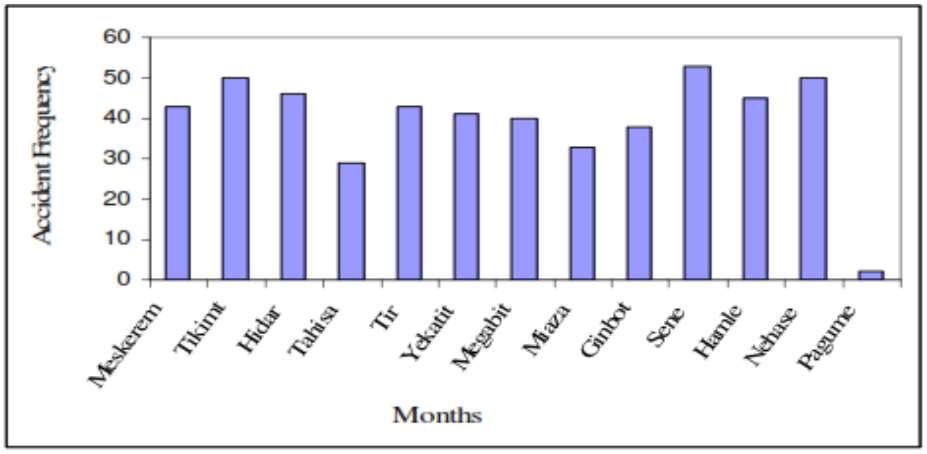

Figure 2.2 Accident distribution by month in Built-up area

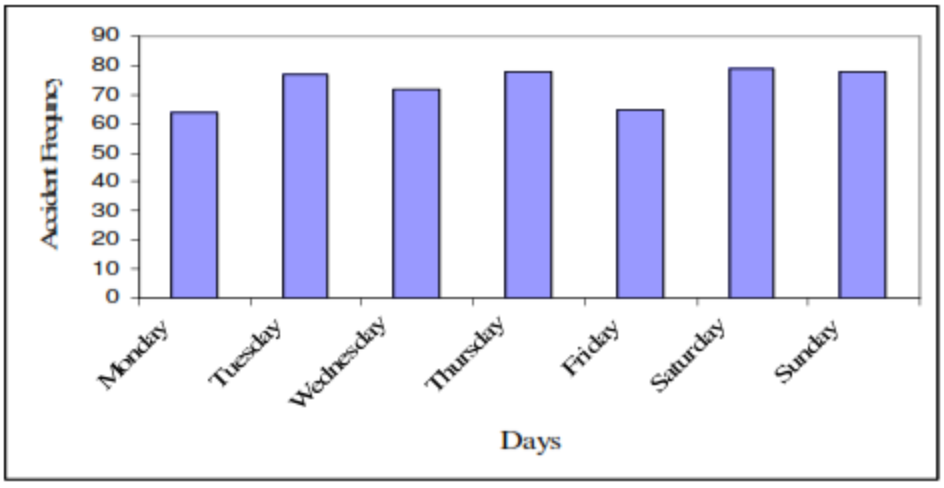

Figure 2.3 Accidents Distribution by days of a week in built-up areas

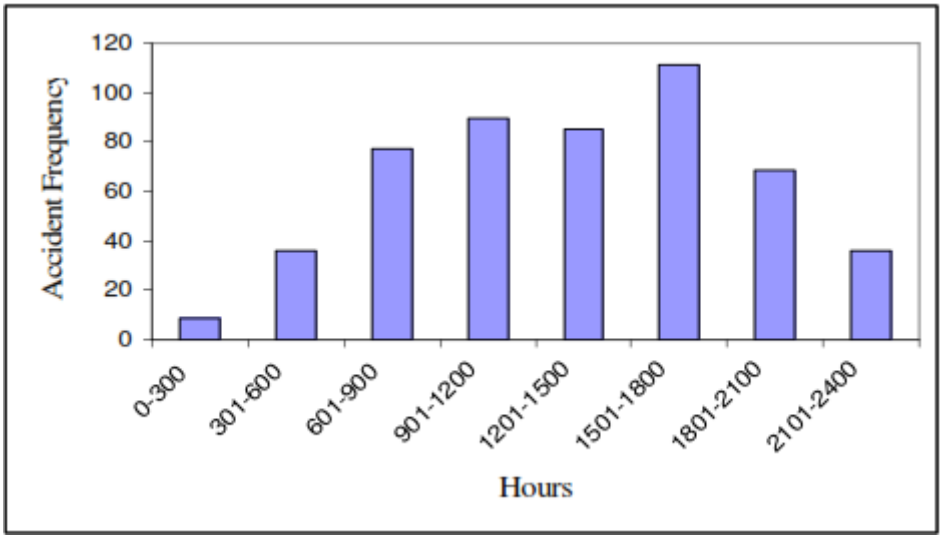

Figure 2.4 Accidents Distribution by hours a day in built-up areas

2.5 Road Safety Audit

Road safety audit is defined as formal safety performance examination of existing or future road or intersection by an existing or future road or intersection by an independent, multidisciplinary team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users.

The main benefits of road safety audits are it will help to achieve the objectives of safe system by providing a safer road network with self-explaining roads, it minimizes the risk of high severity crashes that may result from design deficiencies in a proposed road project, the need for rework and physical remedial works caused by road safety deficiencies at the various stages of project development and finally including construction reduce the whole of life costs of the project. The cost of a road safety audit and the consequent cost of changing a design are significantly less than the cost of remedial treatments after works have been constructed or the social cost of road crashes. It is easier to change design plans than to move or alter construction works. However, conducting post construction road safety audits is still important as the cost of any remedial work may well be less than the cost of crashes that may arise.

A road safety audit should be undertaken at concept stage, scheme or preliminary design stage, detailed design stage and pre-opening or post-construction stage [17].

2.5.1 Check Lists for Inspection of Hazardous Sites

According to road safety audit for existing roads, ERA Road safety audit manual uses the following parameters used in order to undertake road safety audit.

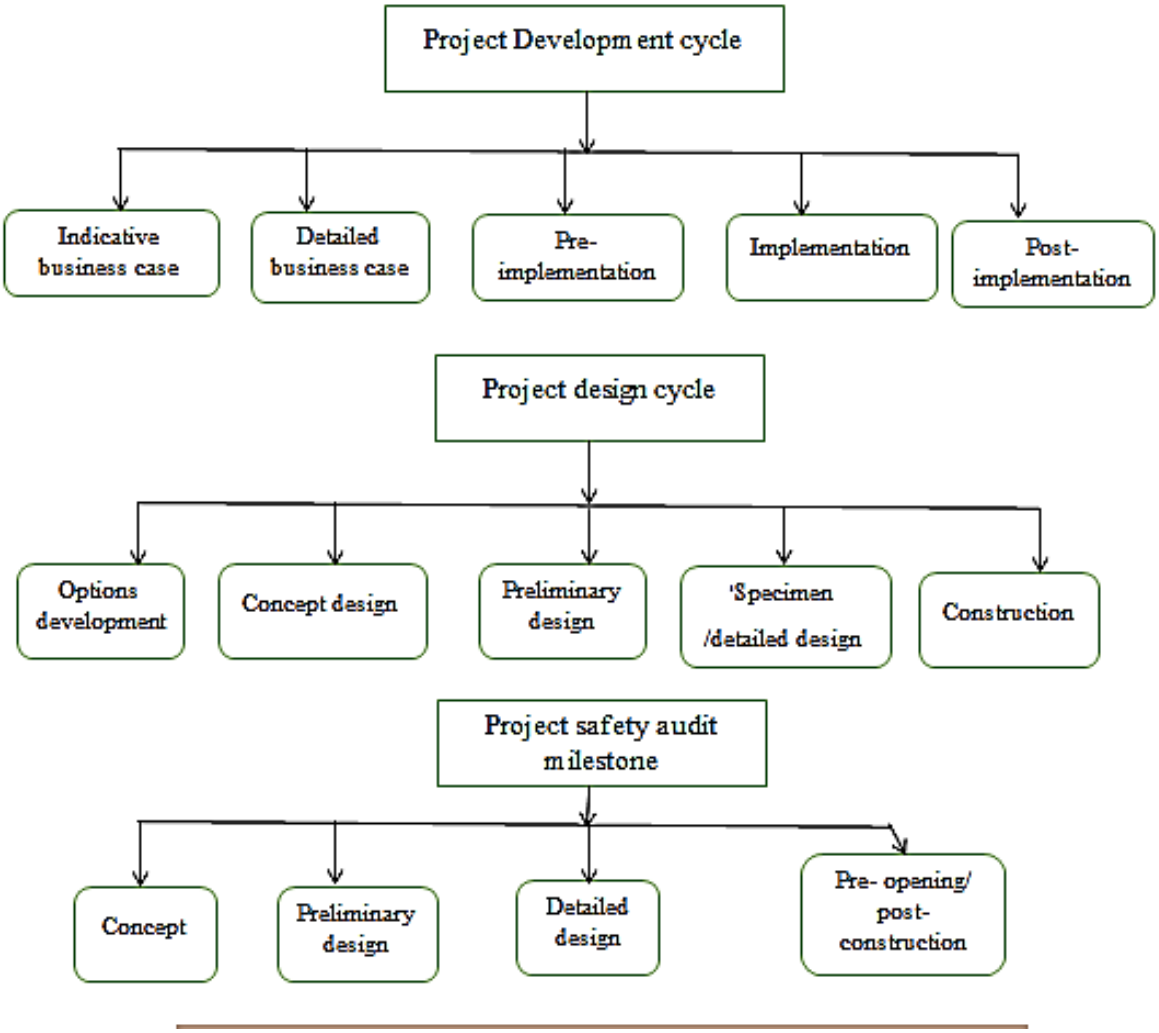

Fig 2.5 Road safety audit milestones within project development cycle

A. Vertical and Horizontal Alignment

Place where the alignment standard changes abruptly will be checked and also the curve with speed value of more than 10km/hr. will be identified for countermeasure.in connection to this, Place where there is prevalence of inadequate stopping sight distance and also any location with inadequate overtaking sight distance at which "double lines" have been marked will be checked and recorded.

B. Cross-Section

The following points are checked:- Any location where the cross-section standard changes abruptly along the route, or is otherwise inconsistent with driver expectations ,and also location where the capacity of the roadway is restricted will be checked, locations of regular traffic congestion is recorded, location with inadequate shoulder width and also the correct type of kerb to be used will be checked, the provision of Pedestrians paved footpaths, adequate refuge width on median and islands, and proper ramps up and down kerbs and location where there is regular pedestrian traffic, Bicyclists-segregated areas (e.g., paved shoulders) where numbers are significant , location where the cross section does not allow the development of appropriate access control .

C. Traffic Signal Installations

Traffic signals are provided only where warranted for safe, efficient, and equitable management of traffic flow along or across main roads, and also it is provided for the safe crossing of pedestrians.

Provision, location, and spacing of traffic signals reflect a sensible traffic management strategy along the route, so that while under taking road safety audit already existing signals are checked whether they are operating effectively or efficiently, simultaneously the positioning and visibility of signal faces are recorded where visibility of signals is obstructed by tree foliage, traffic signs.

D. Traffic Signing

For cases of unauthorized traffic signs and use of non-standard signs (color and shape) ,The location and spacing of signs are appropriately done: that is, they are placed at the required locations, That traffic signs are clearly visible and are prominently displayed to the intended road users, For instances where the legibility of the information on traffic signs is inadequate, bearing in mind the speed of vehicles and the amount of information displayed, For instances where signs contain too much information to be capable of being read by drivers travelling at normal operating speed ,The effectiveness of traffic signs by observing them at night and identifying any lack of reflectorization, The type of signposts used where sign posts constitute a fixed roadside hazard or where the use of frangible signposts should be considered,

For case where there is a lack of (vertical) clearance to traffic signs ,For situations where traffic signs are obstructing essential "lines of sight" for drivers and pedestrians.

E. Pavement Marking

Under pavement marking the following thing are checked:-the general adequacy and visibility of pavement marking both at night and in wet weather, the correct type of line marking has been used in the various situations, e.g., "continuity lines" at merge and diverge sections, "double (Barrier) lines" where overtaking is to be prohibited , etc. , any deficiency in the delineation of merge and diverge areas, including situations where through traffic may inadvertently lead into auxiliary and turn lanes, locations where there is a lack of "hazard marking" at approach ends of islands and medians, locations where auxiliary "turn lanes" have been designated with appropriate pavement arrows and locations where the wrong type of arrow has been used, locations where pavement arrows and other markings are confusing to drivers, particularly where "old incorrect" markings have not been properly removed , The effectiveness of road markings at night and in wet weather and also the need for retro reflective pavement markers or road studs to supplement line and hazard markings is considered, simultaneously inadequacy of provision of these devices and in the use of non-standard arrangements of them will be checked.

F. Roadside Safety and Landscaping

Under this the following points are checked: - The "clear zone width" generally available along both sides of the road, and comment on this aspect in the RSA report, The "fixed roadside object" that occur within the "clear zone width" and comment on the need to treat them in the interests of road safety, The provision of guardrail along the road, consider whether it is really justified and identify locations where it is not justified and locations where it has not been provided where it is warranted, That the correct treatment has been applied to the ends of guardrail sections, including "soft" end treatments and end anchorage, For the adequacy of "bridge railing" systems on all bridges. Take particular note of inadequate railings that will not restrain an impacting vehicle-this is often the case with bridges, The treatment of "approach guardrail" to bridges; record situation, where there is no "strong" anchorage of the approach guardrail to the bridge railing system and/or no proper transition of the

rigidity of flexible or semi rigid approach guardrail as it approaches and meets the rigid bridge railing, The extent to which trees and other vegetation obstruct driver and pedestrian sight lines, which are essential for safe traffic operation, The existence of poles of various kinds along the road and comment on whether some or many can be removed, relocated to less hazardous positions, The degree of hazard associated with large trees, boulders, etc. and whether these can be treated to improve roadside safety.

G. General Traffic Management Items

The degree of safety afforded to pedestrians, particularly school children, and record instances where there is a need for special provisions to be made will be primarily checked. in connection to this, The adequacy and credibility of existing speed limits and comment if they are not appropriate to the traffic situation and the nature of abutting development or are otherwise unrealistic in the view of most motorists will be taken into consideration. The effectiveness of speed limit signing: consider the need for more prominent signing of the start of "restricted" speed zones and for "reminder signs" within the speed zone, particularly near intersections where large numbers of vehicles enter the road in question from side roads. Substandard curves and low speed curved sections of the road; consider the need for "positive" advice to motorists about the safe travel speed and consider the need for "advisory curve speed" signing. The need at substandard curves, for other delineation improvements such as the provision of "guidepost" delineation, and the use of retro reflective road studs. The degree of safety afforded to all road users in town centers, particularly where highways pass through shopping centers or near schools, record the need for "traffic calming" techniques to improve safety in these sensitive locations. The availability of overtaking opportunities along the route as a whole and comment on the need of specific "overtaking lanes" at regular intervals along two-lane undivided roads, particularly where traffic flows are high in hilly terrain [6].

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area

Addis Ababa, Ginchi, Ambo Road is found in Oromia regional State of Central Ethiopian Highlands. The commencement and the completion date of this Asphalt road project was 2002 and 2006 G.C respectively. This road project is found in West Showa Zone of Oromia regional state in central Ethiopia. West Shewa Zone is bordered on the south by the Southwest Shewa Zone and the Southern Nations, Nationalities and Peoples Region, on the Southwest by Jimma, on the West by East Welega, on the Northwest by Horo Gudru Welega, on the North by the Amhara Region, on the Northeast by North Shewa, and on the East by Oromia Special Zone Surrounding Finfinne. Its highest point is Mount Wanchi (3386 meters); other notable peaks include Mount Menagesha and Mount Wachacha.

It is the part of the road that connects Addis Ababa to Bahir dar and Gonder. The total length of the road under consideration is 113Kms. This Road project was originally built in 1930's by Italians with base varying from 4m to 6m. In the 1950's and 1960's the road was partially rehabilitated and upgraded to bitumen standard. The existing road is some 102km long and passes through the Western Showa Zone in westerly direction.

The road passes through major towns of Holeta,Addis Alem and Ginchi . According to the population census undertaken on 28/05/2007 E.C, the population number of Ambo wereda (110,796), Dendi wereda (170,233), Wolmera wereda (83,784) and Ejere wereda (89,168) and the land cover of each of the weredas are 949.46km2, 978.90km2, 656.05km2 and 581.04km2 respectively. The road passes through some 33km of hilly to mountainous terrain. The major towns such as Addis Alem,Holeta & Ginchi through which the road passes have population of 8447,20896 & 164 441 respectively. The road passes through 3.7km of bush land, 21.3km of built up area, 35.6km of farmland, 15.7km of Re-afforested land & 42.1km of grazing land.

Eighty one percent of the road segments are crossing farm land, and the remaining road segments are crossing built up land and reinforced land. (35%)of the road segment is also constructed by following a new route alignment; whereas the remaining road segments

are constructed over the former alignment but a complete destruction and reconstruction was made during rehabilitation.

Altitude is one of the major factors that determine the temperature of the area. About 50% of the West Showa Zone lies in weina dega region (altitude ranging from of 1500-2500m) whilst kolla (altitude<1500m) and dega (altitude ranging from 2300-3500m) constitutes 50.3%, 16.7% and 33% respectively. The average annual temperature of the study area enjoys ranging from 813mm substantial annual rainfall to 1699mm.

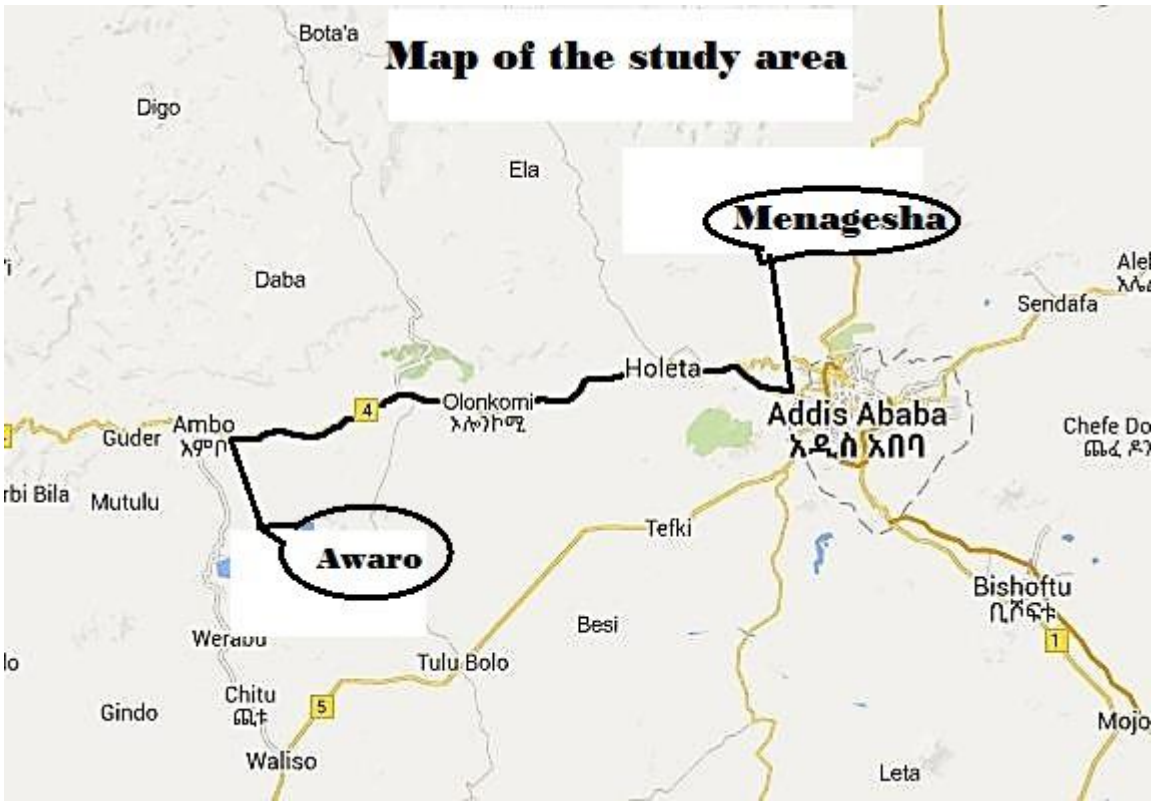

Fig 3.1 Study area of Addis Ababa to Ambo road

3.2 Study Procedure/Sampling technique

The populations taken for this study were the traffic accident data of each of the Weredas and the road safety audit report. The sampling procedures applied were stratified sampling technique. In this study the traffic accident data's were stratified based on age of the driver, time of the day and vehicle type and then finally the after the analysis were made, proper countermeasure was applied.

3.3 Study Design

The study design or frame was used in this study is case study type and the study design type was both observational and secondary data of analysis. In connection to this, the study incorporated road safety audit and site visit of the black spot locations and also it incorporate the extraction of secondary data from respective traffic police stations of Ambo,Dendi,Ejere,Welmera Weredas and Holota town.

3.4 Study Variables

The study design frame applied is an experimental research design, so that the outcome of the intervention was studied. There are two variables that are used to accomplish the task.

- Independent variable – Traffic accident data
  -Road safety audit
- Dependent variable: Identified blackspot locations
  - ✓ MakaWacan/Bayo Kurbi
  - ✓ Awaro
  - ✓ Minini
  - ✓ LegaBerga Bridge
  - ✓ Chiri
  - ✓ Menagesha
  - ✓ Mizana(Mizan Tabya)/Gabreelii
  - ✓ Lega Hoolotaa
  - ✓ Kruchery
  - ✓ Infront of Golden hotel
  - ✓ Karaturi/ Around Flower Station/
  - ✓ Around HawiHotel
  - ✓ Shell

3.5 Data Collection Procedure

The study is undertaken on the Asphalt road from Addis Ababa- Ambo- Ginchi. This roads functional classification is categorized under trunk road. The route corridor touches different Weredas which are found in West Shewa Zone of Oromia regional state.

The Weredas which are touched by this route are: Ambo Wereda, Dendi Wereda, Ejere Wereda,Wolmera Wereda and Holeta Town.

The primary data used in the study was the road safety audit. It was undertaken by site visiting the blackspot locations using the prepared checklist and also by stating the comment for each the black spot locations.

The checklist has included the following road safety audit criteria's:-

1. Road widening (wider road decreases occurrence of accident) so that the width will be checked and also the correct type of kerb to be used is checked.
2. The provision of Climbing Lane was checked, because a longer and steeper road is more useful for provision of climbing lane.
3. The provision of Roadside Delineator was checked, because it helps vehicles not to leave the road.
4. Both the center and edge road marking was checked, because it reduces rate of occurrence of accidents.
5. The presence of Speed limit post was checked, because lower speed limits decrease the rate of occurrence of accidents.
6. Bridge width along black spot location was checked, because shortened than the road or check whether pedestrian walking is provided or not. Because sudden decrease of width may cause approaching vehicles to collide with the side barrier.
7. Road Side improvements were checked, because flat slopes are best to decrease the severity of accidents.
8. Provision of guard rails were checked both along carriage way and shoulders, because it helps vehicles from leaving the road way.
9. Provision of Median Barriers was checked.
10. The longitudinal slope of the road was visually checked.
11. The horizontal curve of the road is visually checked, whether the curve is sharp or not.
12. Traffic sign along the curve was checked.
13. The adequacy of lane width of shoulder was checked.
14. The performance of traffic signal was checked.
15. Adequacy and visibility of pavement marking was checked.
16. Provision of pedestrian walking on town sections was checked.

The detailed road safety audit undertaken for each black spot locations were described on the *Appendix C.*

The secondary data used were the traffic accident data collected from respective police stations found in each wereda's and 24hr traffic accident records. Those data were recorded by copying the original data and by taking pictures. The data applied for study were the accident data from 2005-2007 E.C (2012-2015). Those data were collected from Ambo wereda, Ejere wereda, Wolmera wereda, Holeta Town and Dendi Wereda.

The information Recorded on 24hr traffic accident happened were:

1) Time at which the accident happened
    - ✓ Morning
    - ✓ Afternoon
    - ✓ Night
2) Date, Year at which the accident happened
3) Location at which the accident happened
    - ✓ Specific location of the area
        - o Kebele
        - o Town
        - o Wereda
4) Number of victims involved in the accidents
5) Type of accident
    - ✓ Fatal injury
    - ✓ Severe injury
    - ✓ Slight injury
    - ✓ Severe Injury
6) Type of vehicle involved in the accident
    - ✓ Small bus
    - ✓ Large bus
    - ✓ Truck
    - ✓ Truck Trailer
7) Information about the driver
    - ✓ Name
    - ✓ Age
    - ✓ Sex
    - ✓ Education Level

8) Accident quantified in birr(ETB)
9) Information about the investigator
    - ✓ Name
    - ✓ Signature
10) Cause of accident
    - ✓ Drivers error
    - ✓ Pedestrian error
    - ✓ Design problem

Traffic accident records from September 2012-2015 were showed on *Appendix A.* Sample 24hr accident records together with pictures from individual Weredas were showed on the *Appendix B.*

3.6 Method of Analysis

Different Black spot identification criteria's were used in order to identify blackspot locations that are found in Ambo Wereda, Dandi Wereda, Ejere Wereda, Wolmera Wereda and Holota Town.

For instance, the data collected from respective police stations of the Weredas were recorded in different formats. Data of Ejere wereda & Holota town were recorded on the same format while data of Ambo Wereda, Dandi Wereda and Wolmera Wereda was recorded in another format.

The following form is prepared in order to record the accident data.

- Date on which the accident happened
- Type of accident
    - ✓ Fatal
    - ✓ Injury
    - ✓ Property Damage
- Vehicle type
- Age of the Driver
- Name of the location at which the accident happened
- Approximate location of the accidents
- Accident quantified in Ethiopian birr
- Time at which the accident happened

- Cause of the accident

Then the analysis was made using the Flemish government analyses method for traffic accident data. Based on these data, the following criterion was applied. First, each site within the last three years three or more accidents have occurred is selected. Then, a site is considered to be dangerous when its priority value (P), calculated using the following formula, equals 15 or more [26].

P = X + 3*Y + 5*Z, where

X = total number of light injuries/Slightly injured persons/

Y = total number of serious injuries /severely injured persons/

Z = total number of deadly injuries/Fatal/

Generally, since the accident numbers for Fatalities, Slight injuries, Severe Injuries are properly determined for Ejere wereda and Holota towns, priority value of Flemish government formula is used in order to rank black spot locations. But, due to unavailability of full data from traffic police stations which means, some of data were blank from 24hr traffic record, Accident frequency were used for Ambo Wereda, Dandi Wereda and Wolmera Wereda.

The next step was to cause of accidents determination and the preparation of road safety audit checklist to provide countermeasures based on the site inspection.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Characteristics of Road Traffic Accidents on the Road from Addis Ababa to Ambo September 2012- 2015

Total of 271 accidents happened on the road from Ambo to Addis Ababa. This accident includes fatal, injury and property damage accidents. Figure 4.1 shows the location together with number of accidents and the percentage of accidents for each location. 30.63% of accidents happened in Holota town, 25.09% in Wolmera wereda, 23.99% in Ambo Wereda, 13.65% of the accidents in Dendi Wereda and the lowest number of accidents 6.64% happened in Ejere Wereda.

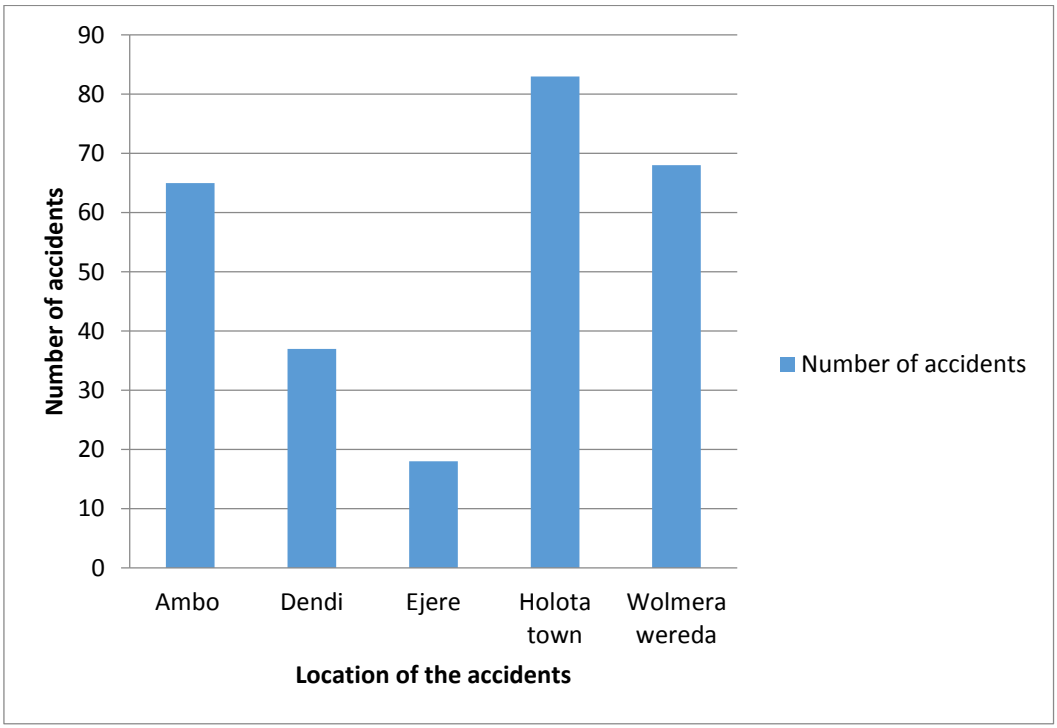

Fig.4.1 Accidents happened on the road from Ambo to Addis Ababa From September 2012-2015

i) Accidents by Driver Age

Figure 4.2 shows the age range of the driver's together with the accident type. Most of the accidents (39.53%) were unidentified by the police. Drivers Age range from 25-34 causes the highest number of accidents (25.91%) on the road from Ambo to Addis Ababa. So

that this shows the young age is suspected to highest cause of accidents on this road and special focus should be given to this young age.

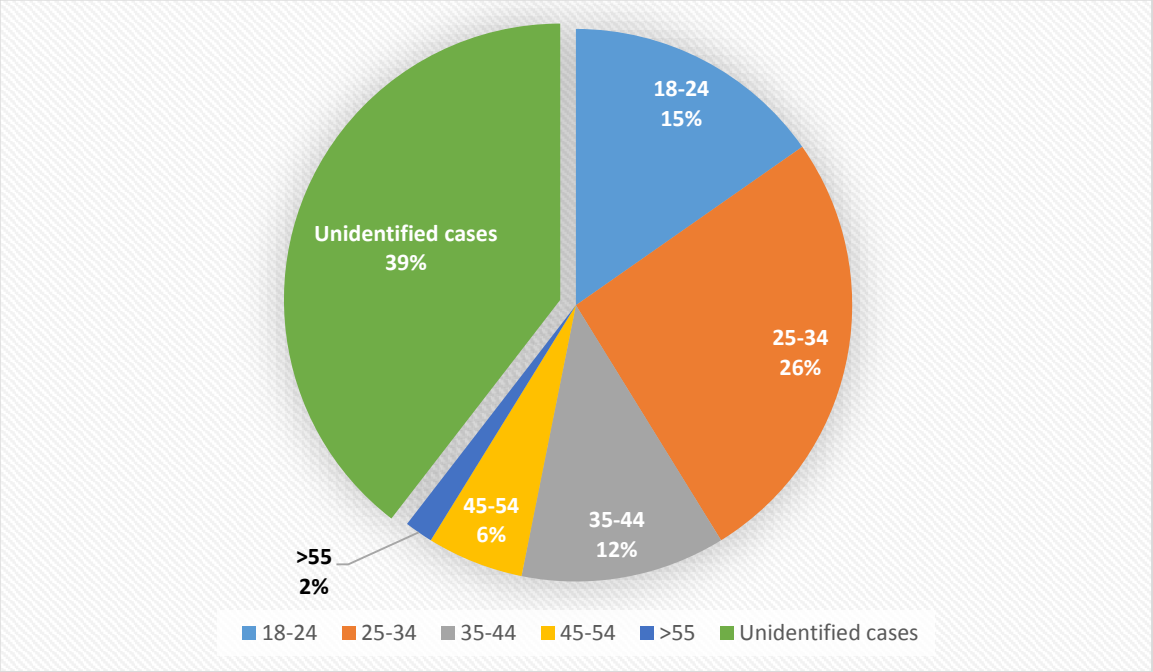

Figure 4.2 Drivers age range vs. type of accidents from September 2012-2015

ii) Accidents by Vehicle type

Table 4.1 shows that vehicle type together with type of accident on the road from Ambo to Addis Ababa. This shows that most of the accidents happened were due to 4WD (23.92%) and next to that Medium truck (18.94%) got the second rank. So that special focus should be given towards these vehicles.

Table 4.1 Vehicle type vs. type of accidents from September 2012-2015

Vehicle type	Fatal injury		Injury		Property damage		Total	%
	Total	%	Total	%	Total	%		
Motor cycle	0	0.0	1	1.12	0	0.00	1	0.33
Bajaj	0	0.0	4	4.49	3	2.08	7	2.33
Cars	4	5.9	6	6.74	10	6.94	20	6.64
4WD	8	11.8	32	35.96	32	22.22	72	23.92
Small buses	2	2.9	5	5.62	3	2.08	10	3.32

Large buses	1	1.5	2	2.25	0	0.00	3	1.00
Small trucks	3	4.4	4	4.49	7	4.86	14	4.65
Medium truck	12	17.6	12	13.48	33	22.92	57	18.94
Heavy truck	8	11.8	7	7.87	20	13.89	35	11.63
Truck Trailers	4	5.9	4	4.49	6	4.17	14	4.65
Unidentified	26	38.2	12	13.48	30	20.83	68	22.59
Total	68	100.0	89	100.00	144	100.00	301	100.00

iii) Accidents by Time of the day

Figure 4.3 shows the time of the day together with the injury accidents. Most of the accidents were happened during day time, which is from 6:00 a.m. (morning) to 9:00 P.m. (afternoon). The highest number of accidents happened during 12:01am-3:00 pm.

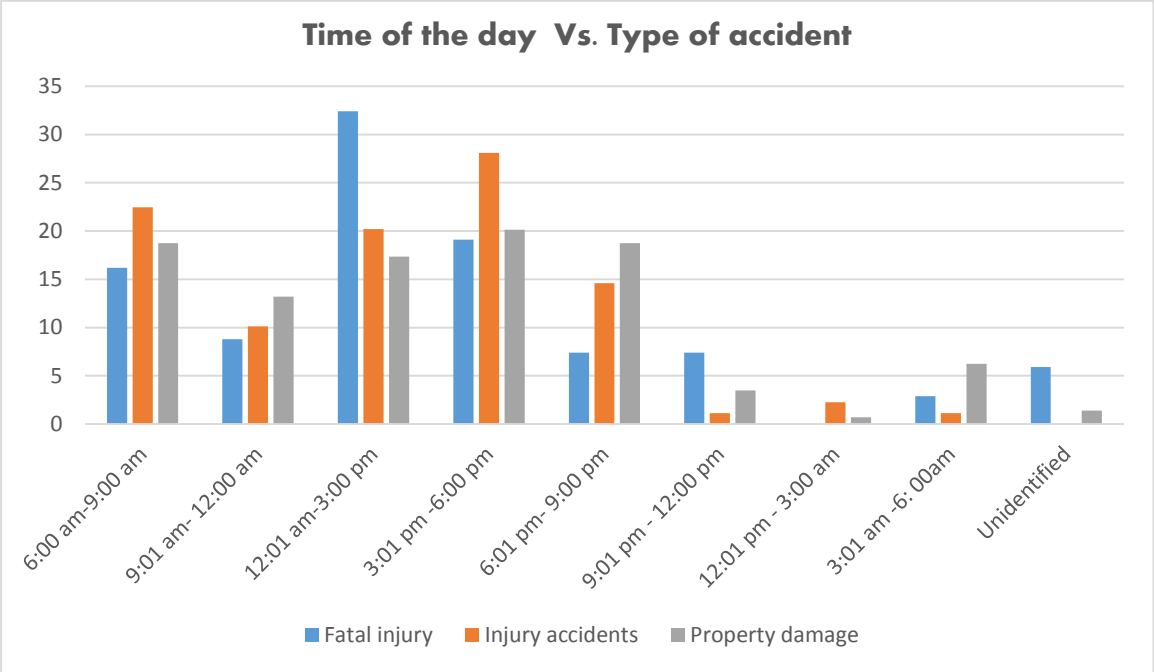

Figure 4.3 Time of the day vs. type of accidents from September 2012-2015

4.2 Analysis of Fatal Accidents from September 2012-2015

I) Accidents by Vehicle type

Total of 14 fatal accidents happened in Ambo wereda, 21 in Dendi wereda, and 12 in Ejere wereda, 15 in Holota Town and 6 in Welmera wereda. Table 4.2 shows the number of fatal injuries together with vehicle category for each wereda. 38.2% of fatal accidents are unidentified, 17.6% are caused by Medium truck, 11.8% are caused by 4WD and heavy truck, 5.9% by cars and Truck trailers, 4.4% by small trucks and 1.5% by large buses.

This analysis shows that 38.2% of the vehicles categories that causes fatal accidents were unidentified. But from the identified cases medium truck causes highest fatal accidents with 17.6%, succeeded by 4WD and heavy truck and lowest percentage of fatal accidents happens due to large buses.

Table 4.2 Number of Fatal injury caused vs. vehicle category from September 2012-2015

Vehicle type	Fatal injury						
	Ambo Wereda	Dendi Wereda	Ejere Wereda	Holota Town	Welemera Wereda	Total	%
Motor cycle	0	0	0	0	0	0	0.0
Bajaj	0	0	0	0	0	0	0.0
Cars	3	0	0	0	1	4	5.9
4WD	2	0	2	4	0	8	11.8
Small buses	0	0	1	0	1	2	2.9
Large buses	0	0	0	0	1	1	1.5
Small trucks	2	0	0	0	1	3	4.4
Medium truck	3	0	4	5	0	12	17.6
Heavy truck	4	0	1	3	0	8	11.8
Truck Trailers	0	0	2	1	1	4	5.9
Unidentified	0	21	2	2	1	26	38.2
Total	14	21	12	15	6	68	100.0

ii) Accidents by Drivers age

Figure 4.4 shows Drivers age range together with number of fatal accidents happened. Most of the fatal accidents (37%) happened were unidentified. But from the identified causes, 25% of the accidents happened within the age range of (25-34), 14.7% (18-24), 8.8 %(35-44), 4.4(45-54) and the lowest number 2.9% is recorded for the age range >55. From the analysis age group 25-34 and 18-24 have got highest rank .when viewed from the age category of our country this group is highly engaged in economic activity and very essential group, so that special focus should be given to this group to minimize the causes of accidents.

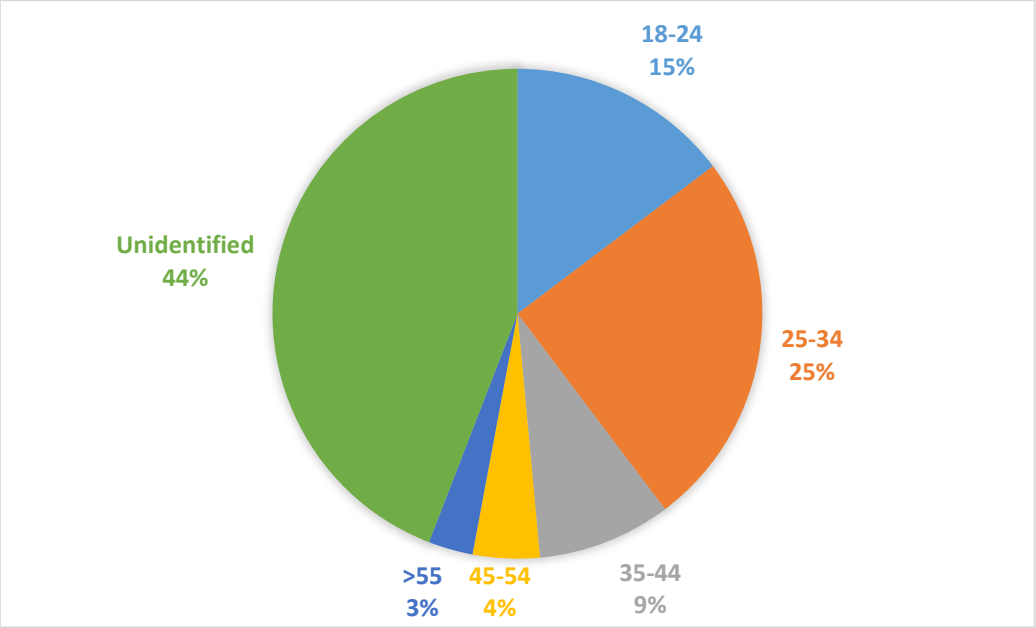

Figure 4.4 Drivers Age Group VS. Number of Fatal injury
From September 2012-2015

iii) Accidents by time of the day

Figure 4.5 shows the variation of fatal injury with time of the day. According to the analysis the highest percentage (32.4%) of fatal accident is recorded within the time range (12:00am-3:00pm) o'clock while the lowest 2.9% is recorded for the time range of (3:01am-6:00am) and no fatal injury is recorded at for the time range of 6:01pm-9:00pm. The analysis shows that most of the fatal injuries were happened at the mid-day that means between 12:01am and 3:00pm o'clock, so that special focus should be given to this time range.

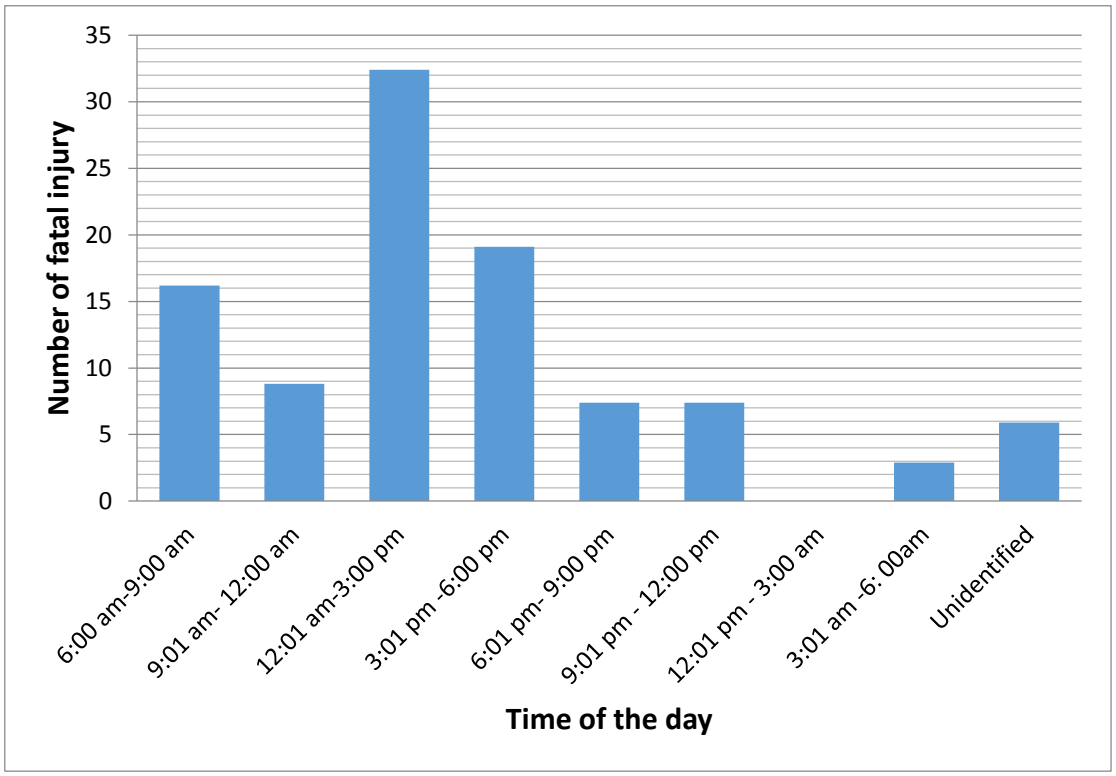

Figure 4.5 Time of the day VS. Fatal injury

From September 2012-2015

4.3 Analysis of Injuries from September 2012-2015

i) Accidents by vehicle type

Different types of vehicles are involved in injury accidents. Table 4.3 shows the Different vehicle category involved in the accident with the injury accidents happened by this vehicle category. The highest percentage of injury accidents (32%) is caused by 4WD while 12% is caused by Medium truck and the lowest injury accidents were caused by Motorcycle and Bajaj.

Table 4.3 Vehicle category Vs. Injury accidents from September 2012-2015

Vehicle type	Injury accidents					Total
	Ambo Wereda	Dendi Wereda	Ejere Wereda	Holota town	Welemera Wereda	
Motor cycle	0	0	0	1	0	1
Bajaj	0	0	0	4	0	4
Cars	1	0	0	4	1	6
4WD	0	8	2	14	8	32

Small buses	3	0	0	1	1	5
Large buses	1	0	0	1	0	2
Small trucks	3	0	0	1	0	4
Medium truck	3	2	2	4	1	12
Heavy truck	1	1	0	5	0	7
Truck Trailers	1	1	0	1	1	4
Unidentified	2	0	1	4	5	12
Total	15	12	5	40	17	89

ii) Accidents by the Drivers age

Figure 4.6 shows the injury accidents for each age group of drivers. Highest injury accidents happened on the age group of 25-34 having (30.34%). the others 13.48 % age group from 18-24, 10.11 % age group from 35-44, 6.74 % age group 45-54, while the lowest value 2.25% is recorded for the age group >55. So that this shows that the highest number of injury accidents is caused by young age Drivers so that special focus should be given to young drivers.

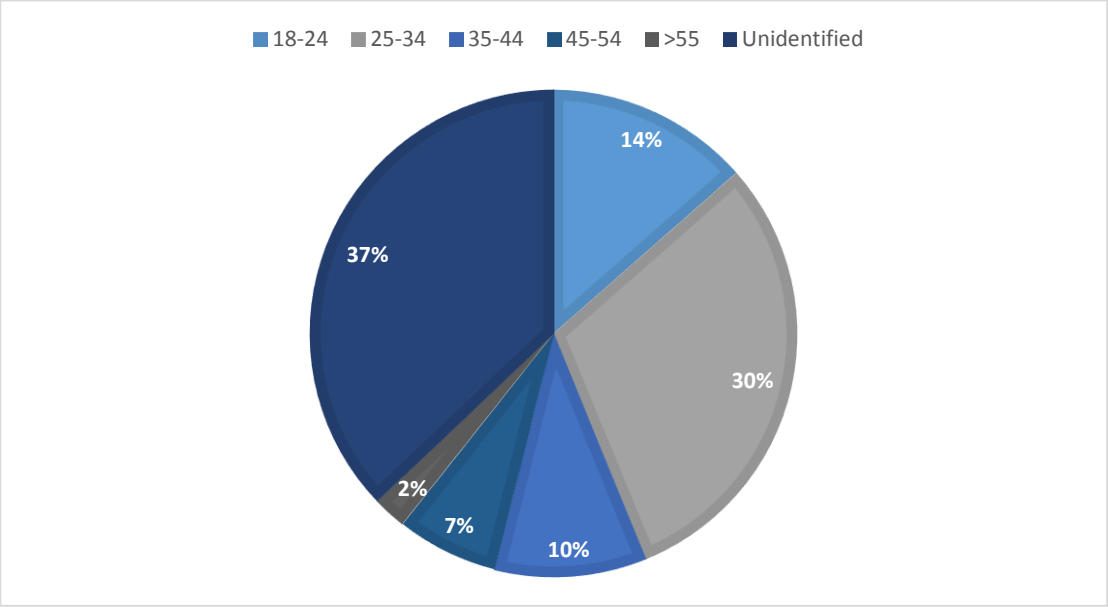

Figure 4.6 Drivers age Vs. Number of injury accidents from September 2012-2015

iii) Analysis by time of the day

The occurrence of accidents varies with time range of the day. Table 4.7 shows the variation of time of the day together with the number of injury accidents happened. The

highest percentage of accidents 28.09% happened for the time range of (3:01pm-6:00pm) while the lowest percentage 1.12% happened for the time range of (9:01pm-12:00pm) & (3:01am-6:00am).

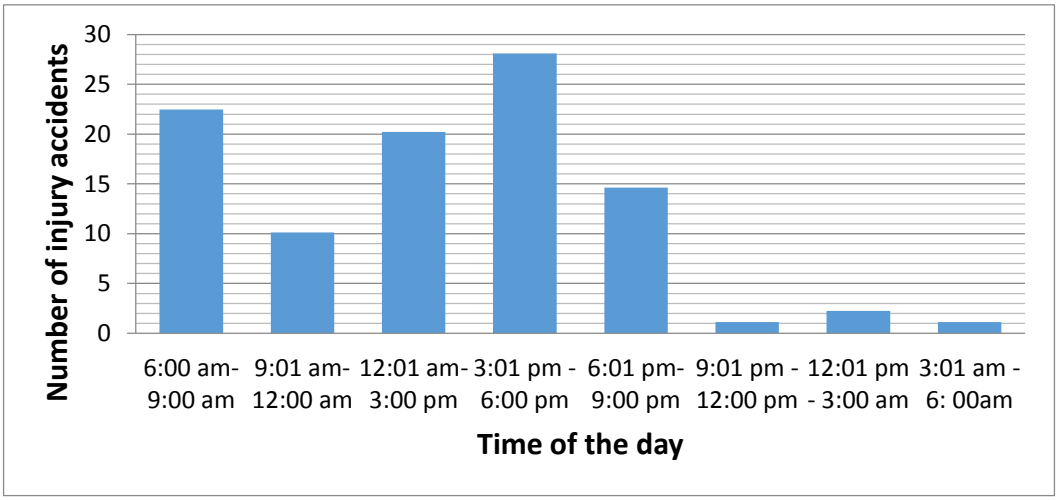

Figure 4.7 Time of the day Vs. Number of injury accidents From September 2012-2015

4.4 Analysis of Property Damage from September 2012-2015

i) Analysis based on accident cost

Table 4.4 shows the costs per each wereda. From the total calculated accident costs, 39.79% of the cost is incurred in ambo wereda, 30.16% is incurred in wolmera wereda, and the least accident cost is incurred in Ejere wereda. So that this shows that most of the accidents happened 3,977,360birr is lost due to accidents happened in ambo wereda , this will cause the economic degradation of both the region and the country as the whole so that special focus should be given to this wereda.

Table 4.4 Accidents cost per each wereda from September 2012-2015

Location	Accident Cost (ETB)	%
Ambo Wereda	3,977,360.00	39.79
Dandi Wereda	676,000.00	6.76
Ejere Wereda	60,000.00	0.60
Holota town	2,267,000.00	22.68
Wolmera wereda	3,014,700.00	30.16
Total	**9,995,060.00**	100.00

ii) Analysis by vehicle type

Table 4.5 shows the number of damaged properties by the vehicle type which causes the accidents. The highest numbers of damaged properties (22.92%, 22.22%) are due to Medium truck, 4WD respectively. so that special study should be undertaken to this vehicle category.

Table 4.5 Vehicle type Vs. Number of damaged properties from September 2012-2015

Vehicle type	Number of Property damage					Total	%
	Ambo	Dendi	Ejere	Holota town	Welmera		
Motor cycle	0	0	0	0	0	0	0.00
Bajaj	1	0	0	2	0	3	2.08
Cars	5	0	0	2	3	10	6.94
4WD	4	5	1	11	11	32	22.22
Small buses	0	0	0	2	1	3	2.08
Large buses	0	0	0	0	0	0	0.00
Small trucks	2	0	0	3	2	7	4.86
Medium truck	15	4	1	7	6	33	22.92
Heavy truck	2	0	1	8	9	20	13.89
Truck Trailers	2	0	0	2	2	6	4.17
Unidentified	1	1	1	4	23	30	20.83
Total						144	100.00

4.5 Priority Value in the Sampled Population

The priority value is determined based on Flemish government's formula which is

$P = X + 3*Y + 5*Z$, where

X = total number of light injuries/Slightly injured persons/

Y = total number of serious injuries /severely injured persons/

Z = total number of deadly injuries/Fatal/

And this formula is applied for two weredas in order to rank the black spot locations.

1. Ejere Wereda

Total of about eleven black spot locations are identified within this wereda. So that Table 4.6 shows that the calculated values of priority value based on fatalities and injuries for each black spot locations. The highest priority value is recorded in Lega Berga Bridge (76) and Cirrii (15).

Table 4.6 Identified black spot Locations at Ejere Wereda

From September 2012-2015

Black spot location	Fatalities	Injuries		Priority value(P)
		Slight	Severe	
Cirrii	2	1	2	15
Laga Berga Bridge	3	6	11	76
Beekkattee	2	0	0	2
Around Ejere Elementary School	2			2
Algawerash	1			1
Beekkattee	1			1
Horaa Karree	1			1
Around Salaalee	1			1
Kampii			1	5
Infront of Mika'el	1			1
Mobil		1		3

2. Holota Town

Total of about thirty four black spot locations are identified within this wereda. Table 4.7 shows that the calculated values of priority value based on fatalities and injuries for each black spot locations. The result shows that, the more than 50 priority value is recorded in miizanaa(mizantabya),Laga hoolotaa,kruchery and in front of golden hotel.

Table 4.7 Identified black spot Locations at Holota town

From September 2012-2015

Black spot location	Fatalities	Injuries		Property Damage	Priority value(p)
		Slight	Severe		
Condominium	0	1	1	3	8
In front of Golden hotel	1	3	8	3	50
Kruchery	1	4	9	6	58
Galaanee	0	2	0	1	6
Holota Bridge	0	1	0	3	3
Goldeen	0	1	0	0	3
Karaatuurii	2	12	0	5	38
Around Abayneh hotel	0	2	0	0	6
Around Flower Station	1	7	0	4	22
Laga Hoolotaa	2	7	7	2	58
Mizanaa(Mizan Tabya)	0	27	4	5	101
Gabreelii	1	7	14	3	92
Sheelii	0	0	3	1	15
Garbii	2	0	0	0	2
Around Hawi Hotel	1	7	1	1	27
Oromia Flower Production Station	0	0	0	1	0
Sadamoo Karaatoorii	1	1	0	1	4
Car training	0	0	1	0	5

Station					
Around Holeta Mirimir	1	0	0	0	1
Kuyyuu	0	0	0	1	0
Firii born	0	2	0	1	6
Infront of Itopy bank	0	2	0	0	6
Footoo Bultoo	0	1	0	1	3
Mura Majar Muzium	1	0	0	0	1
Infrontof karaturii	0	0	0	1	0
Around Adifinyaa(park)	0	2	0	1	6
B/Harbii clinik	0	0	0	1	0
Keetim Hotel	0	0	0	1	0
Oromia Onideri	0	0	0	1	0
Zabiiraa	1	0	0	0	1
Asgorii	0	3	0	1	9
Aaganyo	0	3	0	1	9
Ethio Flower	0	0	0	1	0
Around Bus Station on Coble Stone	0	0	1	0	5

4.6 Accident Frequency in the Sampled Population

Accident frequency is applied based on Australian government's formula, which takes into account the occurrence of accidents for the duration of three years period and it states that if more than three accidents happened in the last three years period then the site is considered as black spot location,. So that accident frequency value is determined for three weredas and the black spot locations are ranked based on this.

1. Ambo Wereda

Total of about six black spot locations are identified within this wereda. Table 4.8 shows the list of black spot locations together with accident frequency and the rank orders. From the total accidents happened Macawacan ,Awaro,mininii and bayo kurbi have got rank from one to three, while Meti town got the lowest rank.

Table 4.8 Identified Locations at Ambo Wereda

From September 2012-2015

Black spot location	Accident frequency	Rank
Makawacan	20	1
Awaro	12	2
Minini	10	3
Bayokurbi	10	3
Meti	2	4

2. Dendi Wereda

Total of thirty black spot locations are identified within this wereda. Table 4.9 shows the list of black spot locations together with accident frequency and the rank orders. Eight locations named as Tellee,around secondary school, Around mazorya, Laga jamjam, Laga Darabbah, Naannoo tulluu baacoo,Daannoo ejersa gibee have experienced the accident two times in the last three years while other locations experienced the accident only one time.

Table 4.9 Identified Black spot Locations at Dendi Wereda

From September 2012-2015

Black spot location	Accident frequency	Rank
Telle	2	1
Around Secondary High school	2	1
Around Mazorya	2	1
Lega Jamjam	2	1
Lega Derabbah	2	1

Around Bacho mountain	2	1
Danno Ejersa Gibee	2	1
Jaldu mazoriya	1	8
Huluko	1	8
Michitu	1	8
G/goftu	1	8
Gaba dilbata	1	8
Handode	1	8
Zetena kilo	1	8
Boreni	1	8
Awash	1	8
Bolole Bridge	1	8
Gare mulo	1	8
Chankitu	1	8
Bataskana Giyoorgisii	1	8
Dhakaa Wucii	1	8
Cufaa	1	8
Bulukoo	1	8
Around Gotoraa	1	8
Yubdoo Laga Baatuu	1	8
Bangichoo	1	8
Dagaa Eeguu	1	8
Qo'ee Mazoriyaa	1	8
Somoonyii	1	8
Fakkarees	1	8

3. Welmera Wereda

Total of Seven black spot locations are identified within this wereda. Table 4.10 shows the list of black spot locations together with accident frequency and the rank orders. the result indicates 46 or more than 90% of accidents frequently happened in the last three years on menagesha while 3 happened in talacaa, 2 in subbaa, and 1 in Rob gebya,Markos station,walmera cooqaa and Asgoriii.

Table 4.10 Identified Locations for Black Spot Identification at Wolmera Wereda

Black spot location	Accident Frequency	Rank
Menagesha	46	1
Talaca	3	2
Suba	2	3
Robgebya	1	4
Markos Station	1	4
Walmera Cooqaa	1	4
Asgorii	1	4

4.7 Locations of Hazardous location

Finally after the priority value and the accident frequency are determined, each site within the last three years three or more accidents have occurred is selected. Then, a site is considered to be dangerous when its priority value (P) is equals 15 or more. Based on this, 13 Hazardous locations are prioritized from the total of selected sites.

Total of thirty black spot locations are identified on the road from Addis Ababa to Ambo. From the total accidents three are from Ambo wereda, two are from Ejere wereda and seven locations are from Holota town. Table 4.11 shows the list of black spot locations together with their rank orders within each weredas.

Table 4.11 Identified Black spot locations from Ambo to Addis Ababa from September 2012-2015

Black spot locations	Rank	
Makawachan/BayoKurbi	1	Ambo wereda
Awaro	2	
Minini	3	
Legaberga Bridge	1	Ejere Wereda
Chiri	2	Ejere Wereda
Menagesha	1	Welmera Wereda

Mizana(MizanTabya)/Gabrel	1	Holota Town
LegaHolota	2	
Kruchery	3	
In front of Golden hotel	4	
Karaturi /Around Flower Station/	5	
Around Hawi Hotel	6	
Shell	7	

4.8 Causes of Road Traffic Accident at Hazardous Locations

The cause of accident is determined based on the traffic accident data collected from the traffic police stations.

1. Ambo Wereda

Total of four causes of accidents are identified in this wereda. Table 4.12 shows cause of accidents with the number and percentages of each of the causes from the total. 69% of the accidents were due to over speeding, 28% due to driving without attention, 2% is due to failure in vehicle and unidentified cases.

Table 4.12 Cause of accident in Ambo wereda

Cause of accident	Number	%
Over speeding	45	69
Driving without attention	18	28
Unidentified	1	2
Failure in vehicle	1	2
Total	65	100

2. Dendi Wereda

Total of Eight causes of accidents are identified in this wereda. Table 4.13 shows cause of accidents with the number and percentages of each of the causes from the total. 10% of the accidents are due to Driving without attention& over speeding, 6% is due to Failure to

give away for Pedestrians, while 5% is due to Driving without attention and 9% were unidentified cases by the police.

Table 4.13 Cause of Accident in Dendi Wereda

Cause Of Accident	Number	%
Driving without attention	5	14
Failure to give away for Pedestrians	6	16
failure to respect Traffic sign &over speeding	1	3
Driving without attention& Over speeding	10	27
Failure to give away for vehicles	1	3
Unidentified	9	24
Failure in vehicle	1	3
Over speeding	4	11
Total	37	100

3. Ejere Wereda

Total of three causes of accidents are identified in this wereda. Table 4.14 shows cause of accidents with the number and percentages of each of the causes from the total. 44% of the accidents happened due to Driving without attention, 6% due to Failure to give away for vehicles and 50% of the accidents were un identified.

Table 4.14 Cause of accident in Ejere wereda

Cause of Accident	Number	% From Total
Driving without attention	8	44
failure to give away for vehicles	1	6
un identified	9	50
Total	18	100

4. Holota Town

Total of sixteen causes of accidents are identified in this Wereda. Table 4.15 shows cause of accidents with the number and percentages of each of the causes from the total. 20% of accidents happened due to overspeeding,24% due to Driving without attention, 10% due to Following too closely,9% due to Failure to give away for pedestrians Pedestrians**,** 5%

due to Others, 4% due to (Driving with fatigue, Failure to give away for vehicles& Failure to give away for vehicles),3% due to (Over speeding& Driving without attention, Influence of alcohol or drug & Improper overtaking) and 1% due to (Improper Turning, Failure to respect Traffic sign, Pedestrian Error, Excess Loading & unidentified cases by the police).

Table 4.15 Cause of accident in Holota Town

Cause Of Accidents	Number	%
Over speeding	20	26
Driving without attention	19	24
Driving with fatigue	3	4
Failure to give away for Pedestrians	7	9
Following too closely	8	10
Failure in vehicle	3	4
Failure to give away for vehicles	3	4
Others	4	5
Over speeding& Driving without attention	2	3
Influence of alcohol or drug	2	3
Improper Turning	1	1
Failure to respect Traffic sign	1	1
Pedestrian Error	1	1
Improper overtaking	2	3
un identified	1	1
Excess Loading	1	1
Total	78	100

4.9 Measures to Minimize the Road Traffic Accidents in Hazardous Locations and Features of the locations

On the next step, check list is prepared in order to collect road condition data at black spot locations. And the black spot locations are evaluated using the same evaluation criteria. The criteria's are set based on ERA road and safety manual of 2001, road safety and Audit guide for rural roads (Rural roads Project-1).

The counter measure is provided by site visiting the black spot locations with traffic officers (police inspectors) and is provided based on the check list provided .The road configuration of the area is properly studied and the sample images were taken at each black spot locations.

The site visitation was done with police officers (Inspectors) of respective Wereda. While the common accident locations are known by the police inspectors working in that area.

Figure 4.8 Site visits of Black spot locations

A) HOLOTA TOWN

i) Gabreelii/Mizanaa/

The black spot location identified is Gabreelii (Miizanaa). This location is found around Ethiopian road authorities size and weight control station. Its location is inside town section. The counter measure that should be applied on this road are:- Edge side and Central traffic marking should be painted, in addition ,Island should be provided inside the intersection area. Sufficient pedestrian walking lane should be provided and also speed limit post should be installed.

Figure 4.9 Gabriel before Counter measure is applied

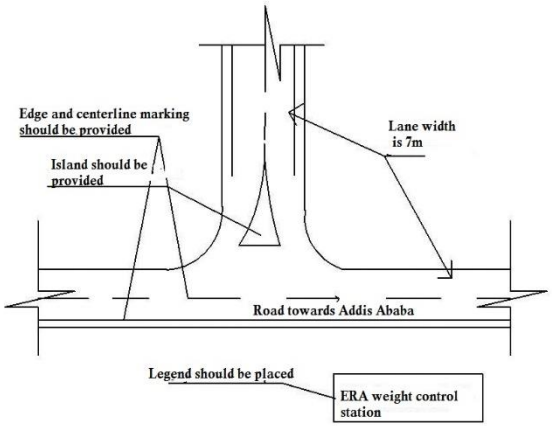

Figure 4.10 Gabriel after Counter measure is applied

i) Lega Holota(Around 27.5km from Addis Ababa)

The counter measure that should be applied is: Obstruction should be removed from the curve (there are trees around the curve so that it should be removed), the road width should be widened because it does not accommodate the existing traffic volume, Centerline pavement marking should be provided, because the existing ones are already removed (faded), Since the road is with steep gradient, proper speed limit post should be installed along the road and finally Road side delineator should be installed that guides vehicles move along the curve.

ii) Crushery (approximately 33km from Addis Ababa)

The counter measure that should be applied is: a) The road stretch is with steep gradient so that speed limit post should be installed, b) there is no pavement marking both along center and edge, so that proper pavement marking should be installed along the road, d) The existing shoulder has deteriorated so that it should be rehabilitated, e) There are obstructions of trees around the curve so that should be removed.

iii) In front of Golden Hotel

The counter measure that should be applied is: a) Road side delineator should be installed along the road that guides vehicles to flow on the horizontal curve, b) Since the stretch is with steep gradient and sharp curve guardrail should be provided along the curve, c) There is problem of obstruction, so that the obstruction should be cleared from the road side.

iv) Karaturi

The road is found in front of Ethiopian Medious Plc. and most part of the road stretch is flat and with the absence of horizontal curve.

The counter measure that should be applied is: a) The longitudinal length of the road is very long and flat (around 700m long), that vehicles always speed up in order to overtake other vehicles so that speed limit post should be provided, b) The original pavement markings are already faded, so that the road should be re- painted, c) The existing road side pedestrian walking lane is deteriorated, so that it should be rehabilitated.

v) Around Hawi Hotel

The counter measure that should be applied is: a) since it is broken back type of curve, proper traffic sign should be installed along this curve, b) The lane width is not enough and there is also pavement deterioration along the road so that the pavement should be

rehabilitated and also the pedestrian walking lane should be provided, c) The route is with very steep gradient, so that speed limit post should be installed d) The horizontal curve radius is very big that guard rails should be installed along the road.

vi) Shell

The counter measure that should be applied is: a) half lane of the pavement is fully deteriorated and vehicles leave their way in order to use the half asphalt, so that it must be rehabilitated, b) Enough shoulder width should be provided along the road, c) Pavement markings are not visible, so that the pavement marking should be re- painted, both centerline and edge markings

B) MENAGESHA

There are two sites identified as hazardous inside Menagesha town, one at approximately 22km and the other at 20km from Addis Ababa respectively. Most stretch of the road configuration of Menagesha is covered with more than 13 horizontal curves and in connection to this; this road is very congested type of road while viewing the traffic characteristics.

i) At approximately 20km from Addis Ababa

The counter measure that should be applied is: a) Pedestrian walking lane should be provided; b) The length between the curves is so small that it needs design revision, c) The centerline marking should be re-painted, d) Speed limit post should be installed, e) There are obstructions inside the curve, so that obstruction should be cleared.

ii) **At approximately 22km from Addis Ababa**

The counter measure that should be applied is: a) the lane width is not sufficient, so that it should be widened, b) There are Equilaptus trees surrounding the curve that obstructs the vision of the drivers, so that it should be cleared, c) There is steep gradient along the road stretch so that speed limit posts should be installed along the road, d) There is already existing concrete road side delineator but destroyed by accidents, so that it should be

Figure 4.11 Menagesha (20km) before counter measure is applied

Figure 4.12 Menagesha (20km) after counter measure is applied

Fig 4.13 Menagesha (22km) before counter measure is applied

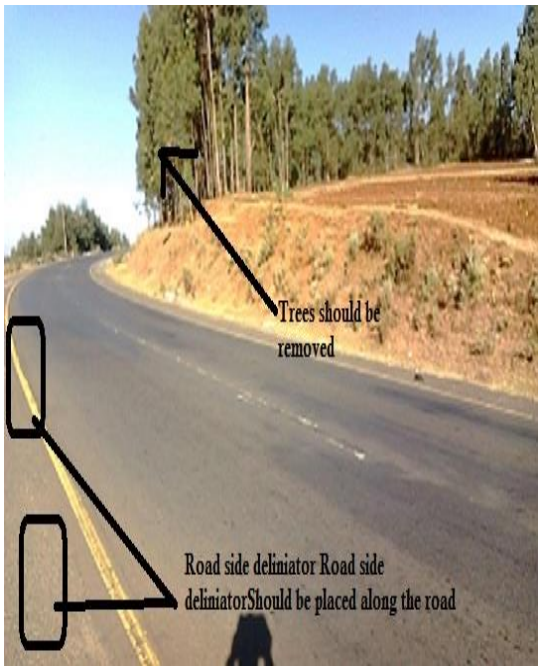

Figure 4.14 Menagesha (22km) after counter measure is applied

C) AMBO WEREDA

i) Wacan Mazoriya

The counter measure that should be applied is: a) Road way width should be increased, b) proper guard rail should be installed, c) Climbing lane should be provided to assist the faster moving vehicles to pass, d) There is steep gradient, so that speed limit posts should be installed, e) Pavement marking is fading so that it should be re-painted, f) There is problem of Mis- phasing so that, the design should be reviewed.

Fig 4.15 Existing road configuration at Wacan Mazoriya

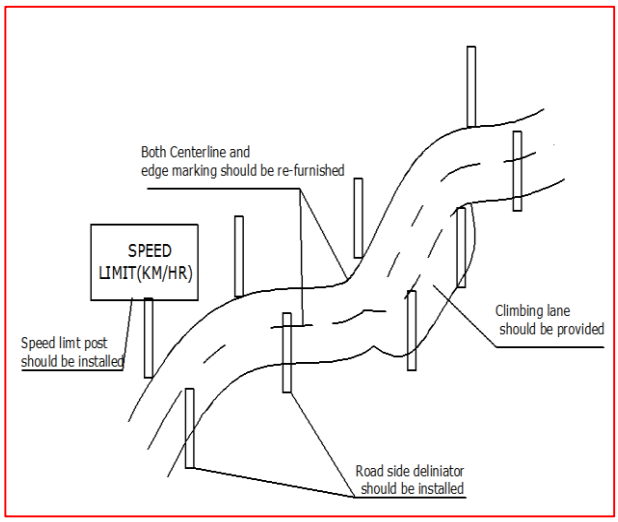

Fig 4.16 Wacan Mazoriya after countermeasure is applied

ii) Awaro

The curve is broken back type of curve, so that it needs design revision, pedestrian walking, Speed limit post and kerb should be provided since it is an entrance to town section, Road side landscape should be leveled to flat, Obstructions inside the curve should be removed, Road side delineator should be placed.

Figure 4.17 Awaro Before counter measure is applied

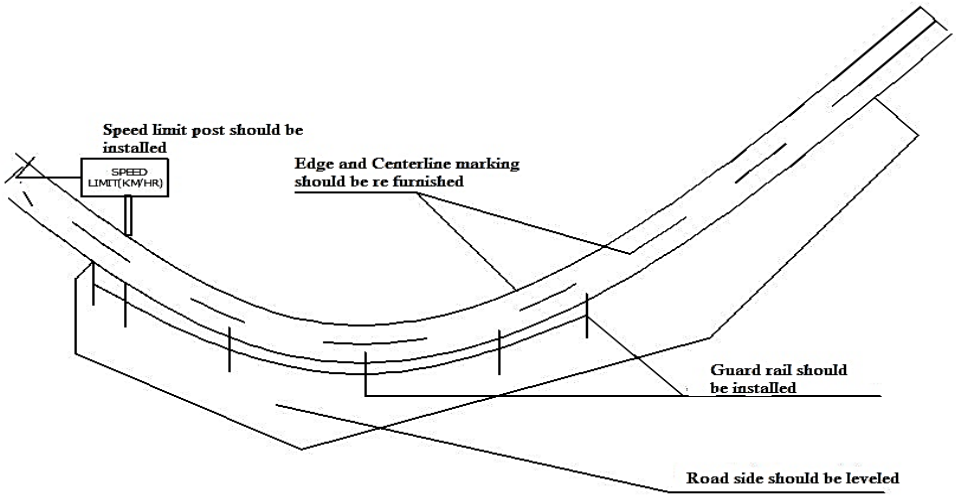

Figure 4.18 Awaro After counter measure is applied

iii) Miniinii

There is obstruction inside the curve so that it should be removed (trees are obstructing the drivers vision). The existing guard rail is not functioning and sufficient along the left side, so that it should be re-installed; Traffic signs are needed inside the curve, so that it should be provided, since the road geometry is like zigzag speed limit posts should be installed.

Figure 4.19 Existing Road Configuration at Minini

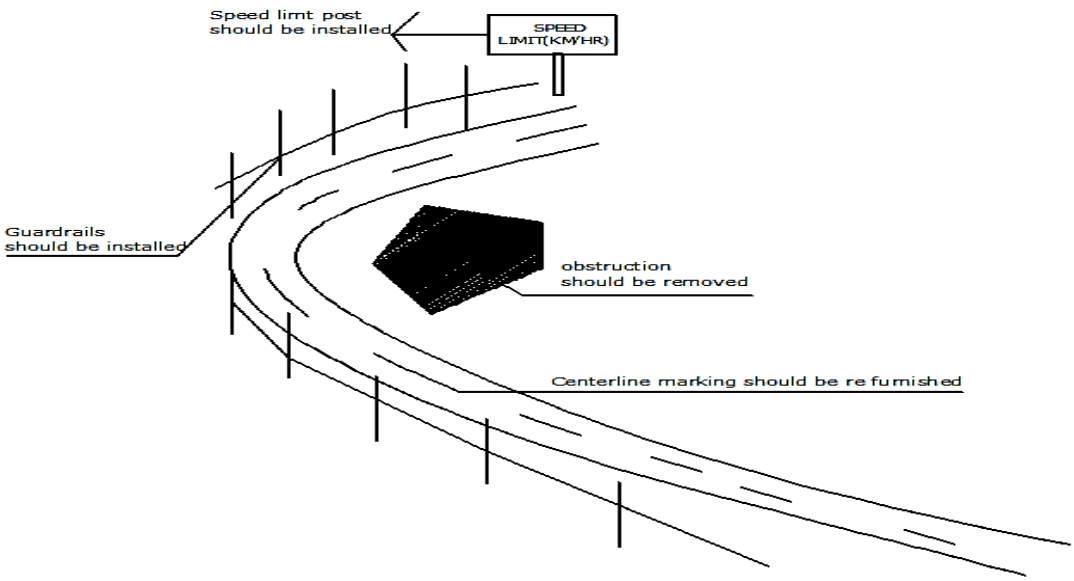

Fig 4.20 Minini Road Configuration after Counter Measure is applied

D) DANDI WEREDA

i) Lega Berga (46km from Addis Ababa)

Pavement is deteriorating along the road stretch, so that it should be rehabilitated. The longitudinal gradient is very is big that, speed limit post should be installed. On one side there are obstructions of trees, so that it should be cleared. Centerline marking is not visible so that it should be painted. The provision of climbing lane is needed, in order to support slow moving vehicles and give the way for faster moving vehicles.

ii) Chiri (Around 39km From Addis Ababa)

Obstruction near the curve should be removed (trees are around). Speed limit posts should be installed. Since the shoulder width is not sufficient should be increased. Road side delineator should be installed along the road.

Figure 4.21 Chiri before Countermeasure Is applied

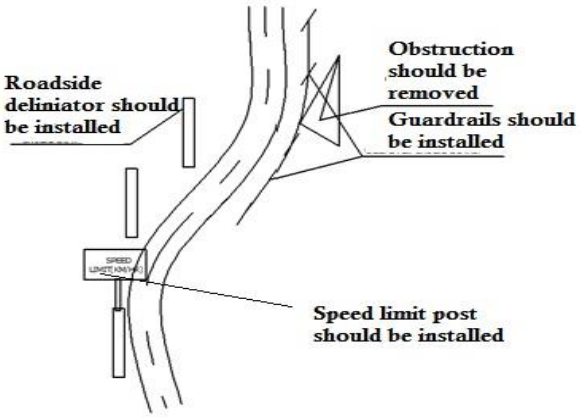

Figure 4.22 Chiri after countermeasure is applied

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

From the above study made on the identification of Blackspot locations that existed on the road from Addis Ababa to Ambo, the following locations are found to be Blackspots .Total of 13 black spot locations were identified. 3 locations were from Ambo wereda, 2 were from Ejere wereda, 1 from Welmera wereda and 7 from Holota town.

Road safety audit and traffic data analysis from September 2012-2015 were undertaken for the road corridor. Based on the available data, priority value and accident frequency were used in order to rank the black spot locations. Priority value were used for Ejere Wereda and Holota town while Accident frequency is used for Ambo Wereda,Dendi Wereda and Welmera Wereda. Based on the analysis and the results derived out of it, the following conclusions and recommendations are made.

5.1 Conclusion

According to the result of the study Makawacan/Bayokurbi, Minini, LegabergaBridge, Chiri, Menagesha, Legaholeta, Kruchery, Infront of Golden Hotel, Karatury, Around Hawi Hotel and Shell were the identified black spot locations on the road from Addis Ababa to Ambo. Most of the locations have problems of insufficient lane width, unimproved road side, absence of climbing lane, absence of road side delineator, fading of pavement marking and the absence traffic signals.

The result of the study indicated that most of the accidents that happened were between times of the day 12:00am-3:00pm, and while the minimum number of accidents that happened were between times of the day 9:01pm-12:00pm. Thus it is concluded that majority of the accidents that happened were during day time and the minimum number of accidents that happened were during night time.

In relation to drivers' age group, majority of the accidents (25.1%) that happened were by drivers' whose ages ranges between 25 and 34. From this it is concluded that young drivers are believed to cause more accidents than the older once.

Regarding the causes so the accidents, 69% of the accidents that happened in Ambo Wereda were due to over speeding. And 27% of the accidents that happened in Dendi Wereda were due to driving without attention and over speeding. In Ejere Wereda, driving without attention has got highest rank of 44% and 50% of the accidents in the Wereda were unidentified cases. And finally in Holota town 26% of the accidents were due to over speeding. From this, it is concluded that majority of the accidents that happened were due to over speeding and Driving without attention.

5.2 Recommendation

Based on the deep analysis of the black spot locations, The major remedial measures that should be applied in order to decrease the occurrence of accidents along this road will be:-increment of the lane width, the provision of climbing lane, the installation of road side delineator, the provision of roadside improvements, the installation of traffic signals and the repainting of pavement marking. In connection to this, the Ethiopian roads authority should take the remedial measures as input and undertake road safety audit on the road in order to mitigate the effects.

Most of the drivers' age groups that cause the accidents are 25-34 and this age group is categorized under young age according to Ethiopian demography. As this age group is often daring after drinking alcohol at night and have lack of experience in driving, the concerned traffic management organ should give priorities in special training while giving driving license. In addition to this, the government should give awareness for drivers, traffic police and pedestrians about traffic rules and regulations.

Maximum number of the accidents that happened were during 12:00am-3:00pm in the afternoon. Therefore, Traffic officers should seriously watch over especially at this duration of time.

The traffic data collected at each Weredas don't contain full information. So, traffic accident recording data base should be prepared in all of the Weredas of the region and the recording system should also be similar region wide.

Finally, further studies by the concerned organs should be conducted so as to get clear and standardized blackspot identification methodologies at the federal level in order to tackle the high fatality rate related to traffic accidents in the country.

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APPENDIX .A

TRAFFIC ACCIDENT RECORDS FROM AMBO TO ADDIS ABABA ROAD FROM 2005-2007 E.C(from September 2012-2015)

AMBO WEREDA 2005-2007 E.C (2012-2015)

No.	Date	Type of Accident	Vehicle Type	Location name	Approximate Location (Km)	Accident Quantified (ETB)	Time	Cause of Accident
1	27/11/05	Fatal injury	DX	Maka wacan	102	135,100.00	2:30 morning	Over Speeding
2	29/05/05	Property Damage only	Un identified	Maka wacan	102	106,100.00	11:30 After noon	Driving without attention
3	8/9/2005	Severe injury	FSR	Maka wacan	102	21,300.00	11:30 After noon	Over Speeding
4	2/13/2005	Property Damage only	Isuzu	Maka wacan	102	250,000.00	4:30 Night	Over Speeding
5	28/1/05	Property Damage only	Isuzu	Miniinii	105	5,000.00	4:00 Morning	Over Speeding
6	13/02/05	Slight Injury	Un identified	Maka wacan	102	48,000.00	4:00 Morning	Driving without attention
7	5/3/2005	Fatal injury	Un identified	Awaro	110	-	5:00 Morning	Driving without attention
8	27/03/05	Slight Injury	Mini Bus	Awaro	110	16,300.00	3:25 Night	Over Speeding
9	25/03/05	Property Damage only	Isuzu	Taltallee	114	10,000.00	1:10 morning	Over Speeding
10	14/04/05	Fatal injury	Mini Bus	Sankale	118	106,500.00	1:30 morning	Over Speeding
11	24/04/05	Property Damage only	Isuzu	Sankale	118	12,100.00	5:00 afternoon	Over Speeding
12	1/5/2005	Property Damage only	Isuzu	Meti	100	67,500.00	2:45 night	Over Speeding

13	29/06/05	Property Damage only	Cino truck	Awaro	110	106,100.00	1:50 night	Driving without attention
14	7/7/2005	Property Damage only	Bajaj	Sankale	118	6,350.00	11:30 afternoon	Driving without attention
15	11/5/2005	Fatal injury	Pickup	Awaro	110	15,000.00	10:00 afternoon	Over Speeding
16	11/10/2005	Property Damage only	Cino truck	Miniinii	105	70,340.00	6:30 afternoon	Driving without attention
17	30/10/06	Property Damage only	DX	Maka wacan	102	10,700.00	2:30 morning	Over Speeding
18	2/13/2006	Property Damage only	Mini Bus	Maka wacan	102	145,000.00	5:30 afternoon	Over Speeding
19	26/10/06	Fatal injury	Isuzu	Maka wacan	102	48,900.00	3:00 morning	Over Speeding
20	27/06/06	Property Damage only	Un identified	Maka wacan	102	94,000.00	2:00 night	Driving without attention
21	13/10/05	Property Damage only	Toyota	Maka wacan	102	48,530.00	11:30 night	Over Speeding
22	27/10/05	Property Damage only	Isuzu	Miniinii	105	38,100.00	1:30 night	Over Speeding
23	24/10/05	Property Damage only	Damas	Miniinii	105	75,010.00	5:00 night	Over Speeding
24	21/11/05	Slight Injury	IUECO	Awaro	110	19,800.00	5:15 afternoon	Driving without attention
25	17/12/05	Slight Injury	Isuzu	Sankale	120	35,000.00	3:00 night	Over Speeding
26	6/11/2005	Slight Injury	Isuzu	Awaro	110	40,000.00	5:30 afternoon	Over Speeding
27	29/12/05	Severe Injury	Damas	Awaro	110	-	11:00 afternoon	Over Speeding
28	2/3/2006	Severe Injury	Auto bus	Awaro	110	-	11:20 afternoon	Over Speeding

29	12/5/2006	Fatal injury	Toyota	Miniinii	105	6,500.00	11:00 afternoon	Over Speeding
30	23/05/06	Property Damage only	Pickup	Awaro	110	23,100.00	2:00 morning	Over Speeding
31	3/6/2006	Property Damage only	Foton	Awaro	110	22,000.00	9:00 afternoon	Driving without attention
32	12/6/2006	Property Damage only	Nisan pickup	Awaro	110	13,100.00	3:00 morning	Over Speeding
33	13/6/06	Property Damage only	Turbo	Gosu	114	181,600.00	3:00 night	Driving without attention
34	23/6/06	Property Damage only	Truck trailer	Awaro	110	52,100.00	3:30 night	Driving without attention
35	24/4/06	Fatal injury	Isuzu	Wadesa	142	26,300.00	8:00 afternoon	firen problem
36	3/6/2006	Fatal injury	Pickup	Wadesa	144	-	8:00 afternoon	Driving without attention
37	12/7/2006	Property Damage only	FSR	Miniinii	110	100,000.00	3:00 night	Over Speeding
38	26/11/06	Property Damage only	IUCEO	Bayo kurbi	99	78,100.00	9:00 afternoon	Driving without attention
39	13/11/06	Property Damage only	Isuzu	Bayo kurbi	99	52,150.00	1:30 morning	Over Speeding
40	20/12/06	Severe Injury	Mini Bus	Miniinii	105	37,300.00	2:00 morning	Over Speeding
41	12/1/2007	Severe Injury	Lifan motor	Miniinii	105	87,500.00	10:00 afternoon	Over Speeding
42	23/11/06	Fatal injury	Cino truck	yahi cebo	125	63,500.00	6:30 afternoon	Driving without attention
43	17/02/07	Property Damage only	Isuzu	Bayo kurbi	99	85,100.00	3:30 morning	Over Speeding
44	29/4/07	Fatal injury	Mini Bus	Miniinii	105	75,080.00	4:00 morning	Over Speeding
45	27/04/07	Fatal injury	Cino truck	Maka wacan	102	145,100.00	4:00 night	Driving without attention
46	6/3/2007	Property Damage only	Car	Maka wacan	102	50,000.00	3:00 morning	Over Speeding

47	19/01/07	Fatal injury	Car	Maka wacan	102	270,000.00	8:00 afternoon	Over Speeding
48	1/5/2007	Fatal injury	Car	Maka wacan	102	68,500.00	1:30 morning	Driving without attention
49	18/4/07	Property Damage	Car	Maka wacan	102	5,000.00	11:30 afternoo	Over Speeding
50	12/3/2007	Property Damage only	Mini Bus	Maka wacan	102	19,500.00	5:00 afternoon	Over Speeding
51	30/10/06	Property Damage only	private car	Maka wacan	102	-	2:00 morning	Over Speeding
52	9/2/2007	Property Damage only	Isuzu	Maka wacan	102	10,700.00	3:00 night	Over Speeding
53	10/2/2007	Property Damage only	Toyota	Maka wacan	102	-	1:30 morning	Over Speeding
54	26/04/07	Property Damage only	Isuzu	Maka wacan	102	40,000.00	1:15 night	Over Speeding
55	22/05/07	Property Damage only	Isuzu	Bayo kurbi	99	38,100.00	11:00 morning	Over Speeding
56	19/06/07	Severe Injury	Truck trailer	Bayo kurbi	99	200,000.00	10:00 afternoon	Over Speeding
57	28/04/07	Severe Injury	Cino truck	Meti	100	-	11:30 afternoon	Driving without attention
58	27/04/07	Fatal injury	Cino truck	Bayo kurbi	99	145,100.00	4:00 night	Driving without attention
59	29/04/07	Fatal injury	Cino truck	Bayo kurbi	99	42,100.00	4:00 morning	Over Speeding
60	29/08/07	Property Damage only	Pickup	Bayo kurbi	99	5,000.00	12:00 afternoon	Over Speeding
61	10/6/2007	Severe Injury	Mini Bus	Goromiti	124	24,100.00	12:00 afternoon	Over Speeding
62	19/6/07	Severe Injury	Isuzu	Miniinii	105	300,000.00	1:00 night	Over Speeding
63	1/9/2007	Property Damage only	Auto bus	Bayo kurbi	99	80,000.00	3:00 morning	Over Speeding
64	15/9/07	Property Damage only	Auto bus	Bayo kurbi	99	85,000.00	10:30 afternoon	Over Speeding

65	25/09/07	Property Damage only	Cino truck	Wadesa	122	15,000.00	5:00 afternoon	un identified

DANDI WOREDA 2005-2007 E.C (2012-2015)								
No.	**Date**	**Type of Accident**	**Age of Driver**	**Vehicle Type**	**Location name**	**Accident Quantified(ETB)**	**Time**	**Cause of Accident**
1	10/1/2006	Property damage		Kachamali & minibus	Jalduu mazoriya	40,500.00	7:30 morning	Over speeding
2	1/2/2006	Fatal injury	20	Minibus	Tellee	-	6:00 morning	Unidentified
3	23/03/2006	Fatal injury		Toyota	around seconday highschool	-	10:10 afternoon	Driving without attention
4	7/4/2006	SLI&Property damage		Minibus	Around mazorya	200,000.00	4:40 morning	Failure in vehicle
5	11/4/2006	Fatal injury		land cruiser	Dandi mazorya	-	7:30 afternoon	Failure to give away for Pedestrians
6	12/4/2006	Fatal injury		Entrée &OM	Hulluuqqoo	-	2:55morning	Unidentified
7	3/5/2006	Fatal injury		Minibus	miicccituu	-	7:30 afternoon	Failure to give away for Pedestrians
8	22/05/2006	Fatal injury		ZH	G/gooftuu	-	10:00 afternoon	Failure to give away for Pedestrians
9	27/05/2006	Fatal injury		Entrée	Gabaa dilbataa	-	-	Failure to give away for Pedestrians

10	13/06/2006	Fatal,SLI&Property damage		Entrée	Andoodee	-	2:00 night	Unidentified
11	7/9/2006	Fatal injury		Minibus	Zetena kilo	-	11:00 afternoon	Failure to give away for Pedestrians
12	30/09/2006	Fatal,SLI&Severe injury		Minibus	borrennii	-	3:00 night	Driving without attention
13	12/10/2006	Fatal& Property damage		Minibus	awash	-		Unidentified
14	30/09/2006	Fatal&Severe injury		Minibus	Rikicha Bolole	-	3:30 night	Unidentified
15	28/10/2006	Fatal& Property damage		Isuzu	Gare muloo	-	10:00 afternoon	Unidentified
16	8/11/2006	Fatal injury	32	Isuzu	Canqituu	-	6:30 afternoon	Unidentified
17	10/11/2006	Fatal injury	22	Isuzu	laga jamjam	-	8:00 afternoon	Driving without attention& Over speeding
18	11/11/2006	Fatal&SLI	40	Tractor trailer	laga darabbah	150,000.00	3:30 night	Failure to give away for vehicles
19	10/11/2006	SLI	27	high roof	bataskana giyoorgisii	-	9:30 afternoon	Driving without attention& Over speeding
20	5/1/2007	SLI	41	Minibus	naannoo tulluu bachoo	-	7:30 afternoon	over speeding
21	9/1/2007	Severe injury&property damage	30	Minibus	dhakaa wucii	210,000.00	2:30 morning	Driving without attention
22	8/1/2007	Fatal injury	25	Minibus	cufaa	35,000.00	12:30 afternoon	Driving without attention& Over speeding
23	12/1/2007	Fatal injury	41	FSR	jamjam	-	10:00 night	Driving without

								attention& Over speeding
24	28/12/2007	Fatal & Severe injury	25	high roof minibus	bulukoo	-	7:00 afternoon	Driving without attention& Over speeding
25	28/12/2007	Fatal injury	32	FSR	Around gotoraa	-	1:00 night	Driving without attention& Over speeding
26	20/07/2007	SLI &Severe injury	23	FSR	yubdoo laga baatuu	-	8:30 night	over speeding
27	14/08/2007	Fatal, SLI &Property damage		Minibus	Tellee	-	1:30 morning	Failure to respect Traffic sign& over speeding
28	15/08/2007	Fatal injury	37	FSR	around high school	-	4:30 afternoon	over speeding
29	2/6/2007	Fatal injury	45	pickup	bangichoo	-	8:30 afternoon	Driving without attention& Over
30	20/06/2007	Fatal injury	28	Minibus	dagaa eeguu	-	11:00 afternoon	Driving without attention& Over speeding
31	8/7/2007	Fatal injury	27	Minibus	qo'ee mazoriya	-	11:30 afternoon	Driving without attention& Over speeding
32	29/02/2007	Fatal injury	34	Toyota	somoonyii	-	7:00 afternoon	Driving without attention& Over speeding
33	2/4/2007	Fatal injury	28	Nissan	darababi	-	3:00 morning	Failure to give away for Pedestrians
34	11/4/2007	Fatal injury	37	Nissan diesel	tulu baaco	-	11:30 afternoon	Unidentified

35	30/12/2005	Property damage	-	FSR	Fakkarees	-	-	Driving without attention
36	30/12/2005	Property damage &SLI	-	FSR	Danno ejersa Gibee	40,500.00	11:40 night	Driving without attention
37	23/12/2005	Fatal injury	-	Minibus	Danno ejersa Gibee	-	3:30 morning	Unidentified

EJERE WEREDA 2005-2007 E.C(2012-2015)

No.	Date	Type of Accident				Age of Driver	Vehicle Type	Location name	Accident Quantified(ETB)	Time	Cause of Accident
		Fatalities	Injuries		Property damage						
			Slight	Severe							
1	6/12/2007	1	1	1	-	32	Isuzu	cirrii	-	6:40 afternoon	un identified
2	29/11/2007	2				35	Cino truck	around ejere elementary school	-	1:30 night	un identified
3	26/07/2007	1				-	-	-	-		un identified
4	6/3/2007							on maram road	-	5:00 night	un identified
5	6/3/2007			1		30	FSR	cirrii	-	6:00 afternoon	Driving without attention
6	20/02/2007	1				28	Turbo	Ada'aa bargaa	-	6:40 afternoon	Driving without attention
7	5/1/2007	1				20	Turbo	beekkattee	-	-	Driving without attention

8	2/1/2007	1				51	Suzuki	algawer ash	2,000	3:30 morning	Driving without attention
9	18/12/2006	1				24	Lonchin	beekkatt ee		6:00 afternoon	Faiule to give away for vehicles
10	3/11/2006					41	Cino truck	guutee	40,000	1:00 morning	Driving without attention
11	14/10/2006	1				24	Isuzu	horaa karree	-	8:00 afternoon	Driving without attention
12	29/7/2006	1				22	minibus	around salaalee	3,000	8:00 afternoon	Driving without attention
13	4/7/2006			1		22	-	kampii	-	6:00 afternoon	Driving without attention
14	26/05/2006	1				-	FSR	infront of mika'el	-	6:00 night	un identified
15	16/03/2006		1			61	Isuzu	mobil	-	10:00 afternoon	un identified
16	9/6/2005	2	6	4		30	minibus	laga berga bridge	-	10:00 afternoon	un identified
17	4/11/2005			7		23	Minibus	bergaa	-	11:00 afternoon	un identified
18	10/12/2005	1				28	FSR	cirrii	15,000	10:30 afternoon	un identified

HOLOTA TOWN 2005-2007 E.C(2012-2015)											
No.	**Date**	**Type of Accident**	**Fatalities**	**Injuries**		**Property damage**					
				Slight	**Severe**		**Age of the driver**	**Vehicle Type**	**Location name**	**Time**	**Cause of Accident**
1	5/6/2005	Sever injury			1	1		Isuzu	Oromiya waldaa	3:00 night	Over speeding

		&PDO									
2	17/06/05	Property Damage				1		Entree	Condominium	5:00 morning	others
3	19/06/05	Slight injury		1				Auto Bus	Infront of golden Hotel	7:30 afternoon	-
4	24/06/05	Slight injury		1				Obama Isuzu	Crushery	11:00 afternoon	Driving with fatigue
5	30/06/05	Slight injury		2				Mercedes	Galane	2:00 morning	Driving without attention
6	1/7/2005	Property Damage				1		Isuzu	Rikicha Holota	9:00 night	Driving with
7	3/7/2005	Slight		1				Mini bus	Goldeen	11:30 afternoon	Failure to give
8	14/07/05	Slight injury		4				viitaaraa	karatuurii	1:30 m0rning	Driving without attention
9	20/07/05	Slight injury		1				Mini bus	abayneh Hotel	9:00 afternoon	Driving without attention
10	1/8/2005	Fatal injury	1					Isuzu	around flower station	6:40 afternoon	Failure to give away for Pedestrians
11	9/8/2005	Property Damage				1		Marchedis	Car training station	2:00 morning	Failure in vehicle
12	10/8/2005	Property Damage				1		Isuzu Obama	oromia flower production station	11:00 afternoon	Over speeding
13	18/08/05	Property Damage				1		Entrée	Condominium	9:20 afternoon	obstacle to vehicle
14	9/9/2005	Fatal injury	1					Mini bus	karatuurii	3:15 morning	Failure to give away for

											Pedestrians
15	14/09/05	Fatal injury	1					Isuzu	karatuurii	4:00 morning	Driving without attention
16	26/9/05	Slight injury		1				turbo		5:30 morning	Driving without attention
17	30/09/05	Property Damage				1		Suzuki	around gabrel	2:00 morning	Driving without attention
18	20/10/05	Fatal injury	1					Mitsubishi trailer	Crushery	9:00 afternoon	Driving without attention
19	22/10/05	Slight injury		1				Mini bus	karatuurii	9:40 afternoon	Driving without attention
20	23/10/05	Sever injury			1			Mini bus	Condominium	2:00 morning	
21	24/11/05	Slight injury		1		1		Hilux	holota bridge	6:35 afternoon	Failure in vehicle
22	24/11/05	Propery				1		cobra	holota	6:35 afternoon	
23	24/11/2005	Propery Damage						Un identified	around flower production station	1:30 morning	Driving without attention
24	3/12/2005	Slight Injury		4			35	tractor	miizanaa	7:00 afternoon	Failure to give away for vehicles
25	6/12/2005	Propery Damage				1	32	Isuzu	Galee	7:15 afternoon	Driving without attention
26	9/12/2005	PD,SLI& SE		21	4	1	42	Small Bus	miizanaa	5:30 morning	obstacle to vehicle
27	22/12/2005	Slight injury		1			33	Motor cycle	around gabrel	1:30 night	Driving without attention
28	27/12/2005	Fatal injury	1				-	-	laga holotaa	-	family case
29	28/12/2005	Slight		1			30		laga	10:00 morning	Driving without

		injury						Isuzu	holotaa		attention
30	2/1/2006	Slight injury	1				24	Isuzu	around holeta mirimir	12:00 afternoon	Driving without attention
31	12/1/2006	Slight injury		3			49	Mini bus	laga holotaa	3:00 morning	Failure in vehicle
32	15/01/2006	Propery Damage				1	25	pickup	miizanaa	12:00 afternoon	Driving without attention
33	26/01/2006	Fatal& severe injury					38	Suzuki	sheelii	10:00 afternoon	speeding
34	28/01/2006	Slight& pDO		2		1	23	Taxi	Firii born	2:40 morning	speeding
35	8/2/2006	Propery Damage				1	25	Minibus	Infront of golden Hotel	11:58 afternoon	speeding
36	10/2/2006	all	1	5	13	1	-	-	around gabrel	6:20 morning	speeding
37	30/02/2006	Slight& PDO		1		1	30	Taxi	Sadamoo karatory	4:30 morning	Improper Turning
38	5/3/2006	Slight injury		1			25	Bajaj	Abaayina xaana	11:30 morning	Over speeding
39	14/03/2006	Propery Damage				1	27	Cino truck	kuyyuu	12:30 afternoon	Over speeding
40	21/03/2006	severe injury			1		68	Suzuki	sheelii	12:30 afternoon	Over speeding
41	15/04/2006	Slight injury		2			48	Bajaj	Infront of itopy bank	4:00 morning	-
42	25/03/2006	all	1	2	8	1	23	Minibus	Infront of golden Hotel	12:00 afternoon	Over speeding
43	9/4/2006	Fatal	1				23	FSR	laga	11:30 afternoon	Driving without

		injury							holotaa		attention
44	16/04/2006	severe injury			2		30	Isuzu	sheelii	12:00 afternoon	Driving without attention
45	8/5/2006	severe injury			1		-	Minibus	Hawi coffee house	2:50 morning	Failure to give away for vehicles
46	20/05/2006	Property Damage				1	20	Isuzu	sheelii	6:00 night	Influence of alcol or drug
47	17/10/2006	Property Damage				1	38	FSR	Infront of karaturii	11:20 afternoon	Failure to respect Traffic sign
48	1/6/2006	all except severe injury		1		1	38	Marchedis	Footoo bultoo	1:30 morning	Driving without attention
49	9/6/2006	Fatal injury	1				24	Isuzu	around kirachery	2:00 morning	Failure to give away for Pedestrians
50	1/7/2006	Fatal injury	1				59	Entree	Mura majar muzium	6:05 night	Pedestrian Error
51	5/7/2006	Property Damage		2		1	27	Mini bus	around adifinyaa(park)	8:30 afternoon	Improper overtaking
52	18/07/2006	PD,SLI		3		1	20	Isuzu	Around oromia flower mandarii	8:30 night	Influence of alcol or drug
53	25/07/2006	Slight injury		5			23	Bajaj and taxi	around hawi hotel	1:30 morning	Excess Loading
54	6/9/2006	Slight injury		4		1	42	Large bus	Around oromia flower mandarii	1:25 morning	Following to closely

55	11/9/2007	Propery Damage				1	36	-	b/harbii clinik	12:10 afternoon	Driving with fatigue
56	2/10/2006	Fatal injury	1				27	Toyota	Around hawi hotel	1:50 morning	Over speeding& Driving without attention
57	18/10/2006	Propery Damage				1	28	Entree	karatuurii	7:15 afternoon	over speeding
58	24/10/2006	Propery Damage				1	24	Minibus	Around oromia flower mandarii	9:00 afternoon	Over speeding& Driving without attention
59	8/11/2006	Fatal injury	1				25	Cino truck	Garbii	7:30 afternoon	Driving without attention
60	10/11/2006	Propery Damage				1	41	Toyota	Infront of golden Hotel	10:30 afternoon	Following to closely
61	23/11/2006	Slight injury		1			52	Land cruiser	karatuurii	11:25 afternoon	Driving without attention
62	3/13/2006	Propery Damage				1	28	Patrol police	karatuurii flower station	6:00 morning	over speeding
63	3/13/2006	Propery Damage				1	-	Tuta	karaturii	4:30 morning	un identified
64	4/13/2006	Propery				1	23	Cino truck	keetim	10:30 afternoon	Improper
65	3/1/2007	SLI&PD		5		1	24	Ambulance	karaturii	6:10 morning	Following to closely
66	8/1/2007	Propery Damage				1	27	turbo	laga holotaa	11:00 afternoon	over speeding
67	14/01/2007	Propery Damage				1	53	Tuta pickup	oromia onideri	7:00 afternoon	Following to closely
68	5/2/2007	Propery				1	28	Isuzu	Condomini	6:20 afternoon	Following to closely

		Damage							um		
69	15/02/2007	Fatal injury	1				37	Cino truck	Zabiiraa	12:30 afternoon	Failure to give away for vehicles
70	30/02/2007	Propery Damage				1	24	Land cruiser	gabreelii	4:45 morning	Following to closely
71	3/3/2007	Slight injury		3		1	62	Public minibus	asgorii	1:00 night	Following to closely
72	17/03/2007	SLI&Sever injury		3	7	1	25	Minibus	laga holotaa	12:15 afternoon	over speeding
73	22/03/2007	Propery Damage		2		1	26	Bajaj	Hawi hotel	12:30 afternoon	over speeding
74	23/03/2007	Fatal injury	1				30	Isuzu	Garbii	11:30 afternoon	over speeding
75	26/03/2007	Slight injury		1			44	tuta	gabreelii	11:30 afternoon	over speeding
76	14/04/2007	severe injury			1		29	Mini bus	around bus station on coble stone	7:00 Afternoon	Failure to give away for Pedestrians
77	15/04/2007	Propery Damage &SLI		3		1	36	Bajaj	aaganyo	9:00 afternoon	Failure to give away for Pedestrians
78	18/04/2007	property damage				1	23	minibus	Itio flower	12:00 afternoon	over speeding
79	22/04/2007	Slight injury		1			26	minibus	kelbesa hotel	1:30 morning	Failure to give away for Pedestrians
80	30/04/2007	property damage				1	35	truck trailer	Mizan tabya	5:30 night	over speeding
81	6/5/2007	Severe&* PDO		1		1	31	Entrée	Karaturii	11:00 afternoon	Overspeeding
82	8/5/2007	Fatal injury	1				28	minibus	Sadamoo karatory	1:00 ganama	Driving without

											attention
83	17/05/2007	Slight injury		4			25	cino truck	-	9:55 afternoon	Following to closely

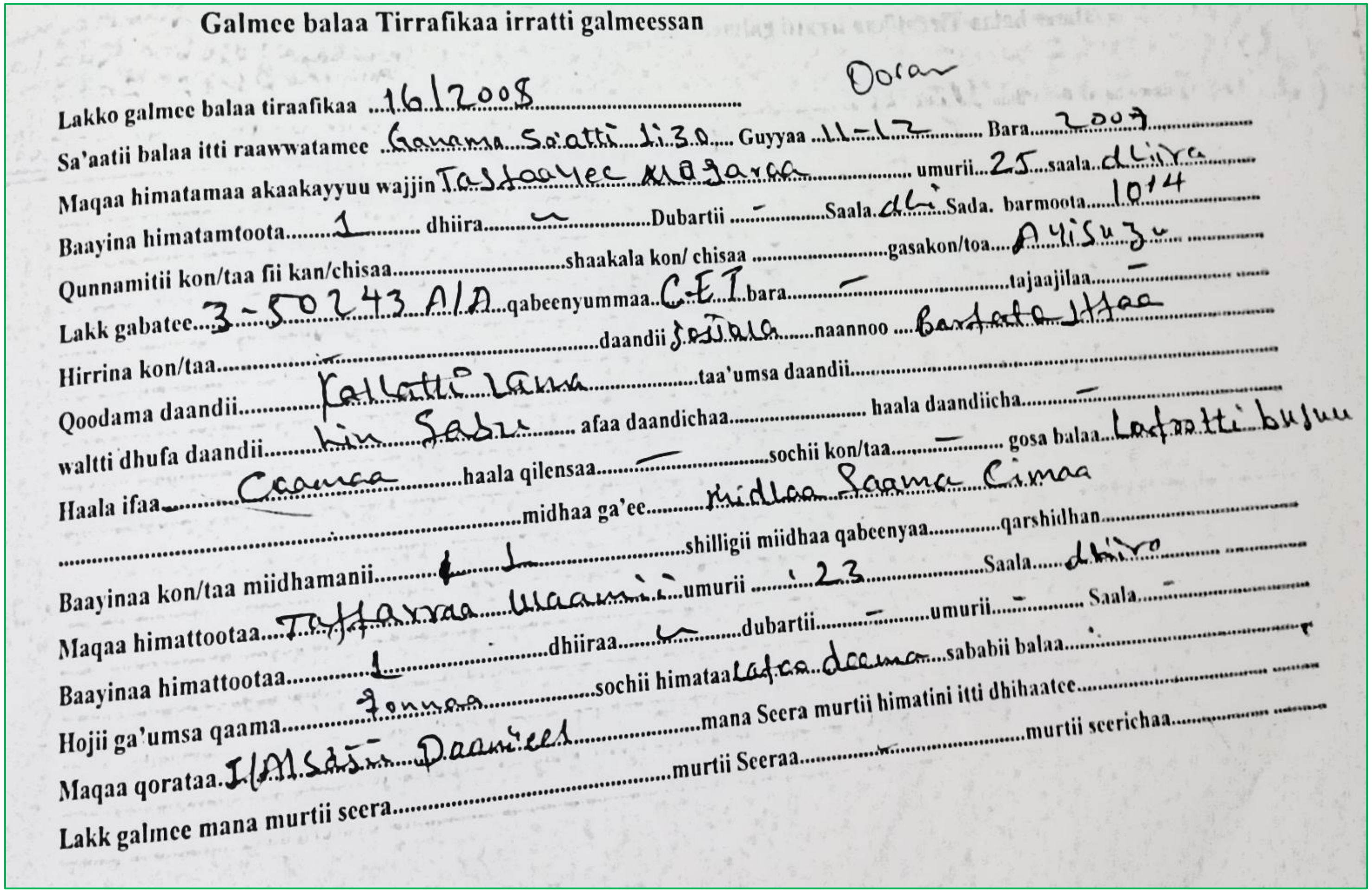
WOLMERA WEREDA 2005-2007 E.C(2012-2015)							
No.	Date	Type of Accident	Age of Driver	Vehicle Type	Location name	Accident Quantified(ETB)	Time
1	Dec-05	Property damage	38	-	menagesha	8,000	1:40 night
2	7/1/2005	Property damage	44	-	rob gebiya	15,000	12:00 night
3	11/1/2005	SLI & Property damage	24	-	menagesha	200,000	10:00 afternoon
4	1/5/2005	Property damage	24	-	menagesha	10,000	9:30 day
5	5/5/2005	Fatal injury	46	Pick up	menagesha		1:30 night
6	21/05/2005	property damage	31	-	talaacaa	10,000	4:00 night
7	12/6/2005	property damage	36	Tractor	menagesha	12,000	11:00 night
8	25/06/2005	property damage	30	Isuzu	menagesha	5,500	11:00 day
9	3/7/2005	property damage	24	-	menagesha	20,000	11:45 morning
10	3/7/2005	Sever &Property damage	35	land cruiser	menagesha	100,000	1:00 morning
11	8/7/2005	Property Damage	40	Nissan UD	menagesha	15,000	11:00 night
12	16/07/2005	Fatal & Property Damage	24	TURBO	menagesha		9:00 afternoon
13	21/08/2005	Property damage	30	entrée	menagesha	22,000	8:00 afternoon
14	6/6/2005	Property damage	60	Pickup	around subbaa	1,000	4:40 morning
15	2/9/2005	property damage	24	D4D	-	30,000	11:00 night
16	10/9/2005	Property damage	27	Mitsubishi	markos statition	80,000	4:00 morning

17	3/9/2005	SLI	42	Mitsubishi	menagesha	110,000	11:00 afternoon
18	6/9/2005	SLI	29	minibus	menagesha		6:30 afternoon
19	18/09/2005	SLI	22	Toyota corolla	menagesha	100	3:00 morning
20	19/09/2005	Property Damage	32	marchedis	menagesha	10,500	11:00 afternoon
21	27/09/2005	Property Damage	24	cinotruck	menagesha		9:30 afternoon
22	16/10/2005	Property Damage	31	land cruser	menagesha		10:20 afternoon
23	6/11/2005	Property Damage		oral kireen	menagesha	10,000	8:00 afternoon
24	15/11/2005	Property Damage	34	Un identified	menagesha	10,000	11:30 afternoon
25	28/11/2005	Property Damage	25	D4D	-	10,000	9:00 afternoon
26	22/12/2005	property damage	53	IVCO	-	32,000	1:00 morning
27	15/11/2005	Sever in&Property damage	27	bus	menagesha	-	1:20 morning
28	23/11/2005	Sever in&Property damage	30	DFN	menagesha	30,000	2:40 morning
29	5/13/2005	SLI	27	Taxi	menagesha	-	3:30 morning
30	5/13/2005	property damage	27	DFD minibus	menagesha	70,000	10:30 afternoon
31	4/1/2006	property damage	23	Un identified	menagesha	-	1:30 morning
32	1/2/2006	Sever in&Property damage	23	Toyota corolla	telaco/kurufa	-	1:40 night
33	3/2/2006	Property damage	35	FSR	menagesha	10,000	9:00 afternoon
34	28/02/2006	property damage	48	automobil	menagesha	500	3:20 morning
35	8/1/2006	SLI&property damage	45	corola	-	20,000	1:30 night
36	20/03/2006	property damage	24	dichaanimee697	menagesha	13,000	2:30 night
37	8/3/2006	property damage	24	Un identified	menagesha	10,000	5:30 night
38	9/3/2006	property damage	-	Un identified	-	-	3:00 morning
39	17/03/2006	fatal injury	35	Un identified	-	50,000	5:00 morning
40	4/4/2006	property damage	35	Mitsubishi	talacoo	10,000	6:30 afternoon
41	21/04/2006	-	23	Toyota hayiluksii	-	20,000	1:00 night
42	19/05/2006	property damage	35	Tractor	menagesha	10,000	3:00 night

43	9/5/2006	property damage	40	Un identified	-	20,000	3:00 morning
44	24/05/2006	property damage	28	Un identified	-	10,000	10:30 afternoon
45	1/6/2006	property damage	-	shakimaa	menagesha	12,000	9:30 afternoon
46	15/06/2006	property damage	-	Un identified	walmera cooqaa	1,500	5:30 morning
47	1/8/2006	fatal injury	60	Large bus	menagesha	800,000	6:50 afternoon
48	22/07/2007	SLI&property damage	30	Minibus	menagesha	50,000	10:30 afternoon
49	25/07/2006	SLI&property damage	25	Isuzu	menagesha	30,000	11:30 afternoon
50	28/07/2006	SLI&property damage	32	Un identified	menagesha	90,100	8:00 afternoon
51	14/08/2006	property damage	35	Isuzu	menagesha	30,000	2:00 night
52	14/08/2006	property damage	24	Cino truck	subbaa	20,000	5:00 morning
53	21/08/2006	property damage	27	Isuzu	menagesha	10,000	1:40 morning
54	24/08/2006	fatal injury&property damage	30	Large bus	menagesha	1,000	1:40 morning
55	28/08/2006	Property damage	39	Hay lux pickup	menagesha	10,000	3:00 night
56	26/09/2006	property damage	-	Cino truck	asgorii	5,500	10:00 afternoon
57	14/10/2006	property damage	23	Taxi	menagesha	-	7:00 afternoon
58	14/10/2006	property damage	40	Nissan	menagesha	-	2:45 night
59	1/6/2006	SLI&property damage	45	land cruiser	-	-	1:30 night
61	20/10/2006	Severe&property damage	48	loobaachii	-	420,000	8:00 afternoon
62	11/11/2006	Fatal injury and property damage	29	taxi	menagesha	320,000	12:30 morning
64	3/12/2006	Property damage	25	Isuzu	menagesha	35,000	1:05 night
65	18/12/2006	Property damage	39	tractor	menagesha	15,000	2:00 morning
66	7/1/2007	Property damage	24	Cino truck	menagesha	110,000	6:30 afternoon
67	2/2/2007	Severe injury	29	Dolphin	menagesha	10,000	12:30 morning
68	2/2/2007	Property damage	46	Isuzu	menagesha	60,000	8:00 afternoon

APPENDIX B. SAMPLE 24HR ACCIDENT RECORDS

i) Sample 24hr Accident Record Booklet for Welmera wereda


Galmee balaa Tirrafikaa irratti galmeessan

Dorar

Lakko galmee balaa tiraafikaa 16/2008

Sa'aatii balaa itti raawwatamee Ganama Sa'atti 1:30 Guyyaa 11-12 Bara 2007

Maqaa himatamaa akaakayyuu wajjin Tasfaayee Magarsaa umurii 25 saala dhiira

Baayina himatamtoota 1 dhiira - Dubartii - Saala dhi Sada. barmoota 10/4

Qunnamitii kon/taa fii kan/chisaa shaakala kon/ chisaa gasakon/toa Ayisuzu

Lakk gabatee 3-50243 A/A qabeenyummaa C.E.T bara - tajaajilaa -

Hirrina kon/taa - daandii Sotala naannoo Bardata Hiyaa

Qoodama daandii Kallattii lama taa'umsa daandii haala daandiicha -

waltti dhufa daandii kin Sabu afaa daandichaa sochii kon/taa - gosa balaa Lafatti buusuu

Haala ifaa Caamaa haala qilensaa -

midhaa ga'ee midhaa Saamaa Cimaa

shilligii miidhaa qabeenyaa qarshidhan

Baayinaa kon/taa miidhamanii 1 umurii 23 Saala dhiira

Maqaa himattootaa Taffarraa Waaminii umurii - Saala -

Baayinaa himattootaa 1 dhiiraa dubartii - sababii balaa

Hojii ga'umsa qaama Jonnaa sochii himataa Lafaa deemaa

Maqaa qorataa I/Al Saajin Daaniel mana Seera murtii himatini itti dhihaatee

Lakk galmee mana murtii seera murtii Seeraa murtii seerichaa

ii) Sample 24hr Accident Record Booklet for Dandi wereda

Lakk 36/10/06
Guyyaa 10/01/2006

Qajeelcha Poolisii Go/Li/Shawaa tiif
Amboo
Aanaa Dandii irraa
Giincii

Qajeelcha Poolisii Godina Lixa Shawaatti Waajjira Poolisii Aanaa Dandii

Ukka Odeeffannoon Balaa Traafikii Sa'a 24:00 keessatti uumame itti in darbu

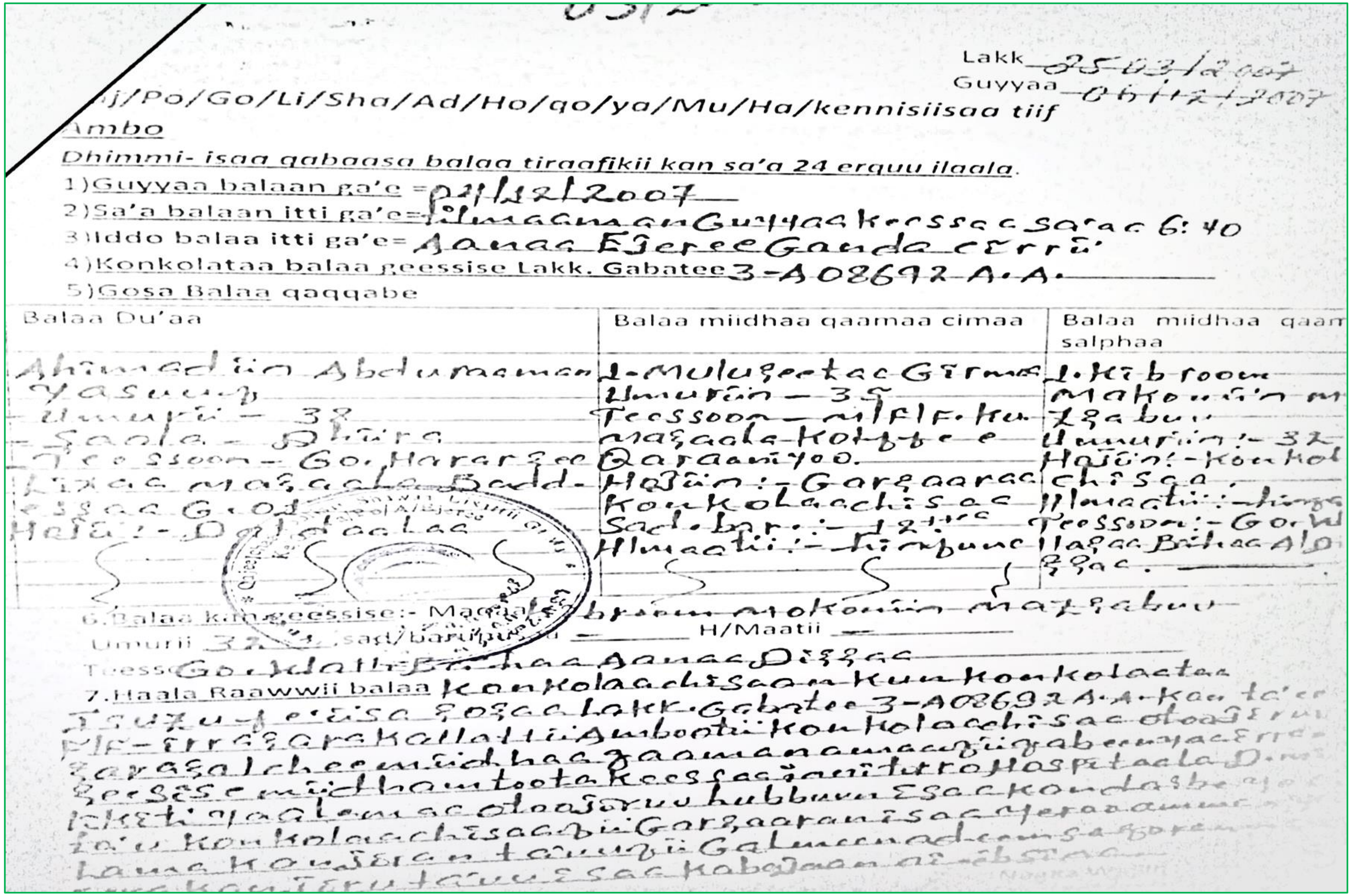
1. Godina Balaan itti gahe Lixa Shawaa Aanaa Dandii
   Ganda Gincii 02 bakka addaa Maannoo Jalduu Maazoo viyaa
2. Guyyaa balaan itti uumame 10/01/06 halkan /ganama/ koossaa sa'a 7:30
3. Gosa Konkolaataa balaa geessisee Kaachamaallii fi Minibaasii Ablaa Diiulaa Lakk Gabatee ③ 27633 fi ③ 26301 ... Kaachaamaallii - nama 47 fi Ablaa duulaa nama - 14 sararaa Gincii irraa gara Jalduu fi irraa Amboo irraa gara Finfinnee gara ...
4. Maqaa Konkolaachisaa ...
5. Sadarkaa Eyyama Oofiisaa fi lakk isaa 3ffaa 000429 Finfinnee guyyaa kennamee
6. Bifa balaa gahee Miidhaan qabeenyaa irra ga'eera.

Maqaa Namoota Midhamanii

a. Balaa Du'aa	b. Balaa Qaama Cimaa	c. Balaa Qa/Salphaa	d. Balaa Qabeenyaa
			Qabeenya tilmaamni isaa qarshii 5500 kan kaheen 100 ... 35,000 kan baasu ... Duulaa walumaa ... qarshii 40,500 ...

Gabaasa kan ...
Maqaa ... Mallattoo ... Guyyaa ...
Maqaa ... 21 Alemu
Mallattoo
Guyyaa 10/01/2006

iii) Fig. Sample 24hr Accident Record Booklet for Ejere wereda



Lakk 25-03/2007
Guyyaa 06/12/2007

[illegible]/Po/Go/Li/Sha/Ad/Ho/qo/ya/Mu/Ha/kennisiisaa tiif
Ambo

Dhimmi- isaa qabaasa balaa tiraafikii kan sa'a 24 erguu ilaala.

1)Guyyaa balaan ga'e = 03/12/2007
2)Sa'a balaan itti ga'e= [illegible] 6:40
3)Iddo balaa itti ga'e= Aanaa Ejeree Gaanda [illegible]
4)Konkolataa balaa geessise Lakk. Gabatee 3-A08692 A.A.
5)Gosa Balaa qaqqabe

Balaa Du'aa	Balaa miidhaa qaamaa cimaa	Balaa miidhaa qaam salphaa
[illegible]	[illegible]	[illegible]

6.Balaa kan geessise:- Maqaa [illegible] H/Maatii
Umurii 32 [illegible] sad/barumsa
Toess [illegible]
7.Haala Raawwii balaa [illegible]

APPENDIX C.ROAD SAFETY AUDIT FOR THE IDENTIFIED BLACK SPOT LOCATION

Date:_____

Name of Black Spot Location : Laga bargaa Station(km):46km from Addis Ababa

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane	√	
3	The provision of Road side Delineator	√	
4	The provision of Road marking	√	
5	The presence of speed limit post	√	
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements	√	
8	The provision of Guard Rails	√	
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.		×
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder	√	
14	The provision of efficient signals installed		×
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on town section		×

Date:_____

Name of Black Spot Location : Crushery Station(km):36km from Addis Ababa

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane		√
3	The provision of Road side Delineator	√	
4	The provision of Road marking		×
5	The presence of speed limit post		×
6	Bridge widening		
7	The provision of Clear(flat slopes) Road Side improvements	√	
8	The provision of Guard Rails	√	
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.		×
12	The provision of Signing in Horizontal Curves		
13	The provision of adequate lane width of shoulder	√	
14	The provision of efficient signals installed		×
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on town section		×

Date:_____

Name of Black Spot Location : Cirrii Station(km):39km from Addis Ababa

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane	√	
3	The provision of Road side Delineator	√	
4	The provision of Road marking		×
5	The presence of speed limit post	√	
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements	√	
8	The provision of Guard Rails	√	
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.	√	
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder		×
14	The provision of efficient signals installed	√	
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.		×
17	Provision of pedestrian walking on town section	√	

Date:_____

Name of Black Spot Location : Karaaturii Station(km):25km from Addis Ababa

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane		×
3	The provision of Road side Delineator	√	
4	The provision of Road marking	√	
5	The presence of speed limit post	√	
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements	√	
8	The provision of Guard Rails	√	
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.		×
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder		×
14	The provision of efficient signals installed		×
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on town section		×

Date:_____			
Name of Black Spot Location : In front of Golden Hotel Station(km):30km from Addis Ababa			
Check list of Site Inspection for the Identified Black Spot Locations			
No.	**Type of Measure**	**Comment**	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane		×
3	The provision of Road side Delineator	√	
4	The provision of Road marking	√	
5	The presence of speed limit post	√	
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements		×
8	The provision of Guard Rails	√	
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.		×
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder	√	
14	The provision of efficient signals installed	√	
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on town section	√	

Date:_____			
Name of Black Spot Location : Shell Station(km):29km from Addis Ababa			
Check list of Site Inspection for the Identified Black Spot Locations			
No.	**Type of Measure**	**Comment**	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane		×
3	The provision of Road side Delineator	√	
4	The provision of Road marking	√	
5	The presence of speed limit post	√	
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements		×
8	The provision of Guard Rails		×
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.		×
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder	√	
14	The provision of efficient signals installed	√	
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on town section	√	

Date:_____

Name of Black Spot Location : Hawi Hotel Station(km):32km from Addis Ababa

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane		×
3	The provision of Road side Delineator	√	
4	The provision of Road marking		
5	The presence of speed limit post		×
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements		×
8	The provision of Guard Rails	√	
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.	√	
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder	√	
14	The provision of efficient signals installed	√	×
15	The provision of adequate and visible pavement marking		
16	The provision of Effective road markings at night and in wet weather.		
17	Provision of pedestrian walking on town section	√	

Date:_____

Name of Black Spot Location : Miizanaa/Gabriel Station(km):28km from Addis Ababa

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane		×
3	The provision of Road side Delineator	√	
4	The provision of Road marking	√	
5	The presence of speed limit post	√	
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements		×
8	The provision of Guard Rails		×
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.		×
12	The provision of Signing in Horizontal Curves		×
13	The provision of adequate lane width of shoulder	√	
14	The provision of efficient signals installed	√	
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on town section	√	

Date:_____

Name of Black Spot Location : Laga Hoolotaa Station(km):27.5km from Addis Ababa

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening		×
2	The provision Climbing Lane	√	
3	The provision of Road side Delineator	√	
4	The provision of Road marking	√	
5	The presence of speed limit post		×
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements	√	
8	The provision of Guard Rails	√	
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.	√	
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder		×
14	The provision of efficient signals installed		×
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on town section		×

Date:_____

Name of Black Spot Location : Miniinii Station(km):3km from Ambo town

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane	√	
3	The provision of Road side Delineator	√	
4	The provision of Road marking	√	
5	The presence of speed limit post	√	
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements	√	
8	The provision of Guard Rails	√	
9	The provision of Median Barriers		×
11	The provision of adequate horizontal curve radius.		×
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder	√	
14	The provision of efficient signals installed		×
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on town section	√	

Date:_____

Name of Black Spot Location : Awaro Station(km):1km from Ambo Town

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane		×
3	The provision of Road side Delineator	√	
4	The provision of Road marking	√	
5	The presence of speed limit post	√	
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements	√	
8	The provision of Guard Rails	√	
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.	√	
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder	√	
14	The provision of efficient signals installed	√	
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on town section	√	

Date:_____

Name of Black Spot Location : Bayo Kurbi Station(km):__ km from Addis Ababa

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening		×
2	The provision Climbing Lane	√	
3	The provision of Road side Delineator	√	
4	The provision of Road marking	√	
5	The presence of speed limit post	√	
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements		×
8	The provision of Guard Rails	√	
9	The provision of Median Barriers		×
11	The provision of adequate horizontal curve radius.		×
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder	√	
14	The provision of efficient signals installed		×
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on town section	√	

Date:_____

Name of Black Spot Location : Menagesha Station(km):20km from Addis Ababa

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane	√	
3	The provision of Road side Delineator	√	
4	The provision of Road marking	√	
5	The presence of speed limit post	√	
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements	√	
8	The provision of Guard Rails	√	
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.	√	
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder	√	
14	The provision of efficient signals installed	√	
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on townsection	√	

Date:_____

Name of Black Spot Location : Menagesha Station(km):22km from Addis Ababa

Check list of Site Inspection for the Identified Black Spot Locations

No.	Type of Measure	Comment	
		Is needed (√)	Not needed(×)
1	The provision of Road widening	√	
2	The provision Climbing Lane		×
3	The provision of Road side Delineator	√	
4	The provision of Road marking	√	
5	The presence of speed limit post	√	
6	Bridge widening		×
7	The provision of Clear(flat slopes) Road Side improvements	√	
8	The provision of Guard Rails	√	
9	The provision of Median Barriers	√	
11	The provision of adequate horizontal curve radius.	√	
12	The provision of Signing in Horizontal Curves	√	
13	The provision of adequate lane width of shoulder	√	
14	The provision of efficient signals installed	√	
15	The provision of adequate and visible pavement marking	√	
16	The provision of Effective road markings at night and in wet weather.	√	
17	Provision of pedestrian walking on townsecti		×