ROAD TRAFFIC ACCIDENT AS AN ENVIRONMENTAL DISASTER IN ADAMA CITY: DETERMINANT FACTORS AND ACCIDENT SPOTS MAPPING

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ABSTRACT

All countries in the world are currently affected by Road Traffic Accidents. Road Traffic Accidents are the foremost causes of death, injury and damage of property at global as well as national level. The main aim of this study is to assess the road traffic accident as an environmental disaster in Adama city from 2010 to 2014. For this purpose, primary data were collected through questionnaire survey, Key Informant Interviews, Focus Group Discussions, observation and Global Positioning Systems. Furthermore, secondary data were obtained from different traffic accident records of Adama city police. Both qualitative and quantitative techniques were employed to analyze the data. The result of the study revealed that, the general trend of road traffic accidents have shown more severe trend and driver factors were the leading responsible factor than other factors for road traffic accidents in Adama City. The analysis of the study indicated that, 1350 Road Traffic Accidents have occurred in the study period. From 1350 RTA incidences 716 road traffic accidents have occurred in 10 black spots. In addition to this, road traffic accidents are more frequent at day time because of a higher traffic movement and road users. It was concluded that, the distributions and frequencies of road traffic accidents as well as the health, socioeconomic and physical environment impacts of road traffic accidents have shown more severe trend in the study period and regarded as an environmental disaster. Therefore, authorities, stakeholders and different groups concerned with road traffic safety management and control should give special attention to deliver education and awareness for the whole communities (road users) to change the attitude and behavior, and to develop the sense of responsibility and ownership to prevent or reduce this kind of catastrophic environmental disaster in Adama City.

Key Terms: *Road Traffic Accident, Road Traffic Accident Black Spots, Road Traffic Accident Casualties*

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

Everybody travels whether it is to work, play shop or do business. All raw materials must be conveyed from the land to the place of manufacturing or usage, and all goods must be moved from factory to the market place and from the stock to the customer. Transport is the means by which those activities occur; it is the cement that binds together the communities and their activities.

Any movement of people for any activity using different means is known as transportation. As indicated in Bamford and Robinson (1978),"Transport by definition infers a movement, and each individual from an early age owns his own "built-in" capability to travel, although within a restricted area". Moreover, to express the crucial part of transport generalized that it is difficult to conceive of a situation where transport does not play a major role in the life of an individual.

According to Rallis (1997) the constraints associated with transport include the risk of traffic mobbing, traffic coincidence, pollution, noise, and the like. Road Traffic Accidents (RTAs) are among the most damaging environmental effects, which have caused from transportation development. Road safety, therefore, urges serious concern worldwide. In addition to this, Ajit and Ripunjoy (2004) RTAs have turned out to be a huge global public health and development problem.

Road Traffic Accident (RTA) is said to be an unplanned occurrence of auto crash that may result in injuries, loss of lives and properties. It is having a worsening effect on our society and economy. It is the cause for the largest loss of human life and tends to be the most serious problem all over the world (Kual et al., 2005). Worldwide, the number of people killed by road traffic accident each year is estimated at almost 1.2 million while the number of people injured could be as high as 50 million (WHO, 2004).

The impact of road transport accident over the socioeconomic aspects of Africa is even much worse. Africa, a continent of people who have long been in a struggle for poverty reduction and for the security of other basic needs, is nowadays seems to face another challenge that is devastating road traffic accident. In addition to this, UN (2011) shows that RTA costs Africa $10 billion annually and remains the second leading cause of death for 5 – 44 age groups around the continent.

The National Road Safety Coordination Office (2006) stated that road traffic accident in Ethiopia is a serious problem. According to the office, the death rate is estimated to be 130 persons per 10,000 vehicles. In Ethiopia one out of five people injured or die as a result of road traffic accident, which again is a very high figure mainly due to poor situation of the emergency medical services. The economic loss due to road accident is

also significant. Unless the present trend is arrested, the social and economic problem of road accident will be more serious as the number of cars increases.

More studies focused on the entire nature and disastrous effect of road traffic accident at a global and national scale. This study is focused on assessing the general trend of road traffic accidents, the causal factors of road traffic accidents, the impacts of RTAs on health, socioeconomic, and physical environment, the frequent road traffic accident places or black spots and time of road traffic accident occurrence, and the challenges to the prevention or reduction of road traffic accidents in Adama City.

1.2. Statement of the Problem

All countries in the world are currently affected by road traffic accidents. It constitute major health, social, economic, developmental, and environmental challenges of developing countries, especially those in Africa (WHO, 2009), holds true as it is evidenced in many countries. According to UN (2011), stated that 1.2 million people die in the world's roads every year. In addition to this report, WHO (2011) described that 145 people die at every hour of every day, someone is killed or utterly hurt in every six seconds of every minute, a million exceeding people lost their lives each year, one in five of whom is a child merely because of road traffic accidents.

Road traffic accidents today are among the leading causes of death in some cases the number one cause in many parts of the world. The number of slight as well as serious injuries and the human suffering and economic loss due to disabilities caused by road traffic accidents is inestimable. Thus while medical science has conquered the ravages of many diseases, accidents have become a new epidemic of public health importance calling for equal effort for control and prevention (WHO, 2004).

According to WHO (2002), the magnitude of the road traffic accidents problem is that in the industrialized and also in many developing countries. Developing countries bear the brunt of the fatalities and disabilities from road traffic crashes, accounting for more than 85% of the world's road fatalities, and about 90% of the total Disability Adjusted Life Years (DALYs) lost due to road traffic injuries. The annual cost of road crashes is in excess of US $500 billion, and in the developing world the estimated cost is about US $65 billion each year.

Likewise, Lagarde (2007) described that two countries, South Africa and Nigeria, account for most of the reported deaths in Sub- Saharan Africa. The South African figure of over 9,000 has been consistent over time, while Nigeria with 6,185 deaths has declined from a high of over 9,200 in the early 1990s. Ethiopia, Kenya, Uganda, Tanzania and Ghana are the other countries that experience high numbers of road deaths.

Ethiopia, one of the poor country in the world and contributes much to the misery of road traffic accident in Africa. In Ethiopia, the situation has been worsened as the number of vehicles has increased and consequently due to increased traffic flow and conflicts between vehicles and pedestrians. According to UN (2009) over half of road traffic accident deaths in Ethiopia involve pedestrians, of whom 20% are children younger than 18 years old. Similarly, Odero (2004) described that pedestrians account for the highest proportion of road fatalities in nearly all African countries, ranging between 31% in Zimbabwe and 51% in Ethiopia.

According to UN (2009) the economic costs of road crashes and injuries are estimated to be 1% of Gross Domestic Product (GDP) in low income countries such as Ethiopia. In addition to this, Mohammed (2011) put his findings of the cost of road traffic accident in Ethiopia on the basis of the Ethiopia's data and economic figure of 2009/10, as the cost of damage only, slight, serious and fatal road traffic crashes were 327.12 million, 204.65 million, 619.38 million, and 716.02 million ETB respectively.

According to Oromia Police Commission Assessment Evaluation Compendium (2006) stated that Adama is situated on cross roads to different marketing, transportation, conference and recreational centers and it said to be a center for social, economical, political and cultural activities. Due to these social, economical, political and cultural phenomena are believed to have a greater share of contribution on the increased road traffic accidents. As a matter of these facts, Adama is on the front lines of towns with higher road traffic accidents prevalence rate in the region.

The main focus of the study area is Adama City. According to Oromia Police Commission report (2013) officially reveals that, Adama City contributes much to the misery of road traffic accident in Oromia region. For example in the year 2012 the total number of road traffic accident occurred in Oromia region accounted for 1050, Adama City contributed 313 (29.8%) of road traffic accident. In addition to this, the report stated that Adama City is the most vulnerable and contributes much to the misery of road traffic accident in Oromia region. Therefore, road traffic accident is problem in Ethiopia as well as specifically in Adama City.

No studies, prior to this study, have been conducted focusing on road traffic accidents as an environmental disaster in Adama city. This research was thus being the first of its kind for Adama City.

1.3. Objectives of the Study

The general objective of this study is to assess the road traffic accident as an environmental disaster in Adama City.

More specifically, this study aspires to:

- identify the determinant (causal) factors of road traffic accident in Adama City.
- identify the major places/black spots and generate maps, and time of road traffic accidents occurrence in Adama City.
- assess the major health, socioeconomic, and physical environment impacts (disasters) of road traffic accident in Adama City.
- forward possible recommendations to reduce road traffic accident in Adama City.

1.4. Research Questions

Based on the aforementioned objectives, the researcher was seek out answer for the following research questions were formulated:

1. Which determinant (causal) factors are responsible for road traffic accident in Adama City?
2. Where and when do the road traffic accidents tend to concentrate or occur more frequently in Adama City?
3. What are the major socioeconomic and environmental disasters occurring due to road traffic accidents in Adama City?
4. What kinds of measures to be taken to prevent or reduce road traffic accidents in Adama City?

1.5. Significance of the Study

This study is mainly focused on the assessment of road traffic accident as an environmental disaster in Adama City. Therefore, the study is significant for the following reasons:

- The findings from the study can be helpful to gain valuable data and information about the trend, factors, impact and places/black spots of road traffic accident in the city, which in turn, could help to develop countermeasures as the basic tool for road traffic accidents mitigation and prevention activities.
- Moreover, it can be used as source of information to decision makers, different groups and the public concerned with traffic safety management and control, and road safety management to reduce road traffic risk by integrating different interests and potentials.
- The study can also be used as a bench mark information to those scholars, institutions and stakeholders who want to conduct future studies on road traffic accident.

1.6. Scope of the Study

This particular research is mainly focused on the assessment of road traffic accident as an environmental disaster in all geographical areas of Adama City. The data presentation, analysis, findings and generalizations of the study were being preliminarily for the study area.

The reliability and availability of the data employed in any study is very important which were having significant impact later on the precision of the analyses and conclusions. This study mainly used road traffic accident data and information of 5 years (2010 - 2014) which is collected from the road traffic accident archives of Adama City Police (i.e. traffic office) and other offices and stake holders concerned with the issues of road traffic accident and road safety.

1.7. Limitation of the Study

Road traffic accident data found in Adama City Police is kept manually, irregularities of recording, not very well systemized and not made comparative analysis. The validity and accuracy of the data was questionable and there was limited time to retrieve data from files for this study. There was also a challenge in the logistical context itself that was meant to provide a more accurate picture of impacts of road traffic accident.

It would be very interesting if the researcher is able to study the issue of the research in different cities to make the results of the research applicable for many urban areas. But due to shortage of time, financial and other limiting factors, it is not possible for the researcher to do so.

1.8. Organization of the Paper

This paper is organized in to five chapters. The first chapter introduces background of study, statement of the problem, objective of the study, basic research questions, significance of the study, scope of the study and limitation of the study. The second chapter discussed about the review of related literatures regarding concepts of RTA, causal factors for RTA, impacts of RTA, RTA in Ethiopia and RTA black spot definition and analysis. The third chapter encompasses description of the study area, topography, climate, demographics and socioeconomic characteristics, and research methods and materials. The fourth chapter presents results and discussion of the study. The fifth chapter embraces conclusion and recommendations.

1.9. Standard Definition of Basic Terms

Terms related to RTA can have different definitions in different places. However, (WHO 2010); Alister and Simon (2011) have quoted the following as standard definitions of basic terms of RTA.

Accident: Involves personal injury occurring on the public highway (including footways) involving at least one road vehicle or a vehicle in collision with a pedestrian and which becomes known to the police within 30 days.

Disability Adjusted Life Years: The years lost by an individual because he or she is disabled as a result of being involved in a Traffic Accident.

Fatal accident: Accident involving at least one fatal casualty.

Injury: Physical damage that results when a human body is suddenly or briefly subjected to intolerable levels of energy. It can be a bodily lesion resulting from acute exposure to excessive energy or impairment of function resulting from lack of vital elements.

Road traffic accident black spots: Places or cites where frequent road traffic accidents occur.

Road traffic accident: A collision or incident involving at least one road vehicle in motion, on a public road or private road to which the public has right of access. Included are: collisions between road vehicles; between road vehicles and pedestrians; between road vehicles and animals or fixed obstacles and with one road vehicle alone.

Road traffic injury (or casualty): A person who has sustained physical damage (i.e. injury) as a result of a road traffic crash.

Road traffic: Any movement of a road vehicle on a given road network.

Road transport: Any movements of goods and/or passengers using a road vehicle on a given road network.

Road user: a person using any part of the road system as a non-motorized or motorized transport user.

Road: Line of communication (travelled way) open to public traffic, primarily for the use of road motor vehicles, using a stabilized base other than rails or air strips.

Serious injury/ casualty: Injury does not cause death within 30 days of the accident and either results in the casualty being detained in hospital as an in-patient, or any of the following injuries: fractures, concussion, internal injuries, crushing's, severe cuts and lacerations, severe general shock requiring treatment, or any injury which causes death more than 30 days after the accident.

Slight injury/ casualty: Injury of a minor character such as a sprain (including whiplash neck injury), bruise or cut which are not judged to be severe or slight shock requiring roadside attention. Injuries not requiring medical treatment are included.

In addition to the above terms related to RTA, main economic terms are used in this study to label countries based on their economic status. The economic terms used in this study are taken on the basis of their definition given by WB (2012) and are stated as follows.

High-income countries: Are countries whose Gross National Income Per capita is US$ 12,616 or more.

Low-income countries: Are countries whose Gross National Income Per capita is US$ 1,035 or less.

Middle-income countries: Are countries whose Gross National Income Per capita is between US$ 1,036 to 12,615.

CHAPTER TWO: REVIEW OF THE RELATED LITERATURE

2.1. Introduction

This chapter presents the main concepts and theories that are related to road traffic accident. The concepts help to assess the factors and health, socioeconomic and physical environmental consequences of road traffic accidents on well being of the people and the environment. Theoretical framework is defined as a conceptual model of how one theorizes or makes logical sense of the relationships among several factors that have been identified as important to the problem. The theories guided and directed identification of literature sources that suited the research questions and it helped as a tool for analysis of the findings.

2.2. Concept of Road Traffic Accident

When you speak of a traffic accident, everybody knows what you mean. Something gone wrong on the highway, for instance, a car wrecked, somebody hurt or possibly killed, medical and repair bills, a trip spoiled, etc. refer to road traffic accident. Such an understanding is good enough for people who don't have much to do with traffic accidents; but if you have to investigate accidents, you need a much clearer idea of exactly what traffic accidents are. If your duties in connection with traffic accidents require you only to handle emergencies arising from them and then make out an accident report, a general knowledge of accidents is sufficient. But if you are responsible for getting information from which to conclude how and why the accident happened, and especially if you have to make such conclusions, you will need a much better foundation for accident investigation.

The dictionary defines "traffic" as the transportation of goods, coming and going of persons or goods by road, rail, air, etc (Segni, 2007). Traffic can be defined as the movement of pedestrians and goods along a route, and in the 21st century the biggest problem and challenge for the traffic engineer is often imbalance between the amount of traffic and the capacity of the route, leading to congestions (Kinra, 2005).

An accident is an events, occurrence which is unexpected or undesired, which has an element of chance or probability, and which has undesirable or unfortunate results. Road traffic accident is an event which leads to personal injury or damage to property that takes place in an area intended for public transport or generally used for transport and in which at least one of the involved parties has been a moving vehicle (Baker, 2010).

Single vehicle accidents that involve a single vehicle, which means without other road user, are also enclosed (Safecarguide 2004). In a similar manner Ajit and Ripunjoy (2004), have mentioned that accident is an occasion, occurring abruptly, unpredictably and inadvertently under unforeseen circumstances. Seemingly, Segni (2007) have also outlined that an accident is a rare, random, multi-factor event always preceded by a situation in which one or more road users have failed to cope with the road environment.

Road traffic accident is defined as any vehicle accident occurring on a public highway (i.e. originating on, terminating on, or involving) a vehicle partially on the highway. It includes collisions between vehicles and animals, vehicles and pedestrians, or vehicles and fixed obstacles. In general, road traffic accident can be defined as an accident that occurred on a way or street open to public traffic; resulted in one or more persons being killed or wounded, and at least one stirring vehicle was intricate. Therefore, road traffic accident is an undesirable or unfortunate result of smash between vehicles; between vehicles and pedestrians; between vehicles and animals; or between vehicles and geographical or architectural obstacles.

Worldwide, the transportation problems faced by various nations have increased manifold, necessitating search for methods or alternatives that ensure efficient, safe, feasible and faster means of transport. Transport is the movement of people and goods from one place to another (Peters 1982; Khanna and Justo 1986; Goodall 1987). According to Belachew (1997), transport also comprises movement of information. Therefore, Transportation is the conveyance of people, properties and information from one place to another or it is the repositioning of people, properties and information over space.

Several road traffic accidents occur throughout the world at every fraction of times in a day. The most shocking and emerging reality of road traffic accident is that, it will continue affecting the survival of several lives across the planet. Consequently, UN (2009), remains pessimistic in road traffic accident cases where it projected that, road traffic injuries will be the 5th leading cause of death globalize by 2030. However, WHO (2004) projected that, road traffic accident crashes which were ranked at 9th leading cause of burden of disease by 2002 could rank at the 3rd cause of burden of disease by 2020, if the current trend in motorization continues increasing in the same or similar manner for the coming decade. Whatever the reason, where ever the scene and whoever the victim is, road traffic accidents remain as the headache of everyone and regarded as a major global environmental disaster.

The conceptual model of systems approach seeks to identify and rectify the major sources of error or design weaknesses that contribute to road traffic accident, as well as to mitigate the severity and consequences of road traffic accident (Muhlrad and Lassarre, 2005: 25). Elements of the system include motor vehicles, roads and road users along with their physical, social and economic environments. They added that 'the essence of using systems approach is to consider not only the underlying factors for road traffic accidents, but also the role of

different agencies and actors on causes, impacts and intervention measures for prevention'. (Muhlrad and Lassarre, 2005: 25) RTAs and injuries are multiple dimensional problems that require a comprehensive view when examining determinants, consequences and solutions. Systems theory approach enhanced understanding for causes of RTAs in Adama and how this is related to risk taking behaviour of road users.

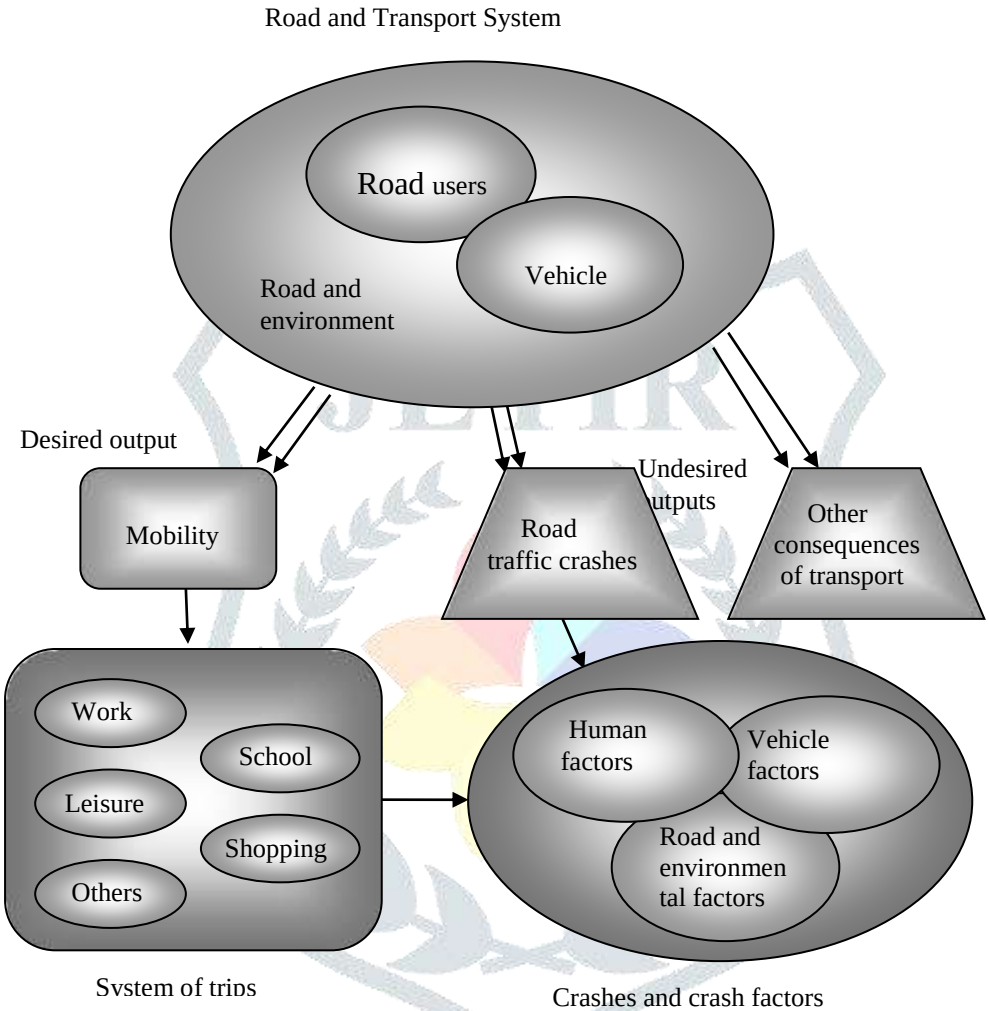


Figure 2.1: The Systems theory approach (Source: Road Traffic Injury Prevention Training Manual-WHO, New Delhi, 2005)

2.3. Causal Factors for Road Traffic Accident

Road traffic accidents have become a major public health, economic, social and physical environment, and regarded as an environmental disaster concern worldwide. However, unlike developed or high income countries, many developing countries have made very little progress towards addressing this problem. Road traffic accident results from an association of different things or factors related to the components of the system including road users, roads, vehicles, and weather condition and the way they interact. Identifying the accident factors that contribute to road traffic accidents is important in identifying interventions that can reduce the accidents associated with those factors (Lisa, David et al. 2005). The factors for road traffic accidents can be categorized into the following major groups, namely:
Person Related Factors (e.g. driver, passenger, pedestrian etc.)**,** Physical Environment Related Factors (e.g. road type and condition, location, etc.)**,** Vehicle Related Factors (e.g. type, technical condition, etc.) and Weather Condition.

2.3.1. Person Related Factors

Person related factors in road traffic accidents include all factors related to drivers and other road users that may contribute to accident. Driver, passenger and pedestrian were considered together. In general, some personal conditions that make drivers to have accidents also make pedestrians to have accidents. Whether it is a pedestrian or a vehicle with its driver, we call it a traffic unit. We do so to avoid repeating drivers and pedestrians when what we say applies to both. Because far more drivers than pedestrians are involved in accidents, we will simply speak of drivers without adding and pedestrians whenever what we say applies to either.

Driver or pedestrian condition often team up with road or vehicle condition to make a combination of factors causing an accident. A single road or vehicle condition can sometimes, cause an accident; but far more often, faulty driver condition by themselves result in behavior that causes accidents (Lagarde, 2007). The use of mobile telephones while driving could result in unexpected road traffic accident risks. WHO (2004) suspects that, the use of hand held mobile telephones can adversely affect driver behavior as regards physical as well as perceptual and decision-making tasks. The process of dialing influences a driver's ability to keep to the course on the road.

Some driver conditions almost always contribute to an accident. The age of drivers affects to the behavior of their driving styles and to the level of driver's attention. In general WHO (2004); Lisa, David et al. (2005) argued that accident rates of male drivers aged 16–20 years were at least three times the estimated accident rate of male drivers aged 25 years and above. The best drivers can overcome almost any hazardous situation

presented by road and vehicle conditions. The poorest drivers, however, can operate successfully only when road and vehicle conditions are favorable and when traffic presents few problems. Hence we are concerned with what driver conditions make a driver unable, in a specific accident, to solve the problem presented by road conditions, vehicle conditions and traffic. We want to know how his personality contributed to the accident.

Road users ought to acquire the general awareness or possession of information or ideas and the ability to do something well needed to travel safely by means of formal training and their own experiences. Inadequate knowledge of road traffic laws and regulations, road traffic signs and signals, vehicles and other elements may be some of the factors contributing to unsafe behavior and road accidents. Road user information and operations are intended to reduce accidents by promoting safer behavior in traffic, by giving road users better knowledge, skill and more favorable attitudes towards such behavior.

Generally, person related factors (driver, passenger, pedestrian etc.) including driver distraction, including fiddling with technical devices, talking with passengers, eating or grooming in the car, dealing with children or pets in the back seat, or attempting to retrieve dropped items and speaking on cell phones; driver's impairment by tiredness, illness, alcohol or drugs (both legal and illegal), driving without rest, over speeding, perilous overtaking, driver negligence, poor driving standards, negligence of pedestrians, vehicle overload or improperly loaded vehicles, drivers not respecting pedestrian priority, poor skill and undisciplined behavior of drivers, pedestrians not taking proper precautions, aggressive driving, driving in wrong way, overtaking from wrong side, jumping from traffic signal, driving without knowledge of vehicle and other driver's fault.

2.3.2. Physical Environment Related Factors

A number of physical environment related factors combined to cause each road traffic accident. Often, for example, unfavorable characteristics of the road combined with driver deficiencies to produce the accident. By understanding some of the attributes and modifiers of roads, drivers and vehicles, the investigator is better able to know what to look for and ask about when he is studying an accident. Road condition combined with one of the other element contributes to accidents. A simple example will illustrate how road can combine with one of the other element of the highway transportation system (i.e. the driver) to cause a dangerous condition.

Road transport is conducted on roads, the road type and condition, location, the size and engineering characteristics of the roads were have considerable contribution to the increase or decrease of road traffic accident risks. WHO (2004) supports this idea by saying that, the deficiencies in road network safety planning and management, and deficiencies in the road network development and maintenance has an effect on accident

risk because it determines how road users perceive their environment and delivers instructions for road users, through signs and signals, and traffic panels, on what they should be doing.

Terje (1998) indicates that in Africa road network is mounting fast, preservation standards have started improving lately, and there is potential for improving the safety standards of the roads. Berhanu (2000) reports that in Ethiopia, the police have limited road and traffic engineering skill in general and thus they underestimate the contribution of roads and environments to traffic accidents and especially they lack trainings on subject area.

The roadway's factors such as traffic control devices (i.e. signs and signals) and crosses (intersections) road can be a factor in road traffic accident. Nothing or fewer traffic control devices (i.e. signs and signals) and complex crosses (intersections) road with excessive signage lead to confusion. All factors are subject to adjustments by outside influences such as road surface that become slippery from rainfall. Modifying each of the listed road factors are weather, lighting, roadside devices, activities, surface deposits, damage, deterioration and age (Lisa, David et al. 2005). In general, physical environment related factors (road) have impacts on occurrences of road traffic accidents.

Generally, physical environment (road type and condition, location, size etc) including foreign obstacles or substances on the road surface; making the roads slick; road damage including potholes, especially during rainy season, bad roads and hilly terrain, serious deficiencies in the road network development and maintenance; and deficiencies in road safety planning, management, enforcement and interventions, and incompletion lighting along the road at night and illegal constructions of road.

2.3.3. Vehicle Related Factors

Vehicle related factors can have considerable influence on accident and its contribution to road traffic accidents. Prior studies of WHO (2004) have proved that vehicle related factors contribution to accidents, through vehicle defects, is generally around 3% in high income countries, about 5% in Kenya and 3% in South Africa. Lisa, David et al. (2005) have argued that a small percentage of crashes are caused by mechanical failure of a vehicle, such as some form of tire failure, brake failure, or steering failure.

The vehicle contributes to accident when some parts of its structure, equipment, accessories, or load becomes defective or hazardous and interferes with the proper operation of the vehicle to such an extent that without such interference the accident would not have happened. An important and often difficult part of accident investigation is discovering whether some vehicle condition existing before the accident did indeed contribute to the occurrence of an accident. Often the problem is to determine whether the alleged defects actually did

exist and contribute. Sometimes after the accident parts of the vehicle are or seem to be obviously unsafe; then the question becomes one of determining whether the condition was a cause or only a circumstance (Persson, 2008).

Any of three major elements of the high way transportation system, namely, vehicle, driver, and road may contribute a condition that combines with conditions of one or both of the others to cause an accident, and each generally contribute to a different degree in any particular accident. In general, vehicles, as one of the three major elements of highway transportation contribute far less than either the road or the driver. Generally, vehicle related factors include mechanical failure, including flat tires or tires blowing out, brake failure, axle failure, steering mechanism failure, poor vehicle conditions, poor maintenance of vehicles, vehicle design and maintenance.

2.3.4. Weather Condition

The weather conditions can be a factor of road traffic accidents. Lisa, David et al. (2005); Alister and Simon (2011) argued that, weather on roads can contribute to accidents: for example wet pavement reduces friction and flowing or standing water greater than 1/8”deep can cause the vehicle to hydroplane. Many several accidents have occurred during conditions of precipitation (rainfall), smoke or fog, which can reduce visibility. Wind gusts can affect vehicle stability. Due to weather condition slippery road, deposit on road and responsible for road traffic accident.

The onset of adverse weather conditions is generally believed to impact on the number of road accidents that occur. Whilst individual weather factors were considered, it is important to remember that the impact is intensified when the factors are combined together. Work undertaken by Parry and Reid highlighted that the main impacts of hazardous weather are related to poor visibility and loss of vehicle control (Parry and Reid, 1988).

Weather conditions are considered to be factors that affect the number of road accidents and casualties significantly, with different effects according to the type of road (motorways, rural roads or urban roads). Moreover, as the weather also affects mobility, it is to be expected that the effects of weather on the number of injury accidents and casualties are partly due to the changes in mobility occurring at the same time. The interaction between weather effects and the effects of other road safety factors, including roadway, driver, vehicle and intervention variables on road accident frequency is certainly a complex phenomenon that attracts increasing attention by researchers (Pilkington, 2005).

Weather condition impacts traffic through several ways, among which poor visibility, precipitation, wind speed and temperature are of most concern. Severe weather conditions affect drivers' capabilities, vehicles' stability and pavement's friction (Kilpeläinen, 2007). In general, the literature on road traffic accidents has noted that person related factors (e.g. driver, passenger, pedestrian etc.)**,** physical environment related factors (e.g. road type and condition, location, etc.)**,** vehicle related factors (e.g. type, technical condition, etc.) and weather condition are risk factors contributing to road traffic accidents.

2.4. Impacts of Road Traffic Accident

2.4.1. Magnitude of the Problem

All countries in the world are currently affected by Road Traffic Accidents (RTAs). It constitute major health, social, economic, developmental, and environmental challenges of developing countries, especially those in Africa (WHO, 2009), holds true as it is evidenced in many countries. In 2002, for example, of the estimated 1.2 million people killed in road traffic crashes 90% occurred in low and middle income countries of which Africa had faced the highest fatality rate, which is substantially higher than developed world, such as those in North America (WHO, 2009).

The problems of road safety remain unresolved despite efforts made to reduce through appropriate road designing methods and legal enactment. Consequently, RTAs are claiming the lives of millions and cause destruction of property leading to what is known as social and economic crisis (Peden et al, 2004). This implies that the impact it has on human, physical and financial capital, is huge posing challenges to national development efforts. In fact, this requires planning for sustainable transport system in general and sustainable urban transport development in particular.

2.4.2. Health Impacts of Road Traffic Accident

The road traffic injury problem began before the introduction of the car. However, it was with the car and subsequently buses, trucks and other vehicles that the problem escalated rapidly. By various accounts, the first injury crash was supposedly suffered by a cyclist in New York City on 30 May 1896, followed a few months later by the first fatality, a pedestrian in London. Despite the early concerns expressed over serious injury and loss of life, road traffic crashes have continued to this day to exact their toll. Though the exact number will never be known, the number of fatalities was conservatively estimated to have reached a cumulative total of 25 million by 1997 (WHO, 2004).

WHO data show that in 2002, people worldwide died as a result of road traffic injuries. This represents an average of 3242 persons dying each day around the world from road traffic injuries. In addition to these deaths, between 20 million and 50 million people globally are estimated to be injured or disabled each year. In the same year, the overall global road traffic injury mortality rate was 19.0 per 100 000 population. Low income and middle income countries had a rate slightly greater than the global average, while that for high income countries was considerably lower. The vast majority (90%) of road traffic deaths were in low income and middle income countries. Only 10% of road traffic deaths occurred in high income countries.

Currently, there are two main models for predicting future trends in road traffic fatalities. These two models are: The WHO Global Burden of Disease (GBD) project, using health data and the World Bank's Traffic Fatalities and Economic Growth (TFEC) project, using transport, population and economic data. Both predict a substantial increase in road traffic deaths if present policies and actions in road safety continue and no additional road safety countermeasures are put into place.

The GBD model predicts the following scenario for 2020 compared with 1990: Road traffic injuries will rise in rank to sixth place as a major cause of death worldwide. It will rise to become the third leading cause of loss and the second leading cause of loss for low-income and middle income countries. Road traffic deaths will increase worldwide, from 0.99 million to 2.34 million (representing 3.4% of all deaths). It will increase on average by over 80% in low income and middle-income countries and decline by almost 30% in high income countries. The lost will increase worldwide from 34.3 million to 71.2 million /representing 5.1% of the global burden of disease/ (WHO, 2004).

2.4.3. Economic Impacts of Road Traffic Accident

The economy of all countries in the world is currently affected by road traffic accidents. The direct economic costs of global road traffic accidents have been estimated at US$ 518 billion, with the costs in low income countries estimated at US$ 65 billion exceeding the total annual amount received in development assistance. The regional of cost of road traffic accidents Naci, Chislom et al. (2008) stated that, the economic cost of road traffic accidents have been estimated to be as much as US$ 24.5 Billion in Asia, US$ 19 Billion in Latin America and Caribbean, US$ 9.9 Billion in Central and East Europe, US$ 7.4 Billion in the Middle East and US$ 3.7 Billion in Africa.

In economic terms, the cost of road crash injuries is also estimated at roughly 1% of gross national product in low income countries, 1.5% in middle income countries and 2% in high income countries (WHO, 2004). This shows that RTAs are not limited to developing nations but are also universal phenomena. In other words, the implication it has on sustainable transport development in a nation or a city is immense. According to Persson

(2008) have discussed that, the economic impact of road traffic accidents in Ethiopia is substantial for Ethiopians as the annual cost is estimated to be around $40 million.

2.4.4. Social Impacts of Road Traffic Accident

In addition to the health and economic impacts of RTAs, the world is also suffering the social impacts from road crashes. According to WHO (2004) describes that, over 50% of the global mortality due to road traffic injury occurs among young adults aged between 15 and 44 years, and the rates for this age group are higher in low income and middle income countries. WHO in 2002, males accounted for 73% of all road traffic deaths, with an overall rate almost three times that for females: 27.6 per 100, 000 population and 10.4 per 100, 000 population, correspondingly.

Road traffic mortality rates are higher in men than in women in all regions regardless of income level, and also across all age groups. On average, males in the low-income and middle-income countries of the WHO Africa Region and the WHO Eastern Mediterranean Region have the highest road traffic injury mortality rates worldwide. The gender difference in mortality rates is probably related to both exposure and risk-taking behavior. Morbidity rates for males are considerably higher than those for females.

The risk of dying as a result of a road traffic injury is highest in the African Region (24.1 per 100, 000 population), and lowest in the European Region (10.3 per 100, 000). Young adults aged between 15 and 44 years account for 59% of global road traffic deaths. More than three-quarters (77%) of all road traffic deaths occur among men. In an absolute similar manner Naci, Chislom et al. (2008) supports this argument by stating that, Road crashes kill and maim the most productive segments of the population; globally, in 1998, 51% of fatalities and 59% of disability adjusted life years lost as the result of road traffic injuries occurred in the most productive age groups.

2.5. Road Traffic Accident in Ethiopia

In Ethiopia, the situation has been worsened as the number of vehicles has increased and consequently due to increased traffic flow and conflicts between vehicles and pedestrians. Despite government efforts in the road development, road crashes remain to be one of the critical problems of the road transport sector in Ethiopia (UNECA, 2009). Every year many lives are lost and much property is destroyed due to road traffic accidents in the country.

Similarly, Mekonnen (2007) suggested that, road traffic accident in Ethiopia is a serious problem. The road traffic accident death rate is estimated to be 130 per 10,000 vehicles. Of the total victims of road traffic accident who lost their lives, over half are pedestrians, out of whom 30% are children. Based on a five-year average records, of the personal injury accidents, 81% are caused due to drivers error, 5% due to vehicle defect, 4% due to pedestrian error, 1% due to road defects and 9% due to other problems in Ethiopia.

The National Road Safety Coordination Office of Ethiopia, the main underlying reasons for the frequent road traffic accident occurrences and severe impacts of road traffic accident in Ethiopia include: improper behavior or lower skill of drivers, poor vehicle technical conditions, animals and carts using the highways, pedestrians not taking proper precautions, poor traffic law enforcement, poor emergency medical services and insufficient safety considerations given in road development.

The UN (2009) stated that the economic costs of road crashes and injuries are estimated to be 1% of Gross Domestic Product (GDP) in low income countries such as Ethiopia. In addition to this, Mohammed (2011) put his findings of the cost of road traffic accident in Ethiopia on the basis of the Ethiopia's data and economic figure of 2009/10, as the cost of damage only, slight, serious and fatal road traffic crashes were 327.12 million, 204.65 million, 619.38 million, and 716.02 million ETB respectively. And also study conducted by Ethiopian Roads Authority described that, road traffic accident costs Ethiopian economy between 350-30 million Birr annually, and loses almost 1860 lives each year with another 8,690 people reported injured (CSA 2007).

According to the Ethiopian transport regulation (*Negarit Gazeta*, 1963, which is still in use with amendments), a driver of a vehicle involved in a road accident shall notify the nearest police station immediately if the accident involves personal injury and within twenty-four hours if it involves property damage only. Similar to most countries of the world stated that by UN (2009), police is responsible for traffic accident investigation and reporting in Ethiopia. According to the regulation, all accidents are reportable.

An account of the accident is recorded in a daily report book at a local police station or traffic office. The accident recordings in the daily recording book form the basis of the Ethiopian road accident statistics. Periodic summaries of aggregate road accident records are made and sent to the immediate higher police department. They finally reach the Federal Police where the national road accident statistics are compiled. The information recorded could generally be adequate for the police work, but it is of limited use to other bodies requiring information for identifying the causes and appropriate remedial measures. It is primarily inadequate in determining the location of accidents and the factors involved. Moreover, accident reporting lacks a significant level of consistency.

2.6. Black Spots of Road Traffic Accident

2.6.1. Black Spot Definition

Traffic accidents and crime occurrence are well-defined threats to public safety (Kuo et al., 2013). They said that using data driven procedures, police departments would assign constraint resources efficiently in order to help crime and traffic crash safety, which substantially reduces the crime and crashes in the black spot areas. Mitra (2008) said "identification of crash "hot spots," "black spots," "high risk", or "high collision concentration locations" as standard practice in departments of transportation throughout the united states to ensure efficient allocation of safety dollars in reducing crash frequencies and severities. Black spot places in road traffic accident are defined in different ways by different countries and scholars. 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 testified to the police in a four year period (Elvic, Runee et al. 2005). Thus, a black spot in the UK may well have only five injury accidents in three years, whereas a city in Bangladesh may have black spot defined as having more than 10 injury accidents in a year (Geurts and Wets 2003).

In most developed states, black spots are defined as the locations where there are 12 accidents in 3 years per 0.3 kilometers (Guo, Gao et al. 2003). In Czech Republic, the black spot criterion is that junctions or 250m long road sections that are considered as black spots on condition that at least 3 road accidents with injuries occurred within 1 year or at least 3 road accidents with injuries of the same type occurred within 3 years or at least 5 road accidents of the same type occurred within 1 year (Rokytova 2000). Study on single carriage way trunk road Walmsley, Summersgill et al. (1998) revealed that the criterion used to delineate road sections for accident analysis are age of opening, carriageway width, curbs, hard strips, and speed of the road section.

From the perspective of Rokytova (2000) black spots are defined as locations that are generally classified after an assessment of the level of risk and the likelihood of a crash occurring at a location. Black spot safety work can be designated as the task of improving road safety through variations of the geometrical and environmental characteristics of the problematic sites in the existing road network. In towns and cities, there is a tendency for traffic accidents to cluster at specific places, often at intersections. A concentration of accidents at a specific spot may partly be due to inappropriate road design or inappropriate traffic control at that place. In such cases, the clustering of accidents can be avoided or reduced by improving road design or traffic control.

Elvic, Runee et al. (2005) points out black spots on national highways in Norway have heavy traffic but do not have particularly high accident rates when compared with places which are not classified as accident black spots. Ranking of black-spots were done with various alternatives. Jonnessen and Sakshaug (2006) show three

alternative methods of ranking black spots. These are number of accident with personal injury or serious personal injury, accident rates (accident per million vehicle kilometer) and potential for accident reduction.

2.6.2. Black Spot Analysis

Accident analysis studies aim at the identification of high rate accident locations and safety deficient areas. Road crash black spot analysis has been widely examined in the academic press, and various types of methods for identifying unsafe locations have been developed. Simple methods for identifying unsafe locations, where the number of crashes or the crash rate per unit exposure exceeds a given threshold, are routine and straightforward (Taylor, Bonsall et al. 2000).

Austroads (1988) describes another method that uses critical crash rates to determine whether the crash record of each location is significantly greater than the system wide average. Another statistical models, such as the empirical Bayes method, include developing a statistical model based on the reference population and comparing the expected number of crashes with the observed number (Elvic and Runee 2008; Li and Zhang 2008). Not only crash rates, but unsafe locations can be ranked according to their severity. Geurts, Wets et al. (2004) use the values of 1, 3, and 5 as the weights for a light, serious, or fatal casualty of a crash. Likewise, ranking methods also are made of a severity index, which is computed based on weights of 3.0 for fatal crashes, 1.8 for serious injury, 1.3 for other injury, and 1.0 for property damage only crashes (RoTA 1994). In addition to these individual ranking methods, other composite methods that consider more than one factor at a time are also used.

Various methods for studying spatial patterns of crash data as point events have recently been developed. One of the most widely used is Kernel Density Estimation (KDE). Many recent studies use planar KDE for hot spot analysis, such as the study of high pedestrian crash zones (Vasudevan, Pulugurtha et al. 2007) road crash hot spots (Anderson 2009), and highway crash hot spots (Erdogan 2009). The goal of planar KDE is to develop a continuous surface of density estimates of discrete events such as road crashes by summing the number of events within a search bandwidth. However, planar KDE has been challenged in relation to the fact that road crashes usually happen on the roads and inside road networks that are portions of two-dimensional space. Road crashes are, therefore, needed to be considered in a network space, a simplification of the road network represented by one-dimensional lines.

CHAPTER THREE: DESCRIPTION OF THE STUDY AREA AND RESEARCH METHODS AND MATERIALS

3.1. Description of the Study Area

3.1.1. Location

Adama is the previous capital city of Oromia region located at $8^0$33'N-$8^0$55'N latitude and 39^0 16'E-39^0 27'E longitude at an elevation of 1712 meters, 100 km to the Southeast of Addis Ababa through old route. The city has shown sustainable and fast progress and at present its total area covers 32.4 km^2. Adama is now divided in to 18 Kebeles including four rural Kebeles of the town to facilitate the basic activities so as to bring about effective changes in offering good governance and relevant public service at all levels (Adama City Administration, 2014).

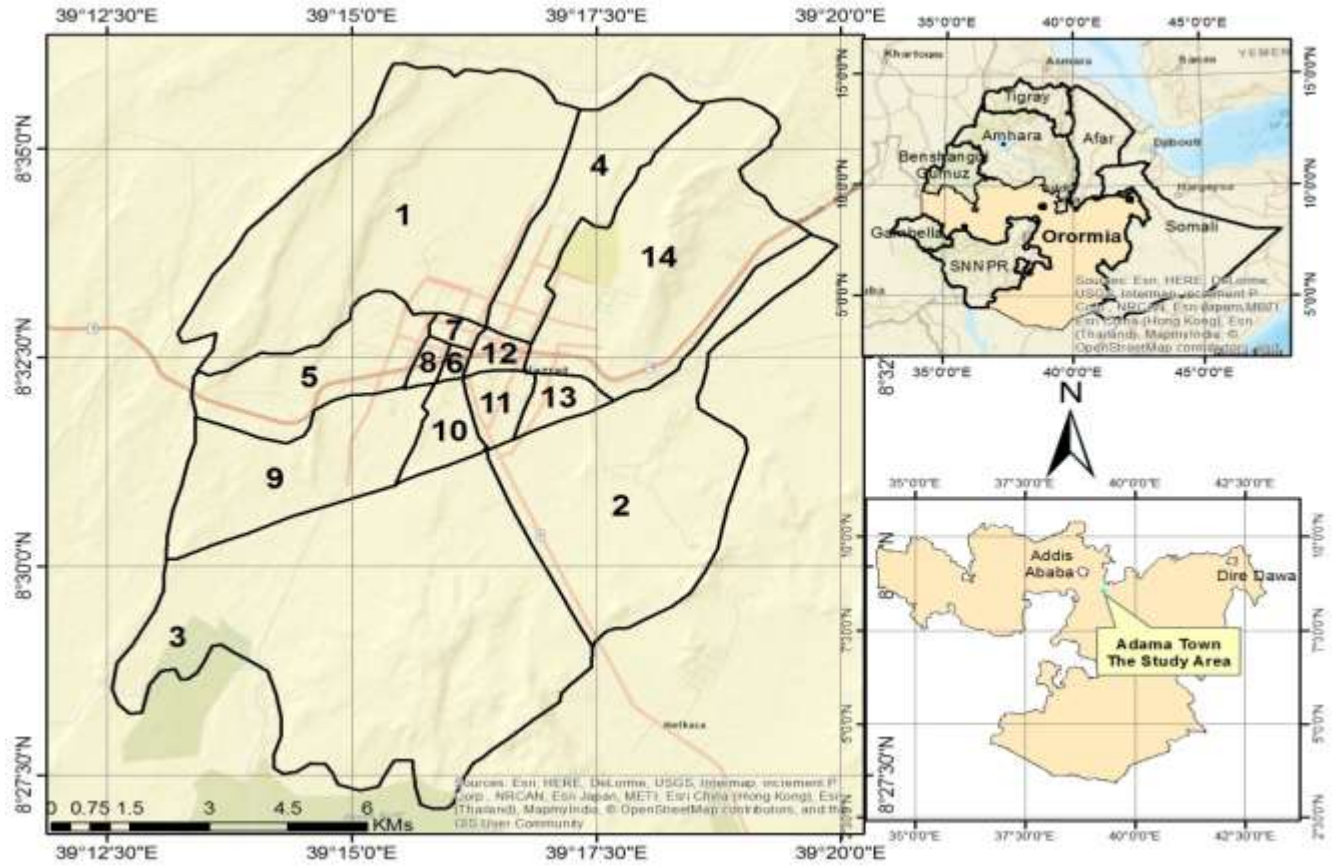


Figure 3.1: The Location of Adama city (Source: ESRI Map ® 2016)

3.1.2. Topography and Climate

3.1.2.1. Topography

Adama is found within the Wonji fault belt, which is one of the main structural systems in the Ethiopian Rift Valley. Its physiographic condition is, therefore, mainly the result of volcano tectonic activities that occurred in the past and also partly the result of the deposition of sediments, which are considered largely of fluvial and lacustrine origin. Adama is regarded as seismically active area concerning earthquake hazards with the probability occurrence of 0.99 in every 100 years (NUPI, 1995). The City lies in a relatively low lying flat land between two mountain ridges. Topographic features such as slope, has an important impact on runoff production and the nature and strength of the flow connectivity. In general, the main landscape in Adama and its surrounding consists of fault scraps and fault controlled depressions covered with sediments and volcanic domes and cones.

3.1.2.2. Climate

i. Rainfall

Rain fall recorded at Adama meteorological station for the past 10 years (2004-2013) indicated that the average annual rainfall is about 885.91mm. The maximum monthly average rainfall is about 224.733mm in July. Most of the rain occurs in summer season (June to September).

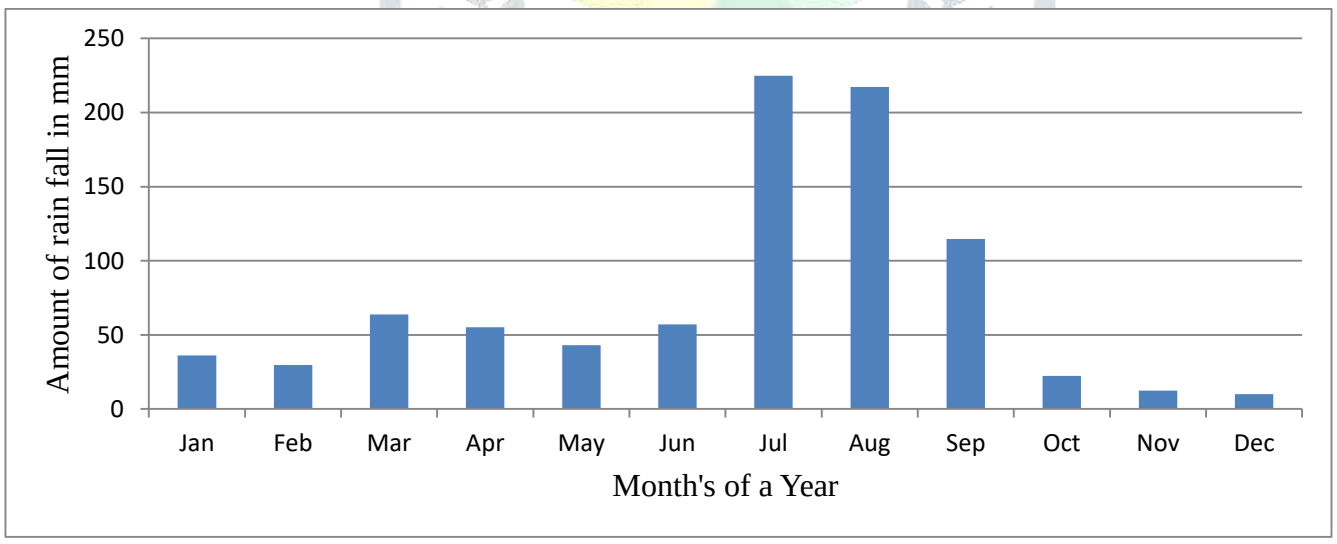
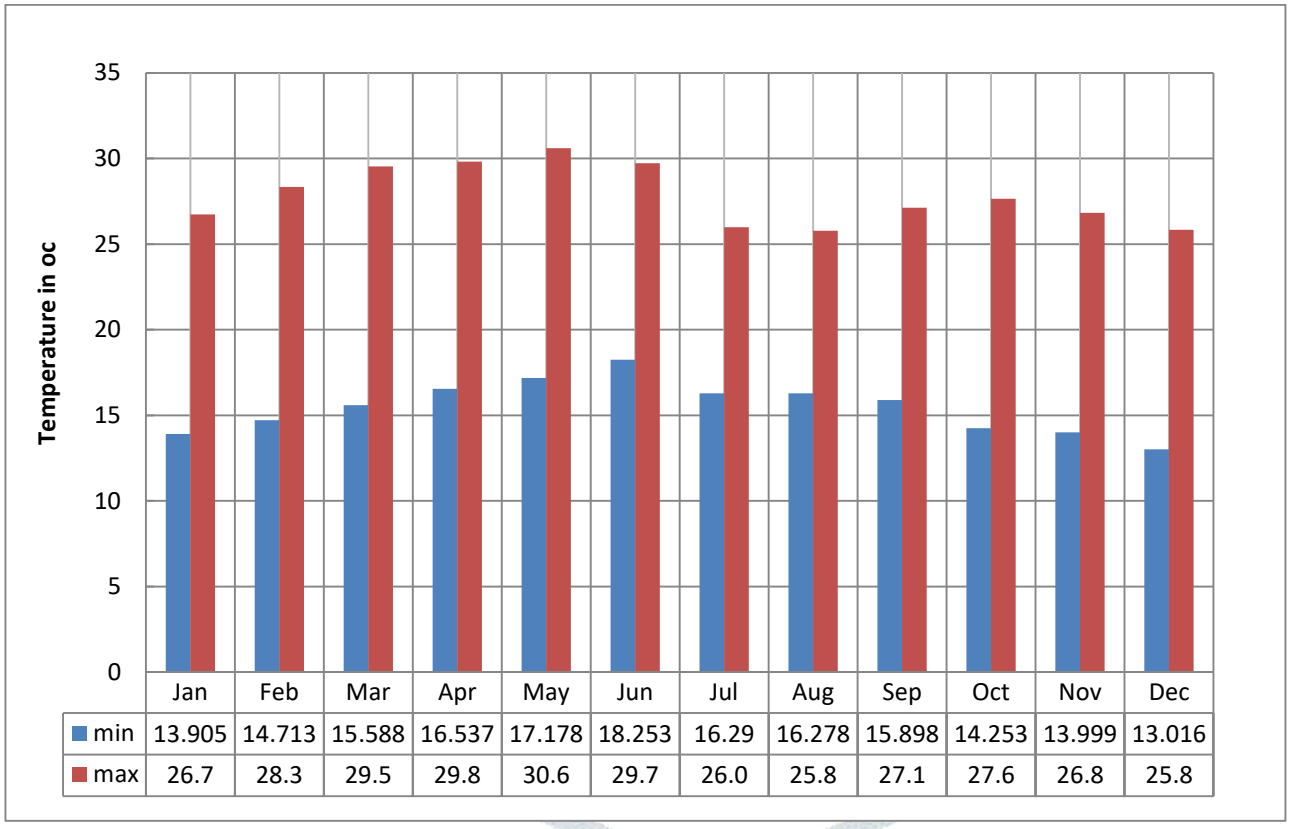


Figure 3.2: Mean monthly rainfall of Adama City (Source: EMA, 2015)

ii. Temperature

The mean annual temperature is 21.6°c. It can be classified as semi-humid to semi-arid climate, which characterizes the altitude range 1300 to 1800 above sea level. In Adama the hottest month with maximum mean temperature of 30.6°c is May. The monthly minimum mean temperature is November and December with the temperature of 13.0°c. The monthly maximum temperature varies between 25.8°c and 30.6°c while the minimum monthly values vary between 13.0°c and 18.3°c. At Adama, the heavy truck movements could contribute to the increment of temperature due CO_2 release into the air (NMA, 2015)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
min	13.905	14.713	15.588	16.537	17.178	18.253	16.29	16.278	15.898	14.253	13.999	13.016
max	26.7	28.3	29.5	29.8	30.6	29.7	26.0	25.8	27.1	27.6	26.8	25.8

Figure 3.3: Minimum and maximum monthly temperature at Adama City (Source: EMA, 2015)

iii. Wind Speed and Direction

The available wind speed measured five times a day at Adama station indicates that wind with minimum speed occurs during September (1.65m/s), while the wind with high velocity occurs during December, January and February (3.05-3.2 m/s). The values calculated over 10 years (1997 to 2006) indicate that mean is 2.31 m/s. Generally the wind speed at Adama is high. During summer month the wind speed portrays decreasing trend .In ten years period (1997-2006), the maximum wind speed recorded was about 10m/s. The prevailing wind direction of the town is North-easterly (AMA, 2010).

3.1.3. Demographic and Socioeconomic Characteristics

3.1.3.1. Demographic Characteristics

Based on figures from the Central Statistical Agency in 2014, this city has an estimated total population of 282,976 of whom 139,919 are males and 143,057 are females with an area of 32.4 km^2. Adama has a population density of 8733 per square kilometer; all are urban inhabitants. A total of 60,174 households were counted in this city, which results in an average of 3.66 persons to a household, and 59,431 housing units (CSA, 2014).

3.1.3.2. Socioeconomic Characteristics

Due to the recent expansion of investment, Adama embraces different industries, port transportation facilities and warehouses making job opportunities relatively available. All these natural and manmade attributes make Adama and its surroundings a base for investment in several sectors, such as hotel tourism, recreations centers, small and heavy industries, international conferences, workshops, meetings, seminars, national holidays, sport games, and also accessible city with multiple national and international agencies with huge number of employee. For instance the existence of Adama Science and Technology University hosting thousands of young students and its staff could be pointed as best example (Adama City Administration, 2010). Adama is a busy transportation center which is hosts from 35000 to 40000 passengers per day. The city is situated along the road that connects Addis Ababa with Dire Dawa. A large number of trucks use this same route to travel to and from the seaports of Djibouti. Additionally, the Addis Ababa-Djibouti railroad runs through Adama.

3.2. Research Methods and Materials

3.2.1. Research Design

In order to assess the road traffic accident as an environmental disaster, this research study used non experimental research design. Non experimental research design is useful to capture the best of both qualitative and quantitative data. The method of collecting both quantitative and qualitative data is important to understand a research problem. Questionnaire survey was used to quantify variables of road traffic accident, and key informant interviews, focus group discussions and observations were used to for collection of the qualitative data.

3.2.2. Study Population

The study population of key informants and focus group discussion members selected purposively. The study population of key informants selected from Adama City police members (patrol police officers, traffic police officers, and traffic accidents investigators) and persons who were exposed to road traffic accident and offenders in Adama city, as well as purposively selected focus group members from Adama City traffic police, Adama City road transport and construction office, and Ethiopian insurance company Adama branch. The population of questionnaire survey was randomly selected traffic police officers and drivers from Adama City.

3.2.3. Data Types and Sources

This study were used both primary and secondary data type and collected from both primary and secondary sources. The primary data were collected from the selected population groups such as key informants, focus group discussion and questionnaire survey members, and observation. Secondary data were obtained from different road traffic accident records of Adama City police office, traffic accident statistics and reports of five years (2010 to 2014) such as: Accident Record (AR), compliant format, annual accident report and different published and unpublished related materials from various organizations such as: Central Statistical Agency, National Meteorological Agency and Adama City Administration. Different journal articles, books and researche documents etc. were the best sources of secondary data.

3.2.4. Sampling Technique and Sample Size

A purposive (judgmental) and random sampling techniques were used for this study. Purposive sampling technique was employed due to the issue of the research (i.e. road traffic accident). This means the study issue needs professional knowledge and awareness about the problem. A purposive (judgmental) sampling technique was employed for the selection of key informant interviews and focus group discussions participants. The number of key informants usually ranges from 15 to 35 (USAID**,** 1996). Based on information, 20 key informants were selected for key informant interview. These were 12 police members (4 patrol police officers, 4 traffic police officers, and 4 traffic accidents investigators) and 4 persons who faced the accident (victims) and 4 offenders.

The number of FGDs participants usually ranges from 6 to 12. For the purpose of this study, 9 participants (i.e. 3 from traffic police members, 3 from Adama city road transport and construction office members, and 3 from Ethiopian insurance company Adama branch members) were selected. Simple random sampling technique was employed to select samples from traffic police members and drivers to conduct questionnaire survey for

quantitative data collection and analysis. From the four *woredas* police stations traffic police members 50 traffic police and from 200 drivers in the City 70 drivers were selected for questionnaire survey.

3.2.5. Methods of Data Collection

As described above, the primary data were collected through questionnaire survey, Key Informant Interviews (KIIs), Focus Group Discussions (FGDs), observation and Global Positioning Systems (GPS). Secondary data were obtained from different road traffic accident records of Adama City police office, traffic accident statistics and reports of five years (2010 to 2014) such as: Accident Record (AR), compliant format, annual accident report and different published and unpublished related materials from various organizations such as: Central Statistical Agency, National Meteorological Agency and Adama City Administration. Different journal articles, books and researche documents etc. were the best sources of secondary data.

3.2.5.1. Questionnaire Survey

Both close-ended and open-ended questions were used to collected information from selected samples of 50 traffic police officers and 70 drivers. In this survey, participants demographic characteristics, the general trend of road traffic accidents, the major factors of road traffic accidents, the impacts of RTAs on health, socioeconomic, and physical environment and the types of measures to be taken to prevent or reduce road traffic accidents in Adama City were collected. Therefore, for effective collection of questionnaire survey data, two enumerators were assigned from Adama city police (i.e. road traffic accidents experts) and two enumerators assigned from Adama City road transport and construction office (i.e. road transport supervisors).

3.2.5.2. Key Informant Interviews (KIIs)

The key informants used to collect primary data (i.e. qualitative data) on the existing major causes and consequences of road traffic accident, and the frequent road traffic accident places or black spots as well as the types of measures to be taken to prevent or reduce road traffic accidents in the study area. As explained above, 20 key informants were selected for key informant interview. The interview should take less than an hour.

3.2.5.3. Focus Group Discussions (FGDs)

In addition to questionnaire survey, focus group discussion was used to collect qualitative data because it is important for data generation especially on distributions and frequencies of road traffic accidents, major causes and consequences of road traffic accident and the major places/spots and time of road traffic accidents

occurrence. As explained above, 9 participants were selected for focus group discussions. Focus group discussions guide was used as a tool for collection of the FGD data.

3.2.5.4. Observation

The researcher's opinion based on his observation of the study area was included in the analysis.

3.2.5.5. Global Positioning System (GPS)

The use of Global Positioning Systems (GPS) is the fastest and most accurate way of obtaining reliable data about road traffic accident places/black spots. Global positioning systems recorder was used as tool for collection of the quantitative data.

3.2.6. Methods of Data Analysis

Both qualitative and quantitative methods of data analysis were used. This is because, as indicated in Creswell (2008) a mixed methods approach is useful to integrate both quantitative and qualitative approaches. This means that the method of mixing both quantitative and qualitative data is important to understand a research problem. This study were used both qualitative and quantitative methods of data analysis. Quantitative research method was employed to analyze the data collected through survey questionnaire by SPSS and the data collected through GPS analyze by ArcGIS. The qualitative research method was employed by descriptive to analyze the qualitative data (i.e. KII, FGD and observation).

3.2.7. Identification of Road Traffic Accident Black Spots

Black spot places in road traffic accident are defined in different ways by different countries and scholars. For instance, 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 testified to the police in a four year period (Elvic, Runee et al. 2005). A black spot in the UK may well have only five injury accidents in three years, whereas a city in Bangladesh may have black spot defined as having more than 10 injury accidents in a year (Geurts and Wets 2003).

The major criteria to identify road traffic accident black spots in Adama City include frequency of road traffic accident occurrences, time and space, and the criteria set, all places that exhibit five or more than five road traffic accidents in a year were defined as road traffic accident places/black spots in this research.

3.2.8. Reliability and Validity Checks

Coleman and Moynihan (1996) indicated that the data obtained from police statistics is the highest level at which the best and the most reliable information can be secured for types, correlates, incidence, rate and trends of investigation. Siegel (2003:55) also recognizes that police statistics is a valid data to measure accident patterns, types and trends. The Key informant interview, focus group discussion and questionnaire survey were evaluated to make sure that the questions were appropriate and accurate enough, and that the answers permit useful analysis. Piloting was conducted by using face-to-face interviews. The researcher himself conducted the interviews and participated to accept their comments, suggestions and ideas forwarded in the interview. The researcher attempted to control the reliability and validity of the data during data collection and analysis.

3.2.9. Ethical Consideration

A letter was prepared by ASTU which enabled me to have access to data collection in Adama in a very successful way. The Adama City Police, National Meteorological Agency of Ethiopia and other concerned offices responded by giving me a written letter of consent confirming approval for my field work.

For ethical considerations names and photographs of all participants were not included in data collection instrument and were not appeared in the analysis. The identifications I have used for participants were “he”, “she”, “the participant (s)”, “the informant (s)”, “the respondent (s)”, etc. The researcher has used his all effort to understand and respect the culture, values and norms of the respondents and the organizational ethics of the police and the National Meteorological Agency of Ethiopia. The respondents were informed about the objective and purpose of the study. During the study, the researcher was responsible and liable for any ethical breach.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1. Introduction

This chapter presents the data collected through key informant interviews, focus group discussions, observations, questionnaire survey, and secondary data derived from Adama city police to show the trends of road traffic accident from 2010 – 2014. In this chapter, analysis is made on the general trend of road traffic accidents, the major factors of road traffic accidents, the impacts of RTAs on health, socioeconomic, and physical environment. The chapter also attempts to display maps of frequent road traffic accident places or black spots in Adama city. Moreover, the types of measures to be taken to prevent or reduce road traffic accidents in Adama City are discussed.

4.2. Background of the Research Participants

As shown in Table 4.1, the background of the research participants shows that all respondents (100%) were male. The age distribution of the research participants, l8-24 years, 25-34 years and 35-44 years accounted for 36 (24.1%), 67 (50%) and 46 (30.9%) respectively and the majority of respondents were between 25 and 34 years.

Table 4.1: Background of the research participants

Research participants	Participants background											
	Sex	Age			Marital status		Educational level			Job experience		
	M	18-24 years	25-34 years	35-44 years	Single	Married	1-10	10+1-10+2	> 10+2	4-9 years	10-20 years	> 20 years
Field survey	120	30	50	40	40	80	35	65	20	35	70	15
KIIs	20	5	11	4	2	18	3	15	2	8	9	3
FGDs	9	1	6	2	1	8	1	2	6	1	7	1
Total	149	36	67	46	43	106	39	82	28	44	86	19

Source: Computed by the Author, 2016

The marital status of the research participants reveals that, single and married accounted for 43 (28.9%) and 106 (71.1%) respectively and the majority of participants were married. The educational level of the research participants indicates that, 1 to 10, 10+1 to 10+2 and above 10+2 accounted for 39 (26.2%), 82 (55%) and 28 (18.8%) respectively and 10+1 to 10+2 educational level respondents were the majority participants of the

research. The job experience of the research participants points out that, 4-9 years, 10 to 20 years and more than 20 years accounted for 44 (29.5%), 86 (57.7%) and 19 (12.8%) respectively and therefore, the majority respondents were between 10 and 20 years job experience.

4.3. The General Trend of Road Traffic Accident in Adama City

Both the primary and secondary data indicate that the distributions and frequencies of road traffic accidents as well as the health, socioeconomic and physical environment impacts of road traffic accidents have shown more severe trend in the study period and regarded as an environmental disaster. The distribution of RTA by time of day show that more accidents take place at day time because of a higher traffic movement and road users due to different purposes such as marketing, transportation, conference and recreational activities, and these interactions contribute a greater share of road traffic accidents. The distribution of RTA by days of week also prove that more accidents occur places on Monday because, Monday is the beginning of work day and higher traffic movement and road users due to socioeconomic activities.

4.3.1. Road Traffic Accident as a Problem in Adama City

The distributions and frequencies of road traffic accidents have shown dangerous trend and it claims the largest toll of human life, injuries, and properties and tends to be the most serious problem in the study period, and regarded as an environmental disaster. In all interviews participants said that road traffic accident is a serious problem, and regarded as an environmental disaster. During interview, one police member justified the distributions and frequencies of road traffic accidents based on his experiences and perceptions and said that the distributions and frequencies of road traffic accidents have shown dangerous trend regarding to accident severity i.e. fatal accident, serious injury, slight injury and property damage from year to year, therefore, road traffic accident is a serious problem in Adama city, and regarded as an environmental disaster.

The victims of road traffic accident describe that not only the distributions and frequencies of road traffic accidents but also the health, socioeconomic and physical environment impacts of road traffic accidents have shown stern trend from year to year in Adama city and therefore, road traffic accident is a serious problem and regarded as an environmental disaster. The offenders of road traffic accident pointed out that the situation has been worsened as the number of vehicles has increased and consequently there is increased traffic flow and conflicts between vehicles and pedestrians. Road crashes remain to be one of the critical problems of the road transport sector in Adama. Every year many lives are lost and much property is destroyed due to road traffic accidents and therefore, road traffic accident is a serious problem and regarded as an environmental disaster in the city.

In FGDs with Ethiopian insurance company Adama branch, members provided more information concerning the economic impacts of road traffic accidents based on their experiences and perceptions. They said that the economic impacts of road traffic accidents are more serious in Adama city. Road traffic accidents are currently deteriorating the economic wealth of the city regarding to the direct economic costs and the cost of road crash injuries, and therefore, it is a serious problem and regarded as an environmental disaster. The other FGD participant from traffic police members pointed out that the distributions and frequencies of road traffic accidents as well as the health, socioeconomic and physical environment impacts of road traffic accidents have shown an alarming trend from year to year.

During discussions one participant from Adama city road transport office member justified that road traffic accident put its impacts on the social aspects of the livelihood. Mortality due to road traffic injury occurs among young adults and productive aged and the rates for this age group are higher. According to the observations of the researcher, the findings from KIIs and FGDs participants, and questionnaire survey not only the distributions and frequencies of road traffic accidents but also the health, socioeconomic and physical environment impacts of road traffic accidents have shown extremely bad trend from year to year in Adama city. As shown the data from questionnaire survey show that all respondents (100%) agreed that road traffic accident a problem in the study area. In all questionnaire survey, respondents answered the same as KIIs and FGDs participants that road traffic accident is a problem and regarded as an environmental disaster. The secondary data derived from Adama City police to show the trends of road traffic accident from 2010 – 2014 and accident investigation record reviews prove that road traffic accident is a serious problem.

Generally, the findings based on primary and secondary data justify that the distributions and frequencies of road traffic accidents as well as the health, socioeconomic and physical environment impacts of road traffic accidents have shown more severe trend in the study period and therefore, road traffic accident is a serious problem and regarded as an environmental disaster.

4.3.2. Distributions of Road Traffic Accident in Adama City

All countries in the world are currently affected by road traffic accidents. According to WHO (2009), it is having a worsening effect on our society and economy. The common and frequently observed distributions and frequencies of road traffic accidents in Adama City are also similar to the aforementioned reasons and have shown dangerous trend in the study period and regarded as an environmental disaster.

The police member key informant provided more information concerning the problems of road safety remain unresolved despite efforts made to reduce through appropriate road designing methods and legal enactment. Consequently, road traffic accidents are claiming the lives of people and cause destruction of property and

leading to social and economic crises. It was added by another respondent (offenders of RTA key informant) point out road traffic accident can be said to be an unplanned occurrence of auto crash and have shown dangerous trend in Adama city. The police member key informant notable that the distributions and frequencies of road traffic accidents have shown more severe trend regarding to accident severity i.e. fatal accident, serious injury, slight injury and property accident (damage) from year to year in Adama city. It was added by another respondent (offender of RTA key informant) that road traffic accident can be said to be an unexpected occurrence of auto crash and have shown dangerous trend in Adama city.

All FGDs participants agree and point out the distributions and frequencies of road traffic accidents have shown extremely harsh trend in the study area. The impact of road transport accident over the socioeconomic aspects and the magnitude of the road traffic accidents problem of Adama are even much worse. Generally, all FGDs participants agreed and concluded the discussion by saying "Adama City contributes much to the misery of road traffic accident in Oromia as well as in Ethiopia, and regarded as an environmental disaster".

Table 4.2: Distribution of road traffic accident in Adama City

In your experience, the distribution of road traffic accident	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
More severe	50	41.7	70	58.3	120	100
Severe						
Less severe						

Source: Field survey Computed by the Author, 2016

As shown in Table 4.2, the data from questionnaire survey show that all respondents (100%) agreed that the distribution of road traffic accident have shown more severe trend in the study period and regarded as an environmental disaster.

The following table (4.3) computed from the raw data obtained from Adama city police accident statistics to show the distribution of RTAs trends in Adama city from 2010 – 2014.

Table 4.3: Distribution of road traffic accidents trends in Adama City (2010 – 2014)

Types of Accident	Accident year					Total	%
	2010	2011	2012	2013	2014		
Fatal accidents	39	24	36	31	22	152	11.2
Serious injury accidents	36	41	57	29	37	200	14.8
Slight injury accidents	27	52	59	56	50	244	18.1
Property accidents	116	125	161	175	177	754	55.9
Total	218	242	313	291	286	1350	100

Source: Computed from Data obtained from ACP by the Author, 2016

As shown in Table 4.3, the available police accident statistics show that from the total road traffic accidents, fatal accidents, serious injury accidents, slight injury accidents and property accidents accounted for 152 (11.2%), 200 (14.8%), 244 (18.1%) and 754 (55.9%), respectively. Based on the available police accident statistics and police accident investigation record reviews, the distributions of road traffic accidents have shown more severe trend in the study area. Therefore, the distributions of road traffic accidents have shown more severe trends in the study period and regarded as an environmental disaster.

4.3.3. Distribution of RTA by Time of Day in Adama City

The distributions and frequencies of RTAs are more frequent at day time because of a higher traffic movement and road users due to different purposes such as marketing, transportation, conference and recreational activities, and these interactions contribute a greater share of road traffic accidents.

The police member key informant provided more information concerning the time of accident based on his experience and perception and said that the road traffic accident is more frequent at day time (i.e. 12:00 o'clock morning – 12:00 o'clock evening local time) in Adama city. He justified the reason why at day time the accident is more frequent is due to a higher traffic movement and road users. Similarly, it was added by other participants (victim and offender of RTA) that road traffic accident is more frequent at day time (i.e. 12:00 o'clock morning – 12:00 o'clock evening local time) in Adama city.

The other two offenders of RTA key informants described contrary to the above interviewees and said that road traffic accidents more frequent at evening time (i.e. 1:00 o'clock evening – 12:00 o'clock morning local time). These interviewees when justify the reasons why the accidents more frequent at evening time is that

drivers most of the time are driving at evening time and at this time there is a higher traffic movement and the accident is more frequent. All FGDs participants agreed that road traffic accident is more frequent at day time (i.e. 12:00 o'clock morning – 12:00 o'clock evening local time) because of a higher traffic movement and road users at day time in Adama city. According to the observation of the author of this research, the findings from the majority KIIs and all FGDs participant road traffic accident is more frequent at day time.

Table 4.4: Distribution of RTA by time of day in Adama City

In your experience, the distribution of RTA more frequent at	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
Day time	50	41.7	55	45.8	105	87.5
Evening time			15	12.5	15	12.5
Total	50	41.7	70	58.3	120	100

Source: Field survey Computed by the Author, 2016

As shown in Table 4.4, the questionnaire survey shows that from the total responses, road traffic accident is more frequent at day time and evening time accounted for 105 (87.5%) and 15 (12.5%), respectively. Therefore, the data reveals that road traffic accident frequency is more at day time than evening time in Adama City.

The following table (4.5) computed from the raw data obtained from Adama city police accident statistics to show the distribution of RTA by time of day in Adama city from 2010 – 2014.

Table 4.5: Distribution of RTA by time of day in Adama City (2010 – 2014)

Time period	Accident year					Total	(%)
	2010	2011	2012	2013	2014		
12:01 o'clock morning - 8:00 o'clock afternoon local time	131	143	171	144	163	752	55.7
8:01 o'clock afternoon - 4:00 o'clock evening local time	78	84	129	113	99	503	37.3
4:01 o'clock evening - 12:00 o'clock morning local time	9	15	13	34	24	95	7
Total	218	242	313	291	286	1350	100

Source: Computed from Data obtained from ACP by the Author, 2016

As shown in Table 4.5, the available police accident statistics show that the highest numbers of road traffic accidents accounted 752 (55.7%) occurred at the time period 12:01 o'clock morning - 8:00 o'clock afternoon local time, 503 (37.3%) of road traffic accidents occurred at the time period 8:01 o'clock afternoon - 4:00 o'clock evening local time and the lowest numbers of road traffic accidents accounted 95 (7%) occurred at the time period 4:01 o'clock evening - 12:00 o'clock morning local time.

Thus, the findings based on police accident statistics and police accident investigation record reviews show that the highest numbers of road traffic accidents accounted 752 (55.7%) occurred at the time period 12:01 o'clock morning - 8:00 o'clock afternoon local time in Adama city. Based on the above data, road traffic accident is more frequent at day time.

4.3.4. Distribution of RTA by Days of Week in Adama City

The distribution of RTA by days of week also proves that road traffic accident is more frequent on Monday because, Monday is the beginning of work day and having higher traffic movement and road users. The police member key informant said that Monday is the day of the week which the accident is more frequent in Adama city. The interviewees provided more information concerning the reasons for more frequency of accidents on Monday based on his experience and perception. Monday is the beginning of work day and many of

government employees, students, non government employees, private employees and drivers are going to their working places to perform their activities through walking and passing by using the road and at this time there is high traffic movement and high road users and these interactions contribute to a greater share of road traffic accidents.

The other victim of RTA key informant described that Sunday is the day of the week when the accident is more frequent in Adama city. When justify the reasons why accident more take places on Sunday, Sunday is considered as the rest and enjoyment day many bars (night clubs) and recreation areas are deliver service for the public exhaustively and high traffic movement and high road users happening during this time, and these interactions contributes a greater share of road traffic accidents.

All FGDs participants agree and point out Monday is the day of the week the accident more takes place in Adama city. The reasons accidents more take places on Monday, Monday is considered as the beginning of work day and many of government employers, non government employees, students, private employees (i.e. business and market center) and drivers are moving and passing through the city for marketing, transportation, conference and recreational activities, and these activities of interactions contributes a greater share of road traffic accidents, and the road traffic accidents occur more frequently.

Table 4.6: Distribution of RTA by days of week in Adama City

In your experience, the distribution of RTA more frequent on	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
Monday	50	41.7	56	46.6	106	88.3
Tuesday						
Wednesday						
Thursday						
Friday						
Saturday						
Sunday			14	11.7	14	11.7
Total	50	41.7	70	58.3	120	100

Source: Field survey Computed by the Author, 2016

As shown in Table 4.6, the questionnaire survey show that from the total responses road traffic accident more take places on Monday and Sunday accounted for 106 (88.3%) and 14 (11.7%), respectively. Therefore, the finding based on questionnaire survey shows that road traffic accident more frequent on Monday in Adama city.

Table 4.7 computed from the raw data obtained from Adama city police accident statistics to show the distribution of RTA by days of week in Adama city from 2010 – 2014.

Table 4.7: Distribution of RTA by days of week in Adama City (2010 – 2014)

Days	Accident year					Total	(%)
	2010	2011	2012	2013	2014		
Monday	46	48	45	40	47	226	16.7
Tuesday	24	35	42	50	42	193	14.3
Wednesday	30	31	47	36	32	176	13
Thursday	37	42	43	47	36	204	15.1
Friday	35	39	53	46	48	221	16.4
Saturday	24	32	43	38	49	186	13.8
Sunday	22	16	40	34	32	144	10.7
Total	218	242	313	291	286	1350	100

Source: Computed from Data obtained from ACP by the Author, 2016

As shown in Table 4.7, the available police accident statistics show that road traffic accidents occurred in all days of the week and the highest rates of road traffic accidents occurred on Mondays accounted 226 (16.7%) and the lowest rates of road traffic accidents occurred on Sundays accounted 144 (10.7%). The average rate of road traffic accidents per day was 14.3%. Therefore, the findings based on police accident statistics and police accident investigation record reviews show that the highest rates of road traffic accidents occurred on Monday. Generally, the findings from primary and secondary data show that the distribution of RTA more frequent on Monday.

4.4. Causal Factors for Road Traffic Accident in Adama City

There are several factors of road traffic accidents across all roads in the world. According to Mebrahtu (2002); Addis (2003); and Segni (2007) the major causes of road traffic accident in Ethiopia and its cities include driver factors, vehicle factors and road factors. The common and frequently observed factors of road traffic accidents in Adama City are also similar to the aforementioned reasons. The analysis below describes the current major causal factors of road traffic accidents in Adama City.

In all interviews, participants said that driver related factors are the leading factors for road traffic accidents among other factors in Adama city. The police member key informant (head of traffic police department) provided more information concerning factors of road traffic accidents based on his experiences and perceptions. According to the head of traffic police department justification, driver related factors are taken as the major responsible factors for road traffic accidents in Adama city. From driver factors the most responsible ones include; driving improperly distance & overtaking from wrong side, drivers not respecting pedestrian priority, over speeding and drivers not respecting vehicle priority. According to the respondent, driver related causes include; poor driving training, poor skill and undisciplined behavior, lack of experience, driving without knowledge of vehicle, not taking proper precautions, illegally given driving license and negligence are the major reasons.

The second factors responsible for road traffic accident mentioned by head of traffic police department is vehicle factors, vehicle factors are the second contributing factors for road traffic accident and from these vehicle factors the most contributing ones is technical condition factors (i.e. brake failure and flat tires or tires blowing out) and poor vehicle conditions and poor maintenance of vehicles are the most responsible reasons for brake failure and tires blowing out. The third factor responsible for road traffic accident mentioned by head of traffic police department is road factors. Road factors are the third contributing factors for road traffic accident and from these road factors the most contributing factor is road condition factors (i.e. road potholes (damage) and illegal construction of road) and serious deficiencies in the road network development and maintenance; and deficiencies in road safety planning and management are the most responsible reasons. The fourth contributing factor mentioned by head of traffic police department is weather condition such as precipitation (rainfall) is responsible factor for road traffic accident in Adama city.

The victim of RTA key informant said that currently the most shocking fatal accidents, serious injury and property accidents of road crashes have been occurred by fault of drivers. According to victim of RTA respondent explanation, driver factor is the major cause of road traffic accident and from driver factors the most responsible ones for road traffic accidents include; drivers not respecting pedestrian priority, over

speeding and drivers not respecting vehicle priority. The respondent also prioritizes factors of road traffic accidents as follows: drivers, vehicle, road and weather condition factor accounted for first, second, third and fourth rank, respectively. Similarly, the offender of RTA key informant added that drivers are the major causes of road traffic accident, and driver factors are the major responsible factors for road traffic accidents in Adama city.

All FGDs participants agreed and pointed out that drivers are the major causes of road traffic accident, and from driver factors the most responsible factors include; drivers not respecting pedestrian priority, over speeding and drivers not respecting vehicle priority. The FGDs participants explained the reasons why driver factor exhibited the major responsible factor for road traffic accident. These reasons include lack of experience, driving without knowledge of vehicle, poor driving training, poor skill and undisciplined behavior, and negligence are the major ones. In addition to this, they prioritized factors of road traffic accidents as follows: driver factor, vehicle factor, road factor and weather condition factor accounted for first, second, third and fourth rank, respectively. In sum, the findings from KIIs and FGDs participant driver factors are the major responsible factors for road traffic accidents and followed by vehicle factors.

Table 4.8: Causal factors for road traffic accident in Adama City

If you have ranked as the first responsible factors of road traffic accident	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
Driver factors	50	41.7	52	43.3	102	85
Vehicle factors			10	8.3	10	8.3
Road factors			6	5	6	5
Weather condition			2	1.7	2	1.7
Total	50	41.7	70	58.3	120	100

Source: Field survey Computed by the Author, 2016

As shown in Table 4.8, the questionnaire survey shows that from the total responses to factors of road traffic accident, driver factors, vehicle factors, road factors and weather condition accounted for 102 (85%), 10 (8.3%), 6 (5%) and 2 (1.7%), respectively.

Therefore, the finding based on questionnaire survey shows that driver as the first responsible factor of road traffic accident in Adama city. In addition to this, vehicle factors, road factors and weather condition accounted for second, third and fourth rank, respectively.

Table 4.9: Driver factors as causes of RTA in Adama City

Driver factors	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
Driving by improper distance & overtaking from wrong side	17	14.2	21	17.5	38	31.7
Drivers not respecting pedestrians priority	14	11.7	16	13.3	30	25
Over speeding	8	6.6	20	16.7	28	23.3
Drivers not respecting vehicle priority	11	9.2	13	10.8	24	20
Total	50	41.7	70	58.3	120	100

Source: Field survey Computed by the Author, 2016

As shown in Table 4.9, from the total responses to driver factors, driving by improper distance & overtaking from wrong side, drivers not respecting pedestrians priority, over speeding and drivers not respecting vehicle priority accounted for 38 (31.7%), 30 (25%), 28 (23.3%) and 24 (20%), respectively. Therefore, the data shows that driving by improper distance & overtaking from wrong side as the first responsible factors of road traffic accident in Adama city.

Table 4.10: Vehicle factors as causes of RTA in Adama City

Vehicle factors	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
Poor technical condition	50	41.7	70	58.3	120	100
Vehicle type						
Vehicle design						
Total	50	41.3	70	58.3	120	100

Source: Computed by the Author, 2016

As shown in Table 4.10, from the total responses regarding vehicle factors, poor technical condition of a vehicle accounted for 120 (100%). Therefore, the finding from questionnaire survey shows that poor technical condition of a vehicle is one of the responsible factors of road traffic accident in Adama city.

Table 4.11: Road factors as causes of RTA in Adama City

Road factors	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
Road type						
Bad road condition	50	41.7	70	58.3	120	100
Traffic signs and signals						
Total	50	41.7	70	58.3	120	100

Source: Field survey Computed by the Author, 2016

As shown in Table 4.11, from the total responses to road factors as cause of RTA, bad road condition accounted for 120 (100%). Therefore, the finding shows that bad road condition is a responsible factor of road traffic accident in Adama city.

Table 4.12: Weather condition factors as causes of RTA in Adama City

Weather condition factors	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
Precipitation (rainfall)	50	41.7	70	58.3	120	100
Temperature						
Wind speed						
Total	50	41.7	70	58.3	120	100

Source: Field survey Computed by the Author, 2016

As shown in Table 4.12, from the total responses to weather condition factors as cause of RTA, precipitation (rainfall) accounted for 120 (100%). Therefore, the finding shows that precipitation (rainfall) is a responsible factor of road traffic accident in Adama city.

Tables from 4.13 to 4.17 computed from the raw data obtained from Adama city police accident statistics to show factors of road traffic accident in Adama city from 2010 – 2014.

Table 4.13: Causal factors for RTA in Adama City (2010 – 2014)

Causal factors for RTA	Accident year					Total	(%)
	2010	2011	2012	2013	2014		
Driver factors	211	233	303	270	273	1290	95.6
Vehicle factors	3	5	5	14	6	33	2.4
Road factors	2	2	4	4	5	17	1.3
Weather condition	2	2	1	3	2	10	0.7
Total	218	242	313	291	286	1350	100

Source: Computed from Data obtained from ACP by the Author, 2016

As Table 4.13 depict, the available police accident statistics show that from the total factors of road traffic accidents, driver factors, vehicle factors, road factors and weather condition accounted for 1290 (95.6%), 33 (2.4%), 17 (1.3%) and 10 (0.7%), respectively. The data show that driver as the first responsible factors of road traffic accident in Adama city. In addition to this, vehicle factors, road factors and weather condition accounted for second, third and fourth rank, respectively responsible factors of road traffic accident in Adama city.

Table 4.14: Driver factors as causes of RTA in Adama City (2010 – 2014)

Driver factors	Accident year					Total	%
	2010	2011	2012	2013	2014		
Driving by improper distance & overtaking from wrong side	50	83	92	70	71	366	28.4
Drivers not respecting pedestrians priority	36	53	71	36	42	238	18.4
Over speeding	55	31	41	55	47	229	17.7
Drivers not respecting vehicle priority	23	33	43	37	45	181	14.1
Driving in wrong way & perilous overtaking	33	30	35	33	40	171	13.2
Drivers negligence	13	3	19	33	27	95	7.4
Drivers impairment by alcohols	1		2	6	1	10	0.8
Total	211	233	303	270	273	1290	100

Source: Computed from Data obtained from ACP by the Author, 2016

As Table 4.14 indicates, the available police accident statistics show that from driver factors, driving by improper distance & overtaking from wrong side, drivers not respecting pedestrians priority, over speeding, drivers not respecting vehicle priority, driving in wrong way and perilous overtaking, drivers negligence, and drivers impairment by alcohols accounted for 366 (28.4%), 238 (18.4%), 229 (17.7%), 181 (14.1%), 171 (13.2%), 95 (7.4%) and 10 (0.8%), respectively. The data show that from driver factors, driving by improper distance & overtaking from wrong side is the major responsible factor for road traffic accidents in Adama city.

Table 4.15: Vehicle factors as causes of RTA in Adama City (2010 – 2014)

Vehicle factors	Accident year					Total
	2010	2011	2012	2013	2014	
Poor technical condition of a vehicle as causes of RTA	3	5	5	14	6	33

Source: Computed from Data obtained from ACP by the Author, 2016

As shown in Table 4.15, the available police accident statistics show that from vehicle factors, poor technical condition of a vehicle is the causes and responsible factor for road traffic accident in Adama city.

Table 4.16: Road factors as causes of RTA in Adama City (2010 – 2014)

Road factors	Accident year					Total
	2010	2011	2012	2013	2014	
Bad road condition as causes of RTA	2	2	4	4	5	17

Source: Computed from Data obtained from ACP by the Author, 2016

As Table 4.16 depict, the available police accident statistics show that from road factors, bad road condition is the causes and responsible factor for road traffic accident in Adama city.

Table 4.17: Weather condition factors as causes of RTA in Adama City (2010 – 2014)

Weather condition factor	Accident year					Total
	2010	2011	2012	2013	2014	
Precipitation (rainfall) as causes of RTA	2	2	1	3	2	10

Source: Computed from Data obtained from ACP by the Author, 2016

As Table 4.17 indicates, the available police accident statistics show that from weather condition factors, precipitation (rainfall) is the causes and responsible factor for road traffic accident in Adama city

Generally, the findings based on primary and secondary data reveals that driver factors are the leading responsible factor than other factors for road traffic accident in Adama City. Vehicle factors, road factors and weather condition accounted for second, third and fourth rank respectively, responsible factors for road traffic accident in Adama City.

4.5. Impacts of Road Traffic Accidents in Adama City

All countries in the world are currently affected by Road Traffic Accidents (RTAs). They imposed major challenges on health, social, economic, developmental, and environmental components of developing countries, especially those in Africa (WHO, 2009). The impacts of road traffic accidents in Adama City are also similar to the aforementioned reasons. The following data presentation and analysis describes the current impacts of road traffic accidents in Adama City.

4.5.1. The Major Health Impacts of Road Traffic Accidents in Adama City

Road traffic accidents can be a cause for fatal accidents, serious injury and slight injury every year in the city and they are the major problems of human health, and regarded as an environmental disaster. The police member key informant describes road traffic accidents can be a cause for fatal accidents, serious injury and slight injury every year in the city and it is a serious problem, and regarded as an environmental disaster. This environmental disaster shows that victims of fatal road accidents died on the scene or in hospitals. Survivors also suffer from different types of injuries and disabilities which can affect their quality of life. The victims can be passengers, pedestrians, drivers; they can even be the cause of the accident themselves. As these victims suffer, their families and communities will suffer too; they must sometimes carry the burden of caring for the victims.

A victim of RTA key informant said that road traffic accidents affect the physical wellbeing of an individual or groups. In terms of physical injury for instance, the victims of head and spinal injury may be unable to return to their normal lives. They may even require full care at all times. Usually, these conditions are permanent and there are no actual treatments or cures because of the direct injury to the brain and spine, although, there are some rare cases that show physical improvements with limited movement. Often, these patients stay at the hospital for a long time. As for partial injury, there are many examples, for instance, fractures of bones, loss of limbs, abrasions, lacerations and blunt injuries.

The Ethiopian insurance company Adama branch members briefly pointed out about the physical and psychological impacts of road traffic accident on wellbeing of an individual and families. The physical impacts of road traffic accident include fatal accidents, serious injury and slight injury. In addition to this, another serious consequence of road traffic accidents is psychological problems which can have a substantial impact on the survivors of road traffic accidents and their families. Families also suffer from their children's involvement in road traffic accidents. They are considered another hidden victim of road traffic accidents, and need care and support just like other road traffic accident victims or survivors. Families can be affected psychologically and socially. It was noted in KIIs and FGDs that road traffic accident is a serious problem of human health and regarded as an environmental disaster.

The findings based on observations, from the KIIs, FGDs and questionnaire survey road traffic accident is the major cause of fatal accidents, serious injury and slight injury. In general, road traffic accident in Adama city is the major problem of human health (i.e. physical and psychological) and regarded as an environmental disaster.

Table 4.18: Major health impacts of road traffic accident in Adama City

Major health impacts of RTA	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
Fatal accident	10	8.3	18	15	28	23.3
Serious injury accident	20	16.7	28	23.3	48	40
Slight injury accident	20	16.7	24	20	44	36.7
Total	50	41.7	70	58.3	120	100

Source: Field survey Computed by the Author, 2016

As shown in Table 4.18, the questionnaire survey shows that from the total responses to major health impacts of RTA, fatal accident, serious injury accident and slight injury accident accounted for 28 (23.3%), 48 (40%) and 44 (36.7%), respectively. Therefore, the data shows that road traffic accident is a serious problem of health in the study area.

Table 4.19 computed from the raw data obtained from Adama city police accident statistics to show the major health impacts of road traffic accident in Adama city from 2010 – 2014.

Table 4.19: The major health impacts of RTA in Adama City (2010 – 2014)

Accident severity	Accident year					Total	%
	2010	2011	2012	2013	2014		
Fatal accident	39	24	36	31	22	152	25.5
Serious injury	36	41	57	29	37	200	33.6
Slight injury	27	52	59	56	50	244	40.9
Total	102	117	152	116	109	596	100

Source: Computed from Data obtained from ACP by the Author, 2016

As Table 4.19 indicates, the available police accident statistics shows that from the total road traffic accidents, fatal accidents, serious injury accidents and slight injury accidents accounted for 152 (25.5%), 200 (33.6%) and 244 (40.9%), respectively. The data show that from every 100 RTA casualties in Adama City 25.5 have the probability of death, 33.6 the fate of serious injury and the rest 40.9 the possibility of suffering from slight injury due to RTAs. The highest frequency of serious injuries and slight injuries in the city have been exhibited in the years of 2012 and the most shocking fatal accidents of road crashes have been unveiled in 2010 in the city. Thus, secondary data derived from Adama City police show that road traffic accident is the major problem of human health, and regarded as an environmental disaster.

Figure 4.1: Automobile crashed around Mugher place/black spot (Source: Adama City Traffic Office, 2011)

4.5.2. Economic Impacts of Road Traffic Accidents in Adama City

Road traffic accidents have multifaceted impacts over the economy of the City. In addition to the health impacts of RTAs, Adama City is also suffering huge economic loss from road crashes, and regarded as an environmental disaster. The police member key informant justify that, road traffic accidents have multifaceted impacts over the economy of the City. More specifically, impacts of RTA have direct economic impact when it is manifested over a property and have indirect influence when it is exhibited on pedestrians or/and passengers and drivers, and regarded as an environmental disaster. The victim of road traffic accident key informants point out, road traffic accidents affect the household of victims, the community and the city of economic regarding to loss of property, cost to economy and cost to health service, and regarded as an environmental disaster.

All FGD participants agree that road traffic accident in Adama city is the major problem of economy, and regarded as an environmental disaster. The FGDs from Ethiopian insurance company Adama branch members revealed more information concerning the economic impacts of road traffic accidents based on their experiences and perceptions said that the economic impacts of road traffic accidents more sever in Adama city. Road traffic accidents are currently deteriorating the economic wealth of the city regarding to the direct economic costs and the cost of road crash injuries, and therefore, road traffic accident a serious problem and regarded as an environmental disaster.

The FGDs participant from traffic police officer agree and said that, the distributions and the cost of property damages due to road traffic accidents have shown an increasing trend from year to year and regarded as an environmental disaster. It was noted in KIIs and FGDs that road traffic accident a serious problem of economic, and regarded as an environmental disaster. The findings based on observations; from the KIIs and FGDs participant and questionnaire survey show that road traffic accidents have multifaceted impacts over the economy of the City.

Table 4.20: Economic impacts of road traffic accident in Adama City

Economic impacts of RTA	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
Loss of property	24	20	30	25	54	45
Cost to economy	12	10	19	15.8	31	25.8
Cost to health service	14	11.7	21	17.5	35	29.2
Total	50	41.7	70	58.3	120	100

Source: Field survey Computed by the Author, 2016

As shown in Table 4.20, the questionnaire survey shows that from the total responses to economic impacts of RTA, loss of property, cost to economy and cost to health service accounted for 54 (45%), 31 (25.8%) and 35 (29.2%), respectively. The findings prove that road traffic accidents have multifaceted impacts over the economy of the study area.

Table 4.21 computed from the raw data obtained from Adama city police accident statistics to show the economic impacts of road traffic accident in Adama city from 2010 – 2014.

Table 4.21: Economic impacts of road traffic accident in Adama City (2010 – 2014)

Accident year	Number of property accidents	Property damage estimated cost (ETB)	Average cost (ETB)	%
2010	116	1,520,050	13103.87	6.1
2011	125	2,859,178	22873.424	11.4
2012	161	3,612,700	22439.13	14.4
2013	175	6,630,483	37888.48	26.4
2014	177	10,457,686	59082.97	41.7
Total	754	25,080,097	33262.73	100

Source: Computed from Data obtained from ACP by the Author, 2016

As shown in Table 4.21, the available police accident statistics show that the estimated total cost of RTA in Adama City from 2010 to 2014 reached ETB 25,080,097. The highest estimated RTA cost has been recorded at ETB 10,457,686 (i.e. 41.7%) in 2014 and the lowest at ETB 1,520,050 (i.e. 6.1%) in 2010 in the city. The year 2011, 2012 and 2013 exhibited ETB 2,859,178 (i.e. 11.4%), ETB 3,612,700 (i.e. 14.4%) and ETB 6,630,483 (i.e. 26.4%) RTA cost respectively. In general, the city has lost ETB 25,080,097 in the last five years only due to RTAs.

More specifically, 1350 RTAs occurred in the city in the last five years, 754 (i.e. 55.9%) of the accidents have been accompanied with property damages. Accordingly, every single accident complemented with property damage has led to an average financial loss of ETB 33,262.73 in Adama City in the study period. The highest frequency of RTAs resulting property damages (i.e. 177), have been recorded in 2014 and the lowest which is (i.e. 116) incidences in 2010. Adama City which is exhibited the economic loss of an average ETB 5,016,019.4 every year only due to road traffic accidents.

Figure 4.2: Heavy truck crashed around Boku place/black spot (Source: Adama City Traffic Office, 2012)

As shown in Figure 4.2, the heavy truck crashed around Boku place/black spot and suffering huge economic loss (i.e. loss of property, cost to economy). Generally, the findings based on primary and secondary data show that road traffic accident is the major problem of economic, and regarded as an environmental disaster.

4.5.3. Social Impacts of Road Traffic Accidents in Adama City

The prevalence of people to road traffic accidents can be a cause for social insecurity and social crisis. In addition to the health and economic impacts of RTAs, Adama City is also suffering the social impacts from road crashes, and regarded as an environmental disaster. In all interviews participants said that road traffic accidents are serious social problems and regarded as an environmental disaster. During interview the police member key informant point out, road traffic accidents affect the whole social groups of the community, but especially the adults group of the community more severely affected. The other victim of RTA key informant describes female, children and disabled of the community groups are more vulnerable to road traffic accidents.

The FGDs participant from Ethiopian insurance company Adama branch member justify that, road traffic accidents have dual impacts over the social aspect of the City and especially, strongly affect the adults and male groups of the community. And also the traffic police officer describes children, elder, female and disabled of the community groups more vulnerable to road traffic accidents. The other FGDs participant from Adama city road transport office member said that, road traffic accident impacts have shown an increasing trend with their influence on the social aspects of the livelihood. The city mortality due to road traffic injury occurs among young adults and productive age and the rates for this age group are higher, and regarded as an environmental disaster. It was noted in KIIs and FGDs that road traffic accident is a serious problem of social, and regarded as an environmental disaster.

The findings based on observations, from the KIIs and FGDs participant and questionnaire surveys show that road traffic accidents affect the whole social groups of the community, especially the adults and male groups of the community more severely affected. In addition to these children, elder, female and disabled of the community groups more vulnerable to road traffic accidents. The findings based on the available questionnaire survey prove that road traffic accidents the major problem of social, and regarded as an environmental disaster.

The following tables from 4.22 to 4.23 computed from the raw data obtained from Adama city police accident statistics to show the social impacts of road traffic accidents in Adama city from 2010 – 2014.

Table 4.22: Distribution of RTA casualties by sex in Adama City (2010 – 2014)

Accident severity	Accident year										Total			%
	2010		2011		2012		2013		2014					
	M	F	M	F	M	F	M	F	M	F	M	F	T	
Fatal accident	26	13	15	9	19	17	20	11	16	6	96	56	152	25.5
Serious injury	20	16	26	15	30	27	19	10	20	17	115	85	200	33.6
Slight injury	19	8	32	20	41	18	30	26	35	15	157	87	244	40.9
Total	65	37	73	44	90	62	69	47	71	38	368	228	596	100

Source: Computed from Data obtained from ACP by the Author, 2016

As Table 4.22 indicates, the available police accident statistics show that males were more frequently vulnerable to road crashes than females in the city. Based on the data, 368 (i.e. 61.7%) males and 228 (i.e. 38.3%) females were victims of RTAs in the city from 2010 to 2014. In general, males were 1.61 times more prevalent to RTAs than females in Adama City.

More specifically, males were 1.74 times, 1.35 times and 1.80 times much vulnerable than females to fatal accidents, serious injury and slight injury in Adama City respectively. In addition to this, males were more victims of RTAs than females in all accident severity and in all years from 2010 to 2014.

Table 4.23: Distribution of RTA casualties by age in Adama City (2010 – 2014)

Age group	Accident year					Total	%
	2010	2011	2012	2013	2014		
Less than 18	12	14	20	15	9	70	11.7
18 – 30	40	45	45	50	42	222	37.3
31 – 50	36	41	55	35	35	202	33.9
More than 51	14	17	32	16	23	102	17.1
Total	102	117	152	116	109	596	100

Source: Computed from Data obtained from ACP by the Author, 2016

As shown in Table 4.23, the available police accident statistics show that all age groups are not equally vulnerable to road crashes and adults between 18 to 30 years of age are more frequently vulnerable to road crashes in the city. Based on the data, between 19 to 30 years of age, between 31 to 50 years of age, more than 50 years of age and less than 18 years of age accounted for 222 (37.3%), 202 (33.9%), 102 (17.1%) and 70 (11.7%), respectively were victims of RTAs in the city from 2010 to 2014. In general, the severity rate of RTA in all severity classes is much higher in the age groups of 18 to 30 than the others in the city from 2010 to 2014. Thus, the secondary data derived from Adama City show that road traffic accident is the major problem of social, and regarded as an environmental disaster.

Figure 4.3: Truck crashed around Tokuma place/black spot (Source: Adama City Traffic Office, 2013)

Generally, the findings based on primary and secondary data show that road traffic accident is the major problem of social, and regarded as an environmental disaster.

4.5.4. Physical Environment Impacts of Road Traffic Accidents in Adama City

The prevalence of road traffic accidents have impacts over the physical environment is a serious problem in the study area and the physical environment impacts of road traffic accident include damage of infrastructures, damage of vegetations and land degradation. In all interviews participants said that road traffic accidents have impacts over the physical environment. During interview one participant (police member) said that road traffic accident damage the physical environment regarded as an environmental disaster. These impacts of physical environment include the damage of infrastructure such as damage of road network, telecommunication network and water supply network.

It was added by another respondent (victim of RTA) that road traffic accident can affect the physical environment regarded as an environment disaster include damage of physical structure such as damage of bridge, roads, buildings and houses. It was noted in all interviews that road traffic accidents have impacts over the physical environment and regarded as an environmental disaster.

The FGDs from Ethiopian insurance company Adama branch members provided more information concerning the impacts of road traffic accident on physical environment. During discussions the members said that impact of road traffic accident on physical environment include degradation and deterioration of land (i.e. by oils & petroleum), damage of plants, and pollution of water, soil and air.

As shown in observations, from the KIIs and FGDs participant and questionnaire survey show that road traffic accidents have impacts over the physical environment. The impacts of road traffic accident on physical environment not only include the damage of physical structure such as damage of bridge, roads, buildings and houses but also include the degradation and deterioration of land (i.e. by oils & petroleum), damage of plants, and pollution of water, soil and air, and regarded as an environmental disaster.

Table 4.24: Physical environment impacts of road traffic accident in Adama City

Physical environment impacts of RTA	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
Damage of infrastructures	20	16.7	28	23.3	48	40
Damage of vegetations	20	16.7	24	20	44	36.7
Land degradation	10	8.3	18	15	28	23.3
Total	50	41.7	70	58.3	120	100

Source: Field survey Computed by the Author, 2016

As shown in Table 4.24, the questionnaire survey shows that from the total responses to physical environment impacts of RTA, damage of infrastructures, damage of vegetations and land degradation accounted for 28 (23.3%), 48 (40%) and 44 (36.7%), respectively. Therefore, the data shows that road traffic accidents have impacts over the physical environment.

Figure 4.4: Heavy truck crashed around Koshe place/black spot (Source: Adama City Traffic Office, 2014)

As shown in Figure 4.4, the heavy truck crashed around Koshe place/black spot and damaged the physical environment (i.e. plants, land). Generally, the data prove that road traffic accidents have impacts over the physical environment.

Generally, the findings based on primary and secondary data show that the health, socioeconomic and physical environment impacts of RTA have shown more severe trend and tends to be the most serious problem in the study period, and regarded as an environmental disaster.

4.6. Distribution of Road Traffic Accident Places/black spots in Adama City

The road traffic accident places/black spots were unevenly distributed throughout the Kebeles of Adama City Administration. According to the criteria set, all places that exhibit five or more road traffic accidents in a year were defined as road traffic accident places/black spots.

The police member key informant (head of traffic police department) points out more information concerning the places/black spots where road traffic accidents tend to occur more frequently in Adama city. According to his explanations, Adama is situated on cross roads for different marketing and transportation activities (i.e. export and import). The country export and import activities from Djibouti port to the entire part of the country pass through the city and Adama city suffering for high traffic movement and road users, when a situation is high traffic movement and road users were happening, there is a possibility of road traffic accident occurring and these trends were happening in Adama city. The places/black spots road traffic accidents tend to occur more frequently in high way road such as Koshe, Boku Shenane and Kela, cross road such as Mugher and Alem hotel, and square road such as Derartu square of the city.

The other key informant (offender of RTA) describes that in Adama city there is a situation of high traffic movement and road users, and the possibility of road traffic accident occurring. According to the respondent, the places/black spots of road traffic accidents tend to occur more frequently include in high way road such as Tokuma hotel, in cross road such as Mugher, in square road such as Derartu square. It was noted in all interviews that in Adama city there is a situation of high traffic movement and road users, and the possibility of road traffic accident occurring. The places/black spots of road traffic accidents tend to occur more frequently in the city include in high way road, cross road and square road.

The FGDs from Adama city road transport office members justify that Adama is situated on cross roads to different conference and recreational centers, and which make it center for social, economic, political and cultural activities. Due to these social, economic, political and cultural activities interactions, the city to have high traffic movement and road users, and these interactions contribute a greater share of road traffic accidents. According to road transport office members, road traffic accidents tend to concentrate or occur more frequently in high way road such as Pan Afric hotel, cross road such as Bekele Molla hotel, and square road such as Derartu square

It was noted in KIIs and FGDs that Adama city has high traffic movement and road users due to different marketing, transportation, conference and recreational activities, and these activities interactions contributes a greater share of road traffic accidents. The places/black spots of road traffic accidents tend to occur more frequently in high way road, cross road and square road of the city. As shown in observations from the KIIs and FGDs participant and questionnaire survey prove that Adama city have a higher traffic movement and road users due to socioeconomic activities, and road traffic accidents occur more frequently in high way road of Koshe places/black spots.

Table 4.25: Distribution of RTA places/black spots in Adama City

RTA occur more frequently places/ black spots	Respondents					
	Traffic police		driver		Total	
	Count	%	Count	%	Count	%
Koshe	25	20.8	11	9.2	36	30
Mugher	15	12.5	18	15	33	27.5
Kela	4	3.3	20	16.7	24	20
Boku	6	5	21	17.5	27	22.5
Total	50	41.6	70	58.4	120	100

Source: Field survey Computed by the Author, 2016

As shown in Table 4.25, the questionnaire survey show that from the total responses of participant road traffic accidents occur more frequently, Koshe, Mugher, Kela and Boku accounted for 36 (30%), 33 (27.5%), 24 (20%) and 27 (22.5%) respectively. Therefore, the findings based on questionnaire survey show that road traffic accidents occur more frequently in high way road of Koshe places/black spots.

Tables from 4.26 to 4.31 computed from the raw data obtained from Adama city police accident statistics to show the distribution of RTA places/black spots in Adama city from 2010 – 2014.

Table 4.26: Distribution of RTA places/black spots in Adama City (2010)

Year	Kebeles	RTA places/black spots	No. of RTAs occurred in the places/black spots
2010	Melka Adama	Koshe	21
	Between 05 & 09	Tokuma Hotel	10
	Between 10 & 11	Misrake Shewa Police	12
	Between 03 & 11	Mugher	19
	Boku Shenane	Boku	17
	Dabe Seleqa	Kela	15
	Between 11 & 14	Alem Hotel	14
	Between 05 & 09	Pan Afric Hotel	6
Total		8	114

Source: Computed from Data obtained from ACP by the Author, 2016

As shown in Table 4.26 and Figure 4.5, a total of 114 RTAs have been recorded from only 8 RTA black spots in the city in the year 2010. This implies that, an average of 14.3 RTA incidences have occurred at every single RTA Black spot in the city in the year 2010. The highest frequency of RTAs (i.e. 21) happened around Koshe in Melka Adama Kebele and the lowest frequency of RTAs (i.e. 6) happened around Pan Afric hotel between 05 & 09 Kebeles in 2010. In addition, 2 out of the 8 RTA black spots of the city in 2010 have occurred between 05 & 09 kebeles in front of Pan Afric hotel and Tokuma hotel.

Melka Adama, Boku Shenane, Dabe Seleqa, between 10 & 11, between 03 & 11 and between 11 & 14 kebeles exhibited only 1 RTA t in the place of Koshe, Boku, Kela, Misrake Shewa Police, Mugher and Alem hotel respectively each in the year.

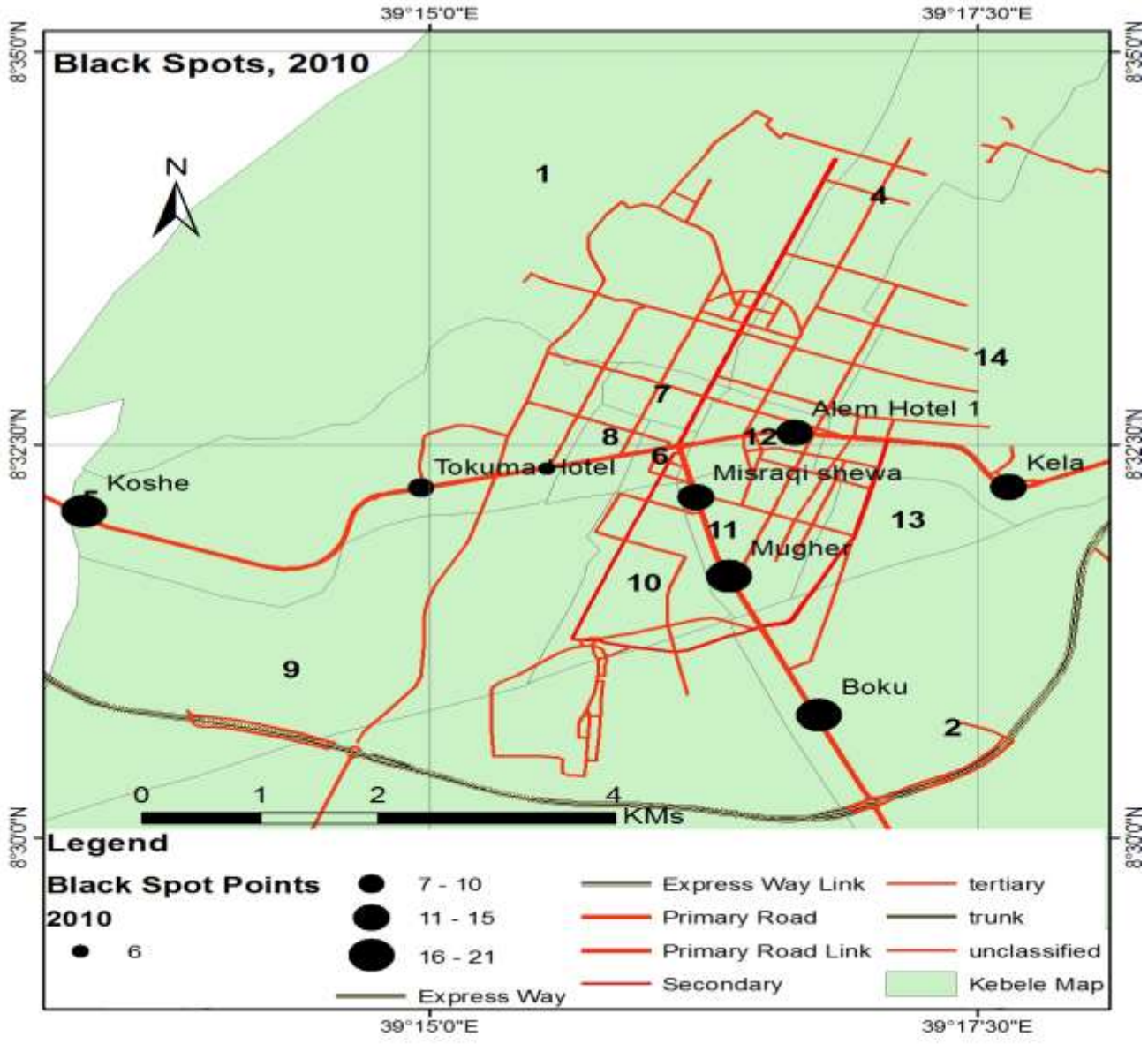


Figure 4.5: Distribution of RTA places/black spots in Adama City (2010)

(Source: ESRI Map ® 2016 and primary data collected through GPS records)

As shown in Table 4.27 and Figure 4.6, 9 places were identified as RTA black spots in Adama City in 2011. Compared to 2010, the number of RTA black spots as well as the frequency of RTAs occurred on the black spots have shown an increasing trend by 1 and by 18 respectively.

Table 4.27: Distribution of RTA places/black spots in Adama City (2011)

Year	Kebeles	RTA places/black spots	No. of RTAs occurred in the places/black spots
2011	Between 11 & 12	Bekele Molla Hotel	5
	Dabe Seleqa	Kela	16
	Melka Adama	Koshe	21
	Between 05 & 09	Tokuma Hotel	11
	Between 10 & 11	Misrake Shewa Police	13
	Between 03 & 11	Mugher	26
	Boku Shenane	Boku	17
	Between 11 & 14	Alem Hotel	14
	Between 05 & 09	Pan Afric Hotel	9
Total		9	132

Source: Computed from Data obtained from ACP by the Author, 2016

As shown in Table 4.27 and Figure 4.6, the available police accident statistics show that a total of 132 RTAs have been recorded from only 9 RTA black spots in the city in the year 2011. This implies that, an average of 14.7 RTA incidences have occurred at every single RTA black spot in the city in the year 2011. The highest frequency of RTAs (i.e. 26) happened around Mugher between 03 & 11 Kebeles and the lowest frequency of RTAs (i.e. 5) happened around Bekele Molla hotel between 11 & 12 Kebeles in 2011. In addition to this, 2 out of the 8 RTA black spots of the city in this year have occurred between 05 & 09 Kebeles in the place of Pan Afric hotel and Tokuma hotel.

Melka Adama, Boku Shenane, Dabe Seleqa, between 10 & 11, between 03 & 11, between 11 & 14 and between 11 & 12 Kebeles exhibited only 1 RTA black spot in the place of Koshe, Boku, Kela, Misrake Shewa Police, Mugher, Alem hotel and Bekele Molla hotel respectively each in the year.

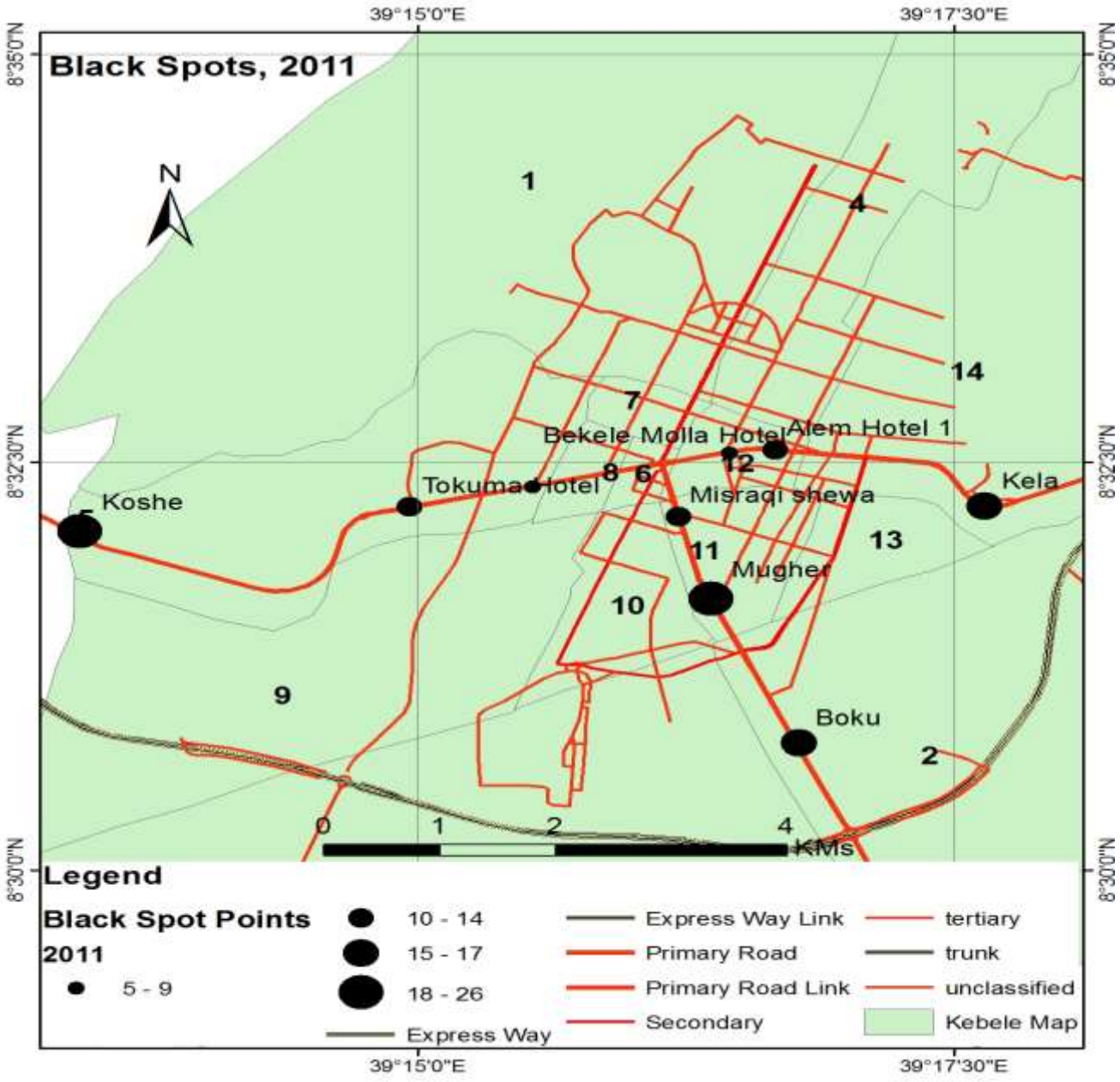


Figure 4.6: Distribution of RTA places/black spots in Adama City (2011)

(Source: ESRI Map ® 2016 and primary data collected through GPS records)

As described in Table 4.28 and Figure 4.7, 10 major places were identified as RTA black spots in Adama City in 2012. Compared to 2011, the number of RTA black spots as well as the frequency of RTAs occurred on the black spots have shown an increasing trend by 1 and by 38 respectively.

Table 4.28: Distribution of RTA places/black spots in Adama City (2012)

Year	Kebeles	RTA places/black spots	No. of RTAs occurred in the places/black spots
2012	Boku Shenane	Boku	21
	Between 03 & 11	Mugher	25
	Between 10 & 11	Misrake Shewa Police	16
	Between 05 & 09	Tokuma Hotel	14
	Melka Adama	Koshe	29
	Dabe Seleqa	Kela	20
	Between 11 & 14	Alem Hotel	18
	Between 05 & 09	Pan Afric Hotel	12
	Between 11 & 12	Bekele Molla Hotel	10
	11	Derartu Square	5
Total		10	170

Source: Computed from Data obtained from ACP by the Author, 2016

As shown in Table 4.28 and Figure 4.7, a total of 170 RTAs have been recorded from only 10 RTA black spots in the city in the year 2012. This implies that, an average of 17 RTA incidences have occurred at every single RTA Black spot in the city in the year 2012. The highest frequency of RTAs (i.e. 29) happened around Koshe place/black spot in Melka Adama Kebele and the lowest frequency of RTAs (i.e. 5) happened around Derartu Square place/black spot in kebele 11 e in 2012. In addition to this, 2 out of the 8 RTA black spots of the city in this year have occurred between 05 & 09 Kebeles in the place of Pan Afric hotel and Tokuma hotel black spot.

Melka Adama, Boku Shenane, Dabe Seleqa, between 10 & 11, between 03 & 11, between 11 & 14, between 11 & 12 and 11 Kebeles exhibited only 1 RTA black spot in the place of Koshe, Boku, Kela, Misrake Shewa Police, Mugher, Alem hotel, Bekele Molla hotel and Derartu Square respectively each in the year.

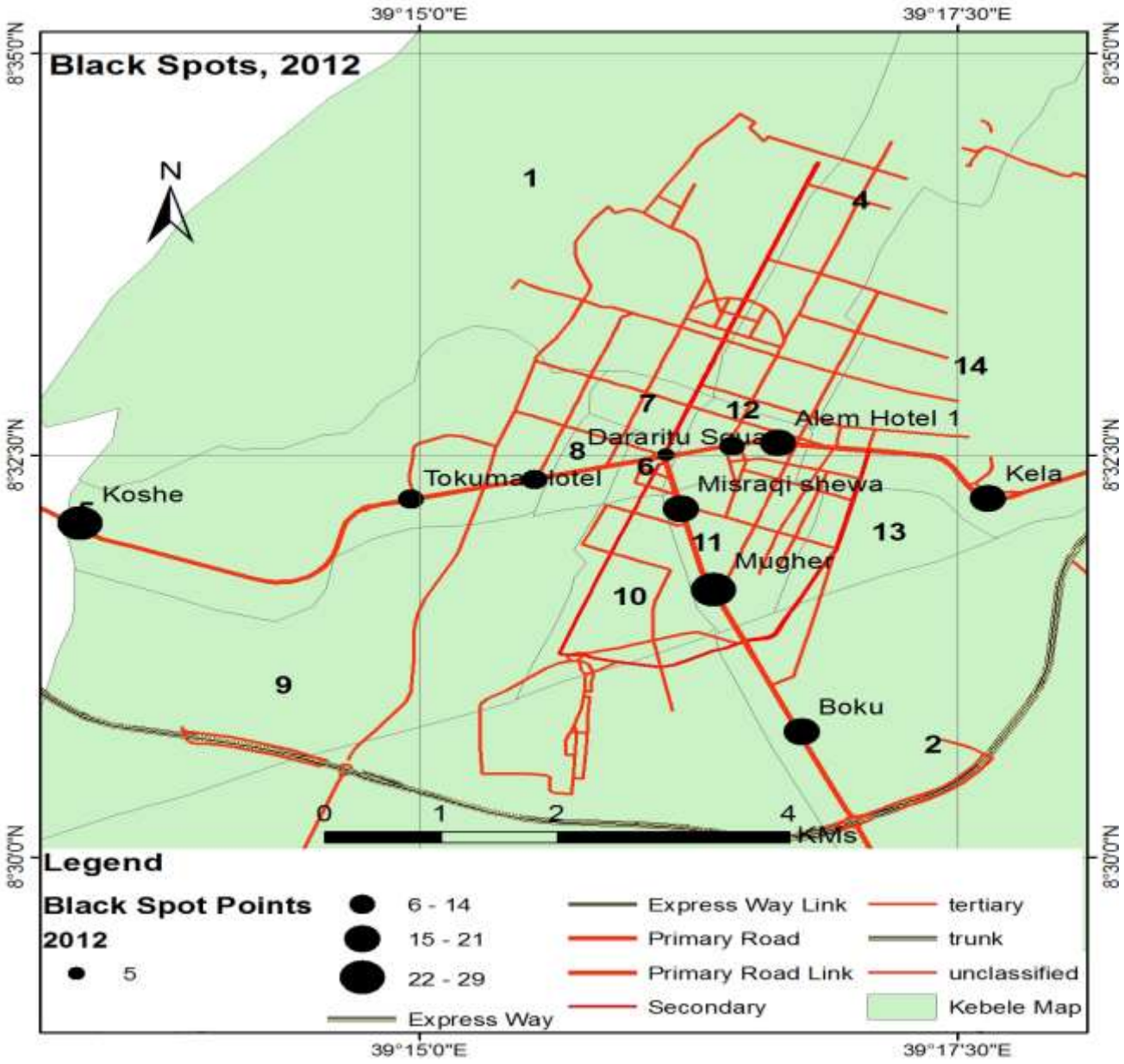


Figure 4.7: Distribution of RTA places/black spots in Adama City (2012)

(Source: ESRI Map ® 2016 and primary data collected through GPS records)

As shown in Table 4.29 and Figure 4.8, 10 major places were identified as RTA black spots in Adama City in 2013. Compared to 2012, the number of RTA Black spots remain the same as 10 but the frequency of RTAs occurred on the black spots have decreased by 16.

Table 4.29: Distribution of RTA places/black spots in Adama City (2013)

Year	Kebeles	RTA places/black spots	No. of RTAs occurred in the places/black spots
2013	11	Derartu Square	7
	Between 11 & 12	Bekele Molla Hotel	5
	Between 05 & 09	Pan Afric Hotel	9
	Between 11& 14	Alem Hotel	17
	Dabe Seleqa	Kela	18
	Boku Shenane	Boku	20
	Between 03 & 11	Mugher	23
	Between 10 & 11	Misrake Shewa Police	15
	Between 05 & 09	Tokuma Hotel	13
	Melka Adama	Koshe	27
Total		10	154

Source: Computed from Data obtained from ACP by the Author, 2016

As shown in Table 4.29 and Figure 4.8, a total of 154 RTAs have been recorded from only 10 RTA black spots in the city in the year 2013. This implies that, an average of 15.4 RTA incidences have occurred at every single RTA black spot in the city in the year 2013. The highest frequency of RTAs (i.e. 27) happened around Koshe in Melka Adama Kebele and the lowest frequency of RTAs (i.e. 5) happened around Bekele Molla hotel between 11 & 12 Kebele in 2013. In addition to this, 2 out of the 8 RTA black spots of the city in this year have occurred between 05 & 09 Kebeles in the place of Pan Afric hotel and Tokuma hotel.

Melka Adama, Boku Shenane, Dabe Seleqa, between 10 & 11, between 03 & 11, between 11 & 14, between 11 & 12 and 11 Kebeles exhibited only 1 RTA black spot in the place of Koshe, Boku, Kela, Misrake Shewa Police, Mugher, Alem hotel, Bekele Molla hotel and Derartu Square respectively each in the year.

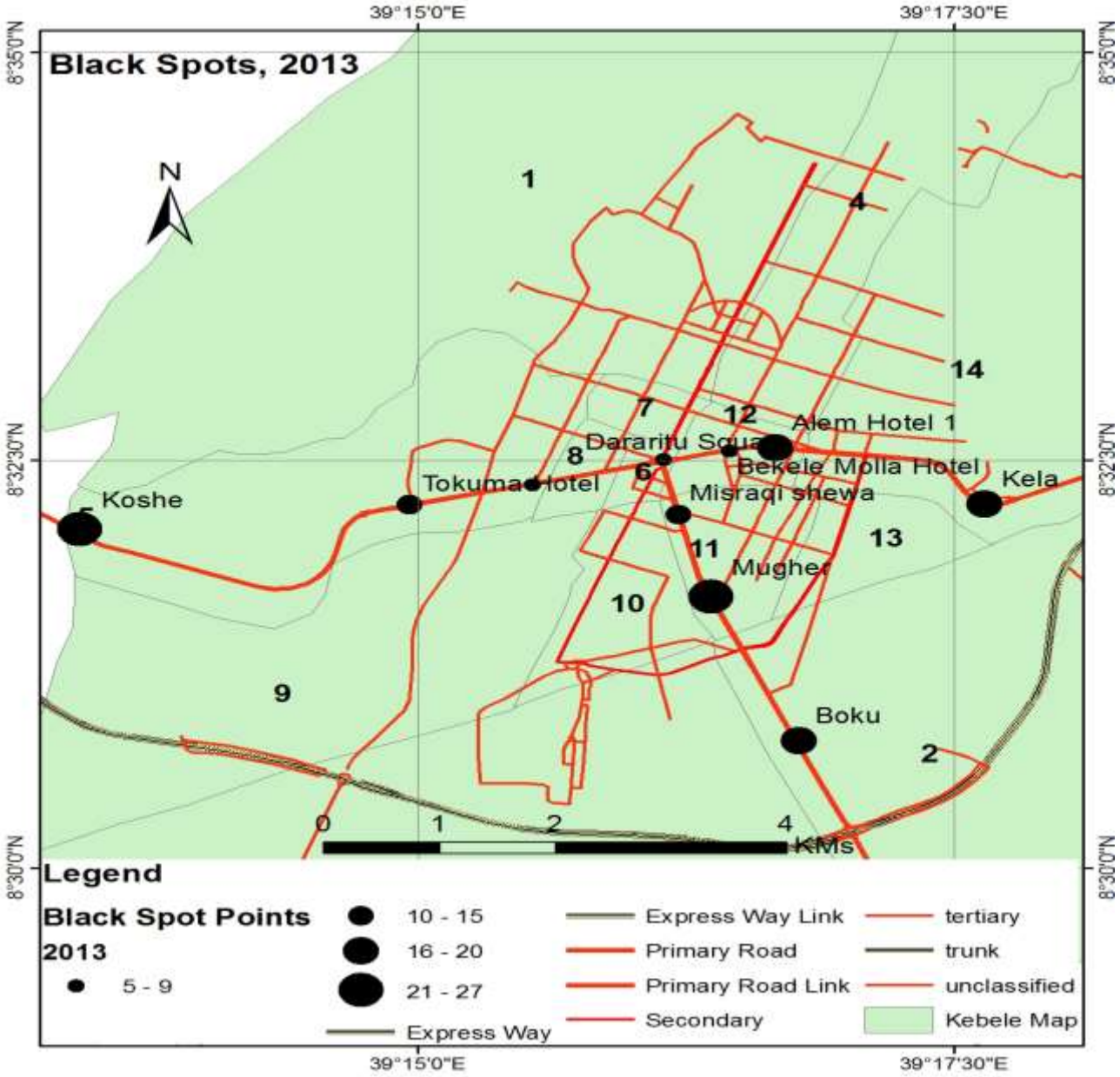


Figure 4.8: Distribution of RTA places/black spots in Adama City (2013)

(Source: ESRI Map ® 2016 and primary data collected through GPS records)

As described in Table 4.30 and Figure 4.9, 10 major places were identified as RTA black spots in Adama City in 2014. Compared to 2013, the number of RTA black spots remain the same as 10 but the frequency of RTAs occurred on the black spots have decreased by 8.

Table 4.30: Distribution of RTA places/black spots in Adama City (2014)

Year	Kebeles	RTA places/black spots	No. of RTAs occurred in the places/black spots
2014	Melka Adama	Koshe	23
	Between 05 & 09	Tokuma Hotel	12
	Between 10 & 11	Misrake Shewa Police	14
	Between 03 & 11	Mugher	25
	Boku Shenane	Boku	19
	Dabe Seleqa	Kela	17
	Between 11 & 14	Alem Hotel	15
	Between 05 & 09	Pan Afric Hotel	10
	Between 11 & 12	Bekele Molla Hotel	6
	11	Derartu Square	5
Total		10	146

Source: Computed from Data obtained from ACP by the Author, 2016

As shown in Table 4.30 and Figure 4.9, a total of 146 RTAs have been recorded from only 10 RTA black spots in the city in the year 2014. This implies that, an average of 14.6 RTA incidences have occurred at every single RTA black spot in the city in the year 2014. The highest frequency of RTAs (i.e. 25) happened around Mugher between 03 & 11 Kebeles and the lowest frequency of RTAs (i.e. 5) happened around Derartu Square in 11 Kebele in 2014. In addition to this, 2 out of the 8 RTA black spots of the city in this year have occurred between 05 & 09 Kebeles in the place of Pan Afric hotel and Tokuma hotel black spot.

Melka Adama, Boku Shenane, Dabe Seleqa, between 10 & 11, between 03 & 11, between 11 & 14, between 11 & 12 and 11 Kebeles exhibited only 1 RTA black spot in the place of Koshe, Boku, Kela, Misrake Shewa Police, Mugher, Alem hotel, Bekele Molla hotel and Derartu Square respectively each in the year.

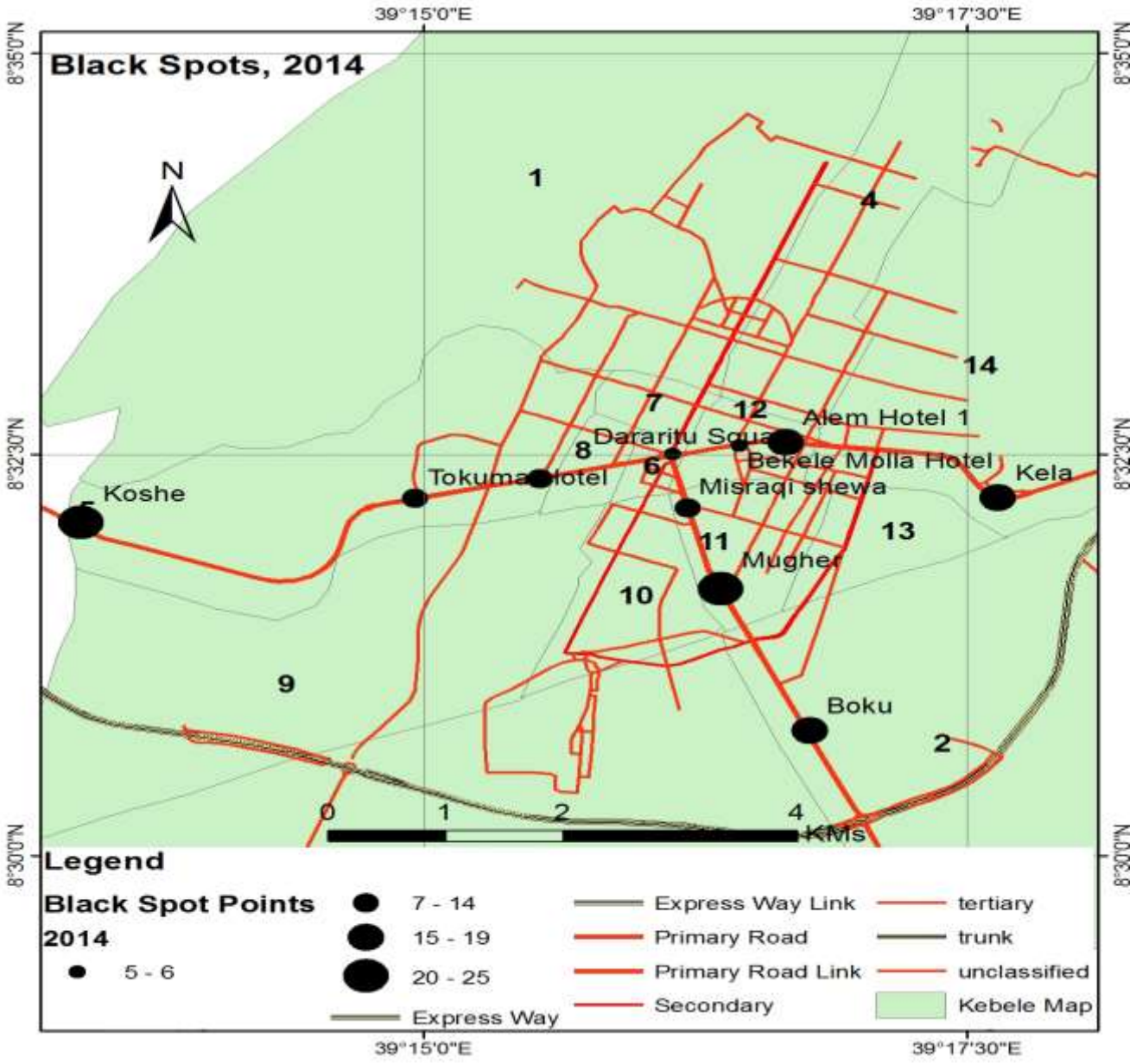


Figure 4.9: Distribution of RTA places/black spots in Adama City (2014)

(Source: ESRI Map ® 2016 and primary data collected through GPS records)

Table 4.31: Distribution of all RTA places/black spots in Adama City (2010 – 2014)

RTA place/black spot name		Accident year					Total	%
		2010	2011	2012	2013	2014		
Koshe		21	21	29	27	23	121	16.9
Tokuma hotel		10	11	14	13	12	60	8.4
Misrake Shewa police		12	13	16	15	14	70	9.8
Mugher		19	26	25	23	25	118	16.5
Boku		17	17	21	20	19	94	13.1
Kela		15	16	20	18	17	86	12
Alem hotel		14	14	18	17	15	78	10.9
Pan Afric hotel		6	9	12	9	10	46	6.4
Bekele Molla hotel			5	10	5	6	26	3.6
Derartu square				5	7	5	17	2.4
Total	10	114	132	170	154	146	716	100

Source: Computed from Data obtained from ACP by the Author, 2016

The distribution and frequency of road traffic accidents occurred in the RTA places/black spots of Adama City exhibits variation. As shown in Table 4.31 and Figure 4.10, 10 different RTA places/black spots have been identified in the city from 2010 to 2014. The findings based on the available police accident statistics show that from 1350 total RTA incidences 716 (i.e. 53%) road traffic accidents have occurred in these 10 places/black spots. This implies that an average of 71.6 RTAs have been recorded from each RTA places/black spots from 2010 to 2014. The highest frequency of road traffic accidents occurred 121 (i.e. 16.9%) in Koshe followed by Mugher accounted 118 (i.e. 16.5%) and the lowest frequency of road traffic accidents occurred in Derartu square accounted 17 (i.e. 2.4%) in the study period.

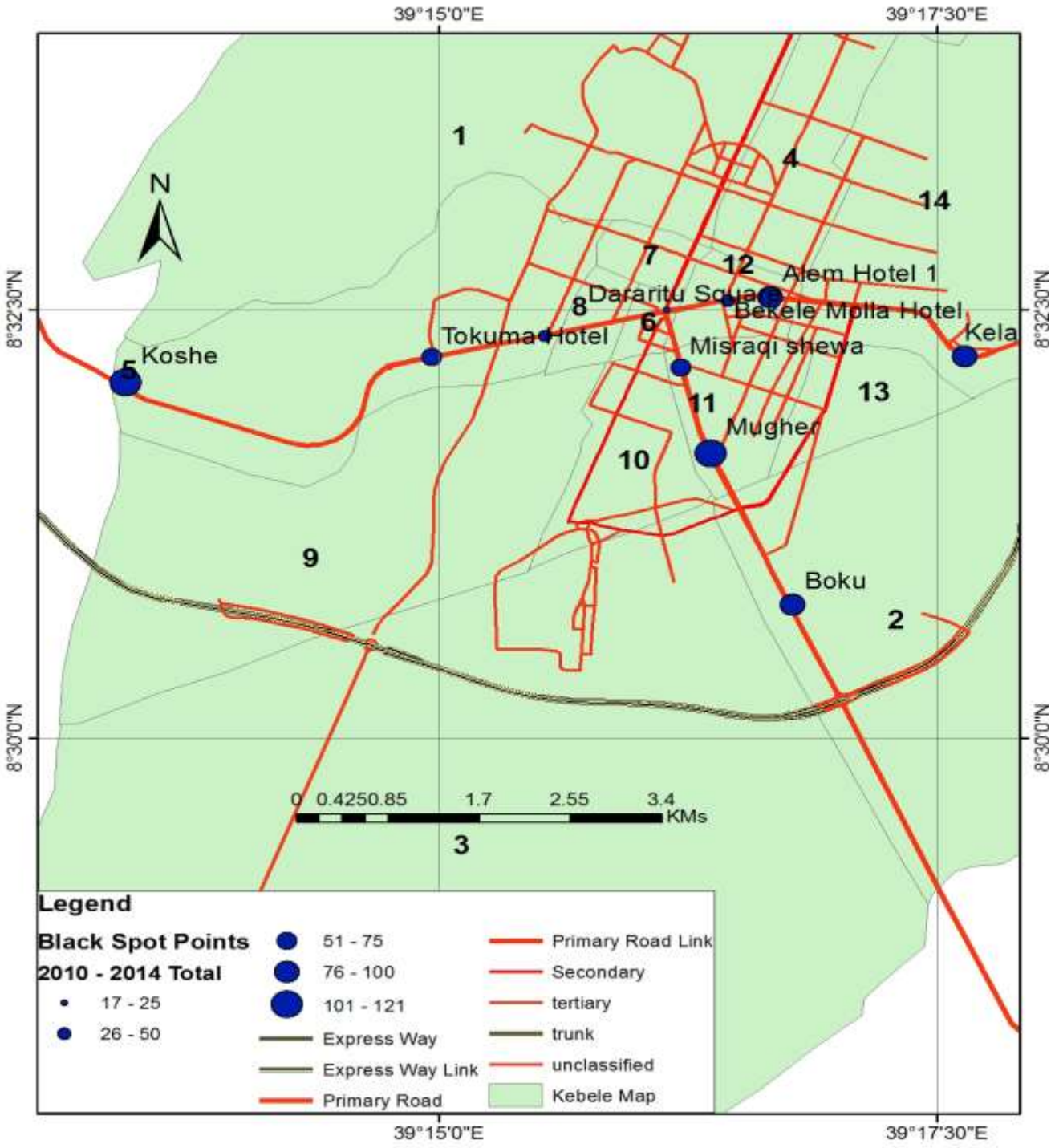


Figure 4.10: Distribution of all RTA places/black spots in Adama City (2010 – 2014)

(Source: ESRI Map ® 2016 and primary data collected through GPS records)

4.7. Challenges to the Prevention of RTA in Adama City

The methods of road traffic accident prevention or reduction measures in Adama city practice generally based on two kinds of mechanisms, the first one by giving education and awareness for the community and the second mechanism based on traffic safety management and control activities.

The police member key informant (head of traffic police department) provided more information concerning methods of RTA prevention or reduction measures based on his experiences and perceptions. According to him, , Adama City has formally a total number of five (5) police offices. Among which the City Administration One head office and Four *Woreda* level police stations. Each *Woredas* have three (3) official department namely; crime prevention department, crime investigation department and finance and personnel administration department. Crime prevention department has two (2) divisions namely; traffic safety management and control division, and community policing division. Each *Woredas* have one traffic safety management and control division and, totally 18 kebele level community policing police service stations.

The total population of police personnel in Adama is 412, from these total police personnel the number of traffic police officers is only 72 and these should serve the population of more than 270,337 (CSA, 2012) and the ratio of traffic police officers to person is 1:3754 that means one police man/women serves 3754 persons in the city. According to the head of traffic police department, under the provisions of the 1942 Police Proclamation, the main functions of the police are the prevention of the occurrence of crime (i.e. road traffic accident), the apprehension of criminals, the maintenance of law and order, the protection of the safety of people and property, and the regulation of traffic. In doing so, the police are expected to deal with every citizen with the principles of due process of the law and to reach at right place and at right time to prevent or reduce road traffic accident.

In Adama, police stations and police personnel are randomly distributed, but not based on systematic and problem solving methods (i.e. road traffic accident). This indicates that the distributions of police stations and police personnel are not based on the real problem of the community and not supported by research rather depend on only traditional mechanism and therefore, the distribution of police station and police personnel are not systematic and not properly structured to prevent RTA in Adama city.

It was added by another police member respondent that, police have primary and secondary goals and objectives; regarding primary goals and objectives, maintaining order and protecting life and property are the most basic functions, and the secondary goals and objectives are meeting the primary goals which includes; preventing crime (i.e. road traffic accident), arresting and prosecuting offenders, recovering stolen and missing property, assisting the sick and injured and enforcing non-criminal regulations. According to the interviews,

the police station (institution) delivering services regarding to the stated goals and objectives related to road traffic accident prevention or reduction measures are not systematic and modern method but focus only on traditional method.

The basic issues raised by key informant interviews and focus group discussions participants are logical regarding the traffic safety management and control supporting materials to prevent or reduce road traffic accident such as vehicles, motorcycle, pedal cycle, radar, and alcohols and drugs tester. According to key informant interviews and focus group discussions participants, particularly traffic police officers and police members stated that the Adama city police have only three motorcycles to perform the activities of traffic safety management and control, and there are no other materials that support traffic safety management and control in the city. Based on these findings, the traffic safety management and control activities are not modern and not properly structured to prevent or reduce road traffic accident in Adama city.

According to key informant interviews and focus group discussions participants, the methods of road traffic accident prevention or reduction measures in Adama city practice generally based on two kinds of mechanism, the first one by giving education and awareness for the community (i.e. students, drivers and road users) about traffic safety management and control mechanism and the second mechanism based on traffic safety management and control activities, and enforcing the laws and regulation related to road traffic safety and control by traffic police officers and other concerned body (i.e. Adama City road transport office members). According to the explanation of participants, these road traffic accident prevention or reduction methods relatively play a great role in prevention or reduction of road traffic accident in the city, and also said that for effective and efficient road traffic accident prevention, traffic police personnel, logistic and other traffic safety management and control supporting materials such as traffic safety signals and signs (i.e. traffic light) shall be fulfilled in Adama city.

The findings based on observations show that the distributions of police station, police personnel, and the traffic safety management and control activities are not systematic and properly structured, and not modern to prevent or reduce road traffic accident in the study period. The findings based on the available questionnaire survey also prove that the methods of road traffic accident prevention or reduction measures in Adama city practice generally based on two kinds of mechanism, the first one by giving education and awareness for the community and the second mechanism based on traffic safety management and control activities.

According to the secondary data derived from Adama City police to show the trends of road traffic accident from 2010 – 2014 and accident investigation record reviews the police personnel, and the traffic safety management and control activities are not systematic and properly structured, and not modern to prevent or reduce road traffic accident in the study period.

Generally, the findings based on primary and secondary data prove that the methods of road traffic accident prevention or reduction measures in Adama city practice generally based on two kinds of mechanism, the first one by giving education and awareness for the community and the second mechanism based on traffic safety management and control activities. In addition to this, the distributions of police station, police personnel, and the traffic safety management and control activities are not systematic and properly structured, and not modern to prevent or reduce road traffic accident, and the distributions and frequencies as well as the health, socioeconomic and physical environment impacts of road traffic accident have shown more severe trend in the study period and regarded as an environmental disaster.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

This paper has focuses on the value of using a combination of different types of information to assess the road traffic accident as an environmental disaster in Adama City. In this study, assessment is made on the general trend of road traffic accidents, the major factors of road traffic accidents, the impacts of RTAs on health, socioeconomic, and physical environment. Moreover, the types of measures to be taken to prevent or reduce road traffic accidents in Adama City are investigated.

5.1.1. Causal Factors for RTA in Adama City

The occurrence and trend of road traffic accident in Adama City exhibits variations because of the impact of various variables like driver factors, vehicle factors, road factors and weather conditions. In Adama City among the various reasons causing road traffic accident, driver factors are the leading responsible factor than other factors for road traffic accident in Adama City. Vehicle factors, road factors and weather condition accounted for second, third and fourth rank respectively, responsible factors for road traffic accident in Adama City.

5.1.2. The Major Health, Socioeconomic and Environmental Impacts of RTA in Adama City

Road traffic accidents are a cause for fatal accidents, serious injury and slight injury and health casualties of the city mainly belong to the productive age groups and accident severity has lost their lives. Road traffic accidents have multifaceted impacts over the socioeconomic aspects of the city, directly when it is manifested over a property and indirect influence when it is exhibited on pedestrians or/and passengers and drivers. This study shows that the physical environment impacts of road traffic accident include damage of infrastructures, damage of vegetations and land degradation. Generally, this study shows that the distributions and frequencies

of road traffic accidents as well as the health, socioeconomic and physical environment impacts of road traffic accidents have shown more severe trend in the study period and regarded as an environmental disaster.

5.1.3. The Major Places/Black Spots and Times of RTA Occurrence in Adama City

The road traffic accident places/black spots were unevenly distributed throughout the Kebeles of Adama City Administration in terms of time and space, and the road traffic accident places/black spots exhibit the highest frequency of road traffic accident occurrences. The highest frequency of road traffic accident occurred in Koshe followed by Mugher place/black spot. This study shows that the distributions and frequencies of road traffic accidents are more frequent at day time because of a higher traffic movement and road users due to different purposes such as marketing, transportation, conference and recreational activities, and these interactions contribute a greater share of road traffic accidents.

5.1.4. Maps Showing Frequent RTA Places/Black Spots in Adama City

The maps showing the distributions and frequencies of road traffic accident occurred in the RTA places/black spots of Adama City exhibits variation. This study shows that 10 different RTA places/black spots have been identified in the city from 2010 to 2014. The maps indicates that from 1350 total RTA incidences 716 (i.e. 53%) road traffic accidents have occurred in these 10 places/black spots. This implies that an average of 71.6 RTAs have been recorded from each RTA places/black spots from 2010 to 2014.

5.1.5. Challenges to the Prevention of RTA in Adama City

The methods of road traffic accident prevention or reduction measures in Adama city practice generally based on two kinds of mechanisms, the first one by giving education and awareness for the community and the second mechanism based on traffic safety management and control activities. However, the traffic safety management and control as well as road traffic accident prevention or reduction measures in Adama city does not in well organized and in modern system regarding to traffic police personnel and logistic (i.e. speed controlling such as radar, alcohol tester).

5.2. Recommendations

- Driver factors were the leading responsible factor than other factors for road traffic accidents in Adama City. The Adama City Police should create education and awareness programs for drivers to change undisciplined behavior of drivers and to develop the sense of responsibility and the Adama City Road Transport and Construction Office should give special attention before providing driving license to

drivers (i.e. assess the capability of drivers and monitor the training given to learners by private organization).

- The City's Police Office should deploy more traffic police officers in the places/black spots in the day time period. This is because; the distributions and frequencies of road traffic accidents are more frequent at day time.
- The distributions and frequencies of road traffic accident as well as the health, socioeconomic and physical environment impacts of road traffic accident have shown more severe trend, and regarded as an environmental disaster in the study period. Therefore, Adama City Police should give special attention to deliver education and awareness in well organized and systematic manner for the whole communities to change the attitude and behavior, and to develop the sense of responsibility and ownership to prevent or reduce road traffic accident in the City.
- In order to enable traffic safety management and control as well as road traffic accident prevention or reduction in the City; Adama City Police should give attention for modern and well organized system regarding traffic police personnel and logistic (i.e. speed controlling instruments such as radar, alcohol tester, etc.).
- Vehicle factors, especially technical condition factors are the second contributing factors for road traffic accidents among other factors in Adama City, and therefore, the Adama City Road Transport and Construction Office should give special attention during annual vehicles technical condition examination.
- The Federal Democratic Republic of Ethiopia (FDRE) government should design and implement strong standards of drivers training manuals and training institution in order to build the skill capacity and discipline behavior of drivers. Moreover, the government should formulate and regulate the road traffic accident places/black spots strategy and program for effective and efficient road traffic accident prevention policy.

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Appendix 1

Questionnaire Survey

Adama Science and Technology University

School of Humanities and Law

Department of Geography and Environmental Management

Questionnaire Survey Prepared for the Drivers in Adama City

Questionnaire Survey Introduction

This questionnaire survey is designed to assess the road traffic accident as an environmental disaster in Adama city. Moreover, this questionnaire is prepared to assemble information which can help to study the general trend of road traffic accidents, the major factors of road traffic accidents, the impacts of RTAs on health, socioeconomic, and physical environment, the frequent road traffic accident places or black spots and the types of measures to be taken to prevent or reduce road traffic accidents in Adama City in partial fulfillment of the requirements for the degree of Master of Arts specialization in environmental disaster risk management.

The information that you were provide to me undoubtedly were have paramount significance for the success of the study. I appreciate your willingness to participate. Please, answer the information and questions truthfully. There is no right or wrong answer.

Direction: Circle and/or write in the blank spaces for the following information.

Part I. General Information

1. Name of the enumerator: _____
2. Enumeration kebeles: _____
3. Date of the enumeration: _____

Part II. Personal Information

1. Sex: A. Male B. Female
2. Age: A. 18 to 24 B. 25 to 34 C. 35 to 44 D. Over 45
3. Marital status: A. Single B. Married C. Divorced D. Widowed E. Widower
4. Educational level: _____
5. Please, would you mention your type of your job? _____
6. Job experience: A. 4 to 9 years B. 10 to 20 years C. More than 20 years
7. Job category: A. Public B. Private C. NGO D. If other, please specify _____

Part III. General Questions

Direction: Circle and/or write in the blank spaces for the following questions. You can choose more than one option when necessary.

1. How old are you? _____
2. How many children do you have? _____
3. How many years of driving experience do you have? _____
4. In your experience, road traffic accident is a problem in Adama City? A. yes B. no
5. In your experience, the distribution of road traffic accident trend. A. more severe B. severe C. less severe
6. If your response to Q4 is "yes", in your experience, which factor(s) are more or less (i.e. rank these factors, e.g. first, second …..) responsible for road traffic accident? A. driver factors B. road factors C. vehicle factors D. weather condition
7. If you have ranked "A" as the first responsible factor in Q6 above, in your experience, which driver factors are more responsible for road traffic accident? A. driver B. passenger C. pedestrian. What are the reasons? _____
8. If your first rank is "B", in Q6 above, in your experience, which road factors are more responsible for road traffic accident? A. road type B. bad road condition C. traffic signs and signals. What are the reasons? _____
9. If you have ranked "C" as the main responsible factor for road traffic accident, in your experience, which vehicle factors are more responsible for road traffic accident? A. vehicle type B. poor technical condition C. vehicle design. What are the reasons? _____
10. If your first rank is "D" in Q6 above, in your experience, which weather condition is responsible for road traffic accident? A. precipitation B. temperature C. wind speed. What are the reasons? _____
11. In your experience, in which place/spot do the road traffic accidents tend to concentrate or occur more frequently in Adama City? A. Koshe B. Mugher C. Kela D. Boku What are the reasons? _____
12. What time does the accident more take place? A. day time B. evening time. What are the reasons? _____
13. On what day of the week is the accident more frequent? A. Monday B. Tuesday C. Wednesday D. Thursday E. Friday F. Saturday G. Sunday What is the reason? _____
14. What are the major health impacts of road traffic accidents in Adama City? A. fatal accident B. serious injury C. slight injury

15. What are the economic impacts of road traffic accidents in Adama City? A. loss of property B. cost to economy C. cost to health service
16. What are the physical environment impacts of road traffic accidents in Adama City? A. damage of infrastructures B. damage of vegetations C. land degradation
17. What kinds of measures to be taken to prevent or reduce road traffic accidents in Adama City?

_____

Thank you for participating in this study.

If you have any further comments and opinions, you can add.

Appendix 2

Questionnaire Survey

Adama Science and Technology University

School of Humanities and Law

Department of Geography and Environmental Management

Questionnaire Survey Prepared for the Traffic Police Officers in Adama City Police

Questionnaire Survey Introduction

This questionnaire survey is designed to assess the road traffic accident as an environmental disaster in Adama city. Moreover, this questionnaire is prepared to assemble information which can help to study the general trend of road traffic accidents, the major factors of road traffic accidents, the impacts of RTAs on health, socioeconomic, and physical environment, the frequent road traffic accident places or black spots and the types of measures to be taken to prevent or reduce road traffic accidents in Adama City in partial fulfillment of the requirements for the degree of Master of Arts specialization in environmental disaster risk management.

The information that you were provide to me undoubtedly were have paramount significance for the success of the study. I appreciate your willingness to participate. Please, answer the information and questions truthfully. There is no right or wrong answer.

Direction: Circle and/or write in the blank spaces for the following information.

Part I. General Information

1. Name of the enumerator: _____
2. Enumeration kebeles: _____
3. Date of the enumeration: _____

Part II. Personal Information

1. Sex: A. Male B. Female
2. Age: A. 18 to 24 B. 25 to 34 C. 35 to 44 D. Over 45
3. Marital status: A. Single B. Married C. Divorced D. Widowed E. Widower
4. Educational level: _____
5. Please, would you mention your type of your job? _____
6. Job experience: A. 4 to 9 years B. 10 to 20 years C. More than 20 years
7. Job category: A. Public B. Private C. NGO D. If other, please specify _____

Part III. General Questions

Direction: Circle and/or write in the blank spaces for the following questions. You can choose more than one option when necessary.

1. How many years of traffic police experience do you have? _____
2. Do you think road traffic accident is a problem in Adama City? A. yes B. no
3. In your experience, the distribution of road traffic accident trend. A. more severe B. severe C. less severe
4. If your response to Q2 is "yes", in your experience, which factor(s) are more or less (i.e. rank these factors, e.g. first, second …..) responsible for road traffic accident? A. driver factors B. road factors C. vehicle factors D. weather condition
5. If you have ranked "A" as the first responsible factor in Q2 above, in your experience, which driver factors are more responsible for road traffic accident? A. driver B. passenger C. pedestrian. What are the reasons? _____
6. If your first rank is "B", in Q2 above, in your experience, which road factors are more responsible for road traffic accident? A. road type B. bad road condition C. traffic signs and signals. What are the reasons? _____
7. If you have ranked "C" as the main responsible factor for road traffic accident, in your experience, which vehicle factors are more responsible for road traffic accident? A. vehicle type B. poor technical

condition C. vehicle design. What are the reasons?

_____

8. If your first rank is "D" in Q2 above, in your experience, which weather condition is responsible for road traffic accident? A. precipitation B. temperature C. wind speed. What are the reasons?

_____

9. In your experience, in which place/spot do the road traffic accidents tend to concentrate or occur more frequently in Adama City? A. Koshe B. Mugher C. Kela D. Boku. What are the reasons?

_____

10. What time does the accident more take place? A. day time B. evening time what are the reasons?

_____

11. On what day of the week is the accident more frequent? A. Monday B. Tuesday C. Wednesday D. Thursday E. Friday F. Saturday G. Sunday. What is the reason?

_____

12. What are the major health impacts of road traffic accidents in Adama City? A. fatal accident B. serious injury C. slight injury
13. What are the economic impacts of road traffic accidents in Adama City? A. loss of property B. cost to economy C. cost to health service
14. What are the physical environment impacts of road traffic accidents in Adama City? A. damage of infrastructures B. damage of vegetations C. land degradation
15. What kinds of measures to be taken to prevent or reduce road traffic accidents in Adama City?

_____

Thank you for participating in this study.

If you have any further comments and opinions, you can add.

Appendix 3

Discussion Questions

Adama Science and Technology University

School of Humanities and Law

Department of Geography and Environmental Management

Discussion Questions prepared for the Focus Group Participant in Adama City

Focus Group Discussion Introduction

This focus group discussion is designed to assess the road traffic accident as an environmental disaster in Adama city. Moreover, this discussion is prepared to assemble information which can help to study the general trend of road traffic accidents, the major factors of road traffic accidents, the impacts of RTAs on health, socioeconomic, and physical environment, the frequent road traffic accident places or black spots and the types of measures to be taken to prevent or reduce road traffic accidents in Adama City in partial fulfillment of the requirements for the degree of Master of Arts specialization in environmental disaster risk management.

The information that you were provide to me undoubtedly were have paramount significance for the success of the study. I appreciate your willingness to participate. Please, answer the information and questions truthfully. There is no right or wrong answer.

Focus Group Participant Demographics		
Date:	**Time:**	**Place:**
What is your job specialty:	**How long have you been in your job:** ○ 4 to 9 years ○ 10 to 20 years ○ More than 20 years	**Job category:** ○ Public ○ Private ○ NGO ○ Other:
Your age: ○ 18 to 24 ○ 25 to 34 ○ 35 to 44 ○ Over 45	**Your gender:** ○ Male ○ Female	**Education level** ○ Illiterate ○ 1 to 10 ○ 10+1 to 10+2 ○ Above 10+2

Focus Group Discussion Guide Questions

Please discuss the following questions

1. Do you think road traffic accident is a problem in Adama City?
2. Can you describe the distribution of road traffic accident trend in Adama City?
3. Can you tell me whether there have been any road traffic accidents in Adama City?
    - Which factors are responsible for them? (i.e. rank these factors, e.g. first, second …)
4. Where and when do the road traffic accidents tend to concentrate or occur more frequently in Adama City?
    - What time did the accident more take place? (For example, Day time or Evening) and what are the reasons for this?
    - On what day of the week did the accident more take place? (For example, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday & or Sunday) and what are the reasons for this?
    - In which place/spot is the road traffic accidents tend to concentrate or occur more frequently and what are the reasons for this?
5. What is the major health, socioeconomic and physical environmental disasters occurring due to road traffic accidents in Adama City?
    - How do road traffic accidents affect the household of victims (For example, loss of life, loss of property) and the community (For example, cost to economy, cost to health service)
6. In what ways could road traffic accident be prevented or reduced in Adama City?
    - Are there any local community workers or school groups that promote road safety and what methods do they use?

Thank you for participating in this study.

If you have any further comments and opinions, you can add.

Appendix 4

Interview Questions

Adama Science and Technology University

School of Humanities and Law

Department of Geography and Environmental Management

Interview Questions prepared for the Key Informant Participant in Adama City

Key Informant Interview Introduction

This key informant interview is designed to assess the road traffic accident as an environmental disaster in Adama city. Moreover, this interview is prepared to assemble information which can help to study the general trend of road traffic accidents, the major factors of road traffic accidents, the impacts of RTAs on health, socioeconomic, and physical environment, the frequent road traffic accident places or black spots and the types of measures to be taken to prevent or reduce road traffic accidents in Adama City in partial fulfillment of the requirements for the degree of Master of Arts specialization in environmental disaster risk management.

The information that you were provide to me undoubtedly were have paramount significance for the success of the study. Thank you for agreeing to be part of the interview. I appreciate your willingness to participate. Please, answer the information and questions truthfully. There is no right or wrong answer.

Key Informant Interview Participant Demographics		
Date:	**Time:**	**Place:**
What is your job:	**How long have you been in the job:** ○ 4 to 9 years ○ 10 to 20 years ○ More than 20 years	**Job category:** ○ Public ○ Private ○ NGO ○ Other:
Your age: ○ 18 to 24 ○ 25 to 34 ○ 35 to 44 ○ Over 45	**Your gender:** ○ Male ○ Female	**Education level** ○ Illiterate ○ 1 to 10 ○ 10+1 to 10+2 ○ Above 10+2

Key Informant Interview Guide Questions

Please answer these questions if you have been a victim of road traffic accident.

Can you briefly describe what happened? _____

Date of accident: _____

1. Do you think road traffic accident is a problem in Adama City?
2. Can you tell me the distribution of road traffic accident trend in Adama City.
3. In your opinion, which determinant factors are responsible for road traffic accident and rank these factors (For example, first, second …..)
4. Where and when do the road traffic accidents tend to concentrate or occur more frequently?
    - What time did the accident more take place? (For example, Day time or Evening time)
    - On what day of the week did the accident more take place? (For example, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday & Sunday)
    - In your opinion, in which place/spot is the road traffic accidents tend to concentrate or occur more frequently in Adama City? Why?
5. What is the major health, socioeconomic and physical environmental disasters occurring due to road traffic accidents in Adama City?
    - How do traffic accidents affect the household of victims (For example, loss of life, loss of property) and the community (For example, cost to economy, and cost to health service)?
6. What kinds of measures to be taken to prevent or reduce road traffic accidents in Adama City?

Thank you for participating in this study.

If you have any further comments and opinions you can share.