JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDY

FACULTY CIVIL AND ENVIRONMENTAL ENGINEERING

Relation of Road users' Behavior and Geometric Elements with Traffic Accidents in Wolaita Sodo Town

A Thesis Submitted to the School of Graduate Studies of Jimma University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Civil Engineering

Highway Engineering Stream

By: Etalem Fenta

June2020

Jimma Ethiopia

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June 2020

Jimma, Ethiopia

DECLARATION

I declare that This research thesis is my original work and has not been presented for degree in any other university

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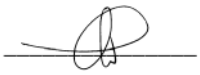
Engr.Elmer C. Agon (Asso. Prof)		23 / 07 / 2020
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ABSTRACT

A road traffic accident is an incident on a way or street open to public traffic, resulting in one or more persons being killed or injured, and involving at least one moving vehicle. Every year the lives of approximately 1.35 million people are cut short as a result of a road traffic crash. Between 20 and 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury.

Wolaita Sodo is one of the densely populated towns in Ethiopia and has high traffic flows. The over population, high traffic flow and absence of Pedestrian road is contributing to high RTAs in the town. These unreasonably high accidents are costing the town a huge price, claiming life of residents and causing major and minor disability in addition to the property damage. The objective of this study was to assess the relation of road users' behaviour and road geometric design elements to traffic accident. Data were collected on road segments, road users, and traffic office records in Wolaita Sodo town. Data were collected by interviewed road users and by measuring road geometric design elements. Data entry and analysis were carried out by SPSS. Descriptive statistics followed by ANOVA was employed to identify the effect of driver's risky behaviours and road geometric variables on crash occurrences.

The result of this study shows strong relation between drivers' risky behaviour, road geometric parameters and crash occurrence. The driver's behaviors that affect crash occurrence includes driving fast for thrills 65.4%, taking deliberate risks for fun 67.9%, driving under the influence of alcohol 24.5, driving under the influence of chat 75.1%, excessive speed 24.1% and close following (tailgating) 46.6% . The modelling result indicates; median width, lane width, shoulder width and gradient also affecting the crash occurrence. In wolaita sodo town 161 road traffic accidents were recorded from the last five years. This indicates that every year an average of 32.2 road traffic accidents have occurred. Major causes of road traffic crashes during the consecutive five years from 2006-2010 were failure to give-way for pedestrians (55.5%), failure to give-way for the other vehicles (25.2%) and tailgating (15%). To minimize road traffic accidents in Wolaita Sodo town, the authority shall provide adequate shoulders, speed breakers and medians.

Key words: traffic accident, geometric parameters, driver's behavior and Wolaita Sodo

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ACRONYMS

ANOVA: Analysis Of Variance

BAC: Blood Alcohol Concentration

BTA: Better than Average

CDC: Central for disease control

MVCs: Motor Vehicle Crashes

NHTSA: National Highway Traffic Safety Administration

RTAs: Road Traffic Accidents

WHO: World Health Organization

SPSS: Statistical Package for Social Science

UN: United Nation

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Every year the lives of approximately 1.35 million people are cut short as a result of a road traffic crash. Between 20 and 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury. Road traffic injuries cause considerable economic losses to individuals, their families, and to nations as a whole. These losses arise from the cost of treatment as well as lost productivity for those killed or disabled by their injuries, and for family members who need to take time off work or school to care for the injured. Road traffic crashes cost most countries 3% of their gross domestic product (WHO).

Road transport plays vital role in economic development, trade and social integration, which rely on the conveyance of both people and goods. Vehicular traffic carrying goods and people increases with the increasing economy. The tremendous traffic growth generally observed in road transportation has led to a lot of negative consequences in the form of road accidents both in developed and developing countries. Road traffic accident is an incident on a way or street open to public traffic, resulting in one or more persons being killed or injured, and involving at least one moving vehicle. Accordingly, RTAs are collisions between vehicles, between vehicles and pedestrians, between vehicles and animals, or between vehicles and geographical or architectural obstacles. Road traffic accidents have become a huge global public health and development problem killing nearly 1.2 million people a year and injuring or disabling between 20–50 million people worldwide; thus making the loss of 518 billion US dollar globally (Peden M ,2004).The World Health Organization (2015) reported that motor vehicle crashes (MVCs) were among the top ten leading cause of death in 2012 in Ethiopia.

Three major factors causing traffic accidents are human, road and vehicles. The human factor has the most significant effect on accident. Risky driving behaviour is a significant contributor to MVCs (Iversen, Hilde ,2004; Lawton et al. ,1997; Parker, D et al. ,1995). One theoretical frame work to study risky driving behaviour proposed by (Reason et al. ,1990)emphasizes two types of risky driving behaviours having two distinctive psychological constructs: errors and violations. Errors refer to the inability to perform a series of designed actions to achieve an optimal outcome. Violations are behaviours performed with the intention of violating traffic regulations. Moreover, research suggested that errors can be split into slips (failure of attention), lapses (failure of memory) and mistakes (failure of intention).

Violations can be aggressive containing an interpersonally aggressive component whereas "ordinary" violations are deliberate deviations from safe driving without intention of harm (Lajunen, Parker & Summala, 2004).

Moreover, any design solution mitigating this kind of individual human behaviour cannot be predicted only some safety rules can be enforced. Also, different mechanical behaviour of vehicles factors is not the scope of civil engineering study. Hence, road factors are only considered as a part of this study. It is very important for the highway to establish a harmony between the all the three factors at the design stage of a highway. With a geometrically good design, it is possible to compensate for the other factors and thus decrease the number of traffic accidents (Iyinam, Iyinam & Ergun ,1997).

Association of road traffic accidents with risky driving tendencies of drivers and road geometric design elements has been researched in other parts of the world. However, there is a paucity of published literature on this regard. Thus, this study is aimed to assess patterns of risky driving behaviour, road geometric design elements and its association with road traffic accidents in Wolaita Sodo town.

1.2. Statement of the Problem

Road trauma is recognized as a serious problem both in Ethiopia and internationally. The World Health Organization (WHO) estimates that road crashes account for 2.1% of all deaths globally (Jaffar Hussain ,2006). Road traffic injuries constitute a major public health and development crisis, and are predicted to increase if road safety is not addressed adequately by Member States. The World Health Organization (WHO) has been concerned with this issue for over four decades. For the past two decades, the World Bank has encouraged its borrowers to include road safety components within most of their highway and urban transport projects. Motor vehicle collisions cause more than 1.2 million deaths (World Health Organization ,2015)worldwide and an even greater number of non-fatal injuries each year, negatively affecting the health and wellbeing of injury survivors and their families (Donaldson, Brooke & Faux ,2009).

Teen drivers are responsible for a disproportionate number of automobile crashes resulting in injury and death every year(CDC 2013; NHTSA ,2013b). Although innovations such as graduated drivers licensing have helped reduce the crash rate in recent years (Shope ,2007; Vanlaar et al. ,2009), motor vehicle accidents are still the single most prevalent cause of

death to young people in the US and worldwide (WHO ,2013). Thus, efforts to reduce deaths attributed to young drivers are still needed.

Wolaita Sodo is one of the densely populated towns in Ethiopia and has high traffic flows. The over population, high traffic flow and absence of Pedestrian road is contributing to high RTAs in the town. These unreasonably high accidents is costing the town a huge price, claiming life of residents and causing major and minor disability in addition to the property damage.

It is likely that the prevalence of risky driving behaviours and the associated risk of a crash may vary between different cultures. Such differences have been purported to exist due to variations in the definition of risk between cultures. That is, the level of acceptance of risk varies with different societies and cultures selecting different acceptable and unacceptable risks (Tursz ,2000). As well, the risk of involvement in a traffic crash, particularly that resulting in fatalities, has been found to vary according to road users' culture(Hilton ,2006), which suggests that there may be a different distribution of risk factors for crashes by culture. Identifying ethnic groups with a high risk of engaging in risky driving behaviour and being involved in a traffic crash is important for the development of targeted intervention strategies to reduce the risk of injury and death in these groups.

However, there is a paucity of published literature on the effect of risky driving behaviour, and road geometric design elements on likelihood of involvement in traffic crashes. The risky driving tendencies of drivers and it association with road traffic accidents has been researched in other parts of the world, but much less is known about patterns of risky driving behaviour and the factors which influence these in Ethiopia.

1.3. Research Question

- What is the prevalence of driver's risky behaviours in Woliata Sodo town?
- What is the relation between driver's risky behaviours and traffic accidents?
- What is the effect of road geometric variables on crash occurrences?

1.4. Objective of the Study

1.4.1. General Objective:

The general objective of the study was to assess road users' behaviour and geometric elements and its relation to traffic accident in wolaita sodo town.

1.4.2. Specific Objectives:

- To determine the types of risky behaviours among driver's in Wolaita Sodo Town
- To identify the relation between drivers risky behaviours and its association with traffic accidents.
- To identify the relation between road geometric design elements and its association with traffic accidents.

1.5. Significance of the Study

This research aims to fill a gap in our knowledge regarding the types and role of a range of human behaviours in road crashes, such that new policies could be developed in order to diminish road crashes involving young drivers. Main contributions of this study are:

i) A well-designed survey for collecting data to understand drivers' driving attitudes, behaviours, and geometric elements.
ii) A dataset containing necessary information for future researchers to study risky behaviours among drivers and geometric elements.
iii) This study used for the road authority and for traffic safety office, to evaluate their design manuals.
iv) For traffic safety office to revise their rules and regulation.
v) For students used as a reference.

No study has ever examined the association between drivers' risky behaviours and accidents in the study area. Considering the severe consequences caused by numerous road crashes involving drivers, this pioneering study is important for improving contemporary road safety of Woliata Sodo.

1.6. Scope and Limitation of the Study

The study focuses on the effect of driver's risky behaviour and the effect of road geometric design elements on traffic accident in Wolaita Sodo Town. The study was used information of five year from December 2014 to December 2018. The research was limited to driver's risky behaviour and the road segments but not include pedestrian volume, road intersections and roundabouts and its environment variables such as land use, posted speed, percentages of heavy vehicles and others

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1.Introduction

Every year the lives of approximately 1.35 million people are cut short as a result of a road traffic crash. Between 20 and 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury. Road traffic injuries cause considerable economic losses to individuals, their families, and to nations as a whole. These losses arise from the cost of treatment as well as lost productivity for those killed or disabled by their injuries, and for family members who need to take time off work or school to care for the injured. Road traffic crashes cost most countries 3% of their gross domestic product (WHO, 2020).

2.1.1. Traffic Accident in Africa

Africa has one of the highest road traffic death rates in the world, with little difference in rates between those countries categorized as low-income. Whereas the range of fatalities per 100,000 populations in countries of African region is not very wide, 70% of all the deaths occurred in ten countries that account for 70% of the regional population: Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Madagascar, Mozambique, Nigeria, South Africa, and Tanzania (World Health Organization & World Bank, 1999). While, this incident were more affecting countries in sub-Saharan Africa.

Road injury deaths are severely underreported in most sub-Saharan countries. Our estimates are often six times those of official government statistics. In Nigeria, they are 14 times the official statistics of the national road death toll. Road injuries killed 231,000 people in sub-Saharan Africa in 2010, accounting for almost one-fifth of the global road injury death toll. In addition, there were over 8 million non-fatal injuries, of which 885,000 were severe enough to warrant hospital admission if adequate access to medical care were available. The combined burden of non-fatal road injuries in sub-Saharan Africa exceeded 14 million healthy life years lost.

Western, Central and Eastern sub-Saharan Africa has the highest road injury death rates of any global region. The death rate in Western sub-Saharan Africa is more than four times the rate in Western Europe.

Road injuries are the 8th leading cause of death in sub-Saharan Africa and the 10th leading cause of healthy life years lost. The public health burden of road injuries exceeds that from tuberculosis and maternal disorders. Deaths due to road injuries have grown by 84% in sub-Saharan Africa since 1990, almost twice the global increase. The Western and Southern regions of sub-Saharan Africa had the highest growth in road deaths of any region in the world, more than doubling over this period. Road injuries are the 7th leading cause of death in males in sub-Saharan Africa. They are the 13th leading cause of death in females, compared with 18th globally. The road injury death rate for females in Western sub-Saharan Africa is more than twice the global average and almost five times the rate in Western Europe.

Road injuries pose a high burden over the entire life course in sub-Saharan Africa, impacting not just young adults but also children and the elderly. Among children aged 1-4 years, road injuries are the 8th leading cause of death in the region. Among adults aged 70+ years, road injuries are the 12th leading cause of death and 14th leading cause of healthy life years lost, compared with 26th and 23rd globally.

Pedestrians comprise 44% of road deaths in sub-Saharan Africa, substantially more than the global average of 35%. The rate of pedestrian deaths in Western sub-Saharan Africa is 8 times the rate in Western Europe. Nigeria has the highest road injury death rate (52.4 per 100,000 people) of any country globally. Mozambique has the third highest death rate (46.7 per 100,000). These rates are more than 15 times the death rates in Sweden, UK, and the Netherlands, which have among the lowest death rates globally. Four countries (Nigeria, Ethiopia, South Africa, and Sudan) together account for half the road injury death toll of sub-Saharan Africa. Burden of Road Injuries in Sub-Saharan Africa. Road safety has emerged as an important health priority in sub-Saharan Africa. Trends over the last two decades show that road injury rates in the region have remained at among the highest in the world even though substantial improvements are being made in controlling other diseases, such as tuberculosis, malaria, and diarrheal disease. Unless significant preventive efforts are undertaken, road safety will continue to climb in regional health rankings during the UN Decade of Action for Road Safety. National governments and the international development community need to prioritize road safety in the region and implement the recommendations of the 2004 World Report on Road Traffic Injury Prevention (GRSF, World Bank, 2014).


Figure 1: Shows traffic accident in Africa

2.1.2. Traffic accident in Ethiopia

According to the latest WHO data published in 2017, road traffic accident deaths in Ethiopia reached 27,140 of 4.27% of total deaths. The age adjusted death rates 36.36 per 100,000 population ranks Ethiopia number 22 in the world. In Ethiopia, the number of deaths due to traffic accidents is reported to be amongst the highest in the world. According to the WHO, in 2013 the road crash fatality rate in Ethiopia was 4984.3 deaths per 100,000 vehicles per year, compared to 574 across sub-Saharan African countries.

According to a World Health Organization report in 2015, Ethiopia is one of the 50 countries with the deadliest roads in the world (The Economist 2015). Principally, injured people have occupied 30 to 70 percent of orthopaedic beds in developing countries hospitals (World Health Organization (WHO), Time for action 2009). Road traffic accident related causalities are extremely high in Ethiopia. Male young adults and vulnerable road users are at increased risk of RTAs. There is urgent need for bringing road safety to the country's public health agenda. Pedestrian death in Ethiopia was common and high. Accordingly; about 74% of the fatal, serious and slight injury accidents happened when pedestrians tried to cross streets (Teferi Abagaz 2018).

2.2. Causes of Road Traffic Accident

Non-use of motorcycle helmets, seatbelts, and child restraints

Correct helmet use can lead to a 42% reduction in the risk of fatal injuries and a 69% reduction in the risk of head injuries. Wearing a seat-belt reduces the risk of death among drivers and front seat occupants by 45 - 50%, and the risk of death and serious injuries among rear seat occupants by 25%.The use of child restraints can lead to a 60% reduction in deaths.

Distracted driving

There are many types of distractions that can lead to impaired driving. The distraction caused by mobile phones is a growing concern for road safety. Drivers using mobile phones are approximately 4 times more likely to be involved in a crash than drivers not using a mobile phone. Using a phone while driving slows reaction times (notably braking reaction time, but also reaction to traffic signals), and makes it difficult to keep in the correct lane, and to keep the correct following distances. Hands-free phones are not much safer than hand-held phone sets, and texting considerably increases the risk of a crash.

Unsafe road infrastructure

The design of roads can have a considerable impact on their safety. Ideally, roads should be designed keeping in mind the safety of all road users. This would mean making sure that there are adequate facilities for pedestrians, cyclists, and motorcyclists. Measures such as footpaths, cycling lanes, safe crossing points, and other traffic calming measures can be critical to reducing the risk of injury among these road users.

Unsafe vehicles

Safe vehicles play a critical role in averting crashes and reducing the likelihood of serious injury. There are several UN regulations on vehicle safety that, if applied to countries' manufacturing and production standards, would potentially save many lives. These include requiring vehicle manufacturers to meet front and side impact regulations, to include electronic stability control (to prevent over-steering) and to ensure airbags and seatbelts are fitted in all vehicles. Without these basic standards the risk of traffic injuries – both to those in the vehicle and those out of it – is considerably increased.

Inadequate post-crash care

Delays in detecting and providing care for those involved in a road traffic crash increase the severity of injuries. Care of injuries after a crash has occurred is extremely time-sensitive: delays of minutes can make the difference between life and death. Improving post-crash care requires ensuring access to timely prehospital care and improving the quality of both prehospital and hospital care, such as through specialist training programmes.

Inadequate law enforcement of traffic laws

If traffic laws on drink-driving, seatbelt wearing, speed limits, helmets, and child restraints are not enforced, they cannot bring about the expected reduction in road traffic fatalities and injuries related to specific behaviours. Thus, if traffic laws are not enforced or are perceived as not being enforced it is likely they will not be complied with and therefore will have very little chance of influencing behaviour. Effective enforcement includes establishing, regularly updating, and enforcing laws at the national, municipal, and local levels that address the above-mentioned risk factors. It also includes the definition of appropriate penalties.

2.3. Driver's Risky Behaviors

Various driving behaviours have been found to predict crashes, and/or crash seriousness (Jonah ,1986). Such behaviours are often the subject of legislation – which people violate by engaging in these behaviours. Intentional violations have been distinguished from errors or lapses, and pose greater risks (Parker, D, Reason, J.T., Manstead, A.S.R., Stradling, S.G., 1995).Iversen found that people who had been involved in at least one car crash over the last one-year period engaged in more speeding, drink-driving and reckless driving, as well as lower use of seat belts, over the same period(Iversen, H., 2004). Jonah concluded from a review of relevant literature that risky driving is an important contributor to the over-representation of young drivers(Jonah, 1986).This study focusses on four risky driving behaviours: speeding, drink-driving, driving while fatigued, not wearing seat belt, using mobile phones while driving (including text messaging), driving during high-risk night time hours, and driving older vehicles.

2.4. Factors Contributing to Risky Behaviours

Young Age:

Young novice drivers aged 17–25 years constitute a major public health concern. This group comprises inexperienced drivers who are involved in a large number of crashes with high rates of crash involvement(Scott-Parker et al., 2014). They are over-represented in crashes among all classes of road user throughout the world (WHO ,2004), including Ethiopia (Hailemichael, Suleiman & Pauolos, 2015), at high societal cost.

The young driver was deemed to be responsible in 78.9% of their fatal crashes, and this primarily is a result of risky driving behaviours like speeding. Whilst fatalities are a cause for great concern, 36% of all hospitalised casualties (i.e. non-fatal injuries) globally in 2010 involved a driver aged 17–24 years. Road crashes were conservatively estimated to cost a

country's economy $AU27.12 billion in 2006 alone (Tooth ,2010). Clearly young driver road crashes area significant problem; a problem that is in part preventable if risky behaviours such as substance-impaired driving are reduced. The overrepresentation of young driver's inroad crashes is a persistent global road safety problem

Factors such as inexperience, lack of skill, and risk-taking behaviours have been associated with the collisions of young drivers. In contrast, visual, cognitive, and mobility impairment have been associated with the collisions of older drivers.

While the majority of young people appear to "grow out" of their risky driving tendencies, for a small number, this behaviour appears more entrenched, persisting beyond their first years of driving (Begg, DJ, Langley, J., 2001), and others become riskier with age (Vassallo 2014). Longitudinal study from Australian found that almost two-thirds of young drivers (62%) displayed similar levels of risky driving at both time-points, with 20% showing a decrease between 19–20 and 23–24years, and a further 19% reporting an increase over this time span. The highest levels of stability were found amongst those who reported low risky driving behaviour at 19–20 years. Also identified a small group of drivers who continued to engage in high levels of risky driving into their mid-twenties (age 26).

Male Sex:

Young male drivers are more likely to get into car crashes than female drivers of the same age (Lardelli-Claret et al. 2011; NHTSA 2013a; Shope ,2007). Additionally, the types of crashes for which male drivers are responsible are more devastating than those of female drivers: male drivers are typically involved in higher speed crashes, often involving the car leaving the roadway(Rhodes, Brown & Edison, 2005). Such crashes are characterized by greater likelihood of fatalities and higher numbers of injuries per crash. Research to understand better the factors that specifically put young male drivers at risk is warranted.

According to study conducted in New Zealand (Begg, D, Langley, J.D., 2004) the group, who they labelled 'persistent risky drivers', were predominantly male and were more likely to have been involved in serious crashes resulting in injury than other drivers (Begg, DJ, Gulliver, P., 2008). Members of this group were characterized by higher aggression and alienation and lower traditionalism (Gulliver, 2007).

Thrill and Adventure Seeking:

People often believe they are more capable, competent, and talented and also less biased and prone to errors than others (Pronin ,2004). These beliefs are considered illusory because it is unlikely fora majority of people to be above average in every domain (Taylor ,1988). Robust ''better-than-average" effects(BTA) have been found in different domains, including driving (Horswill ,2004). Thus, previous studies found that drivers tend to consider themselves superior to other drivers on several dimensions such as reflexes (Delhomme, 1991), judgment (Glendon ,1996), driving skills(Horswill , 2004),and safety behaviours (Delhomme ,1991).

Drivers' overestimation of their own abilities combined with the lack of understanding of personal limitations is considered a critical safety factor in traffic (Gregersen ,1996). However, while a number of studies showed that it contributes to excessive risk-taking behind the wheel (Svenson, 1981; Williams, 2003), other studies found little evidence for this relation(Horswill ,2004). A few other studies sustain that the tendency to overestimate personal driving abilities can determine a driver to engage in aggressive driving behaviours(Stephens, 2014).

2.5 Relation of Driver's Risky Behaviours with Traffic Accidents

Speeding:

Speeding has been found to increase both the frequency and severity of road crashes (Vernon ,2004). High speed increases the chance of death or severe injury among all road users: drivers, pedestrians, passengers, young and old alike. Excess or inappropriate speed is a major risk factor for road traffic crashes. The higher the speed, the shorter time a driver has to stop and avoid a crash. In addition, a higher speed is more likely to result in severe consequences if a crash does occur. Recent research confirms that certain risky driving behaviours are more prevalent among younger drivers than older drivers, especially among men. These include high-level speeding and speeding for the thrill of it (Moore, 1995).

Drink Driving:

Alcohol consumption before using the roads – whether as a driver or a pedestrian – increases the likelihood of a crash occurring, as well as the likelihood that death or serious injury will result. The risk of a road traffic crash begins to increase significantly at a blood alcohol concentration (BAC) level of 0.04 g/dl and rises steeply after that for each small increase in BAC. Research has consistently shown that higher levels of alcohol consumption are associated with a higher risk of a road crash. Compared to more experienced drivers (those

who have been driving for 5 years or more) first year Provisional drivers are 3 times more likely to be injured in a crash if they have been drinking. The risk is greater for young drivers: drivers in their 20s have at least 5 times the risk of crashing compared to drivers in their 30s for all alcohol levels.(Mayhew,1986).

Driver Fatigue:

Evidence for the contribution of driver fatigue to road crashes is hampered by the lack of a direct and objective measure of fatigue. Nonetheless, (Arnedt ,2005)found that sleep deprivation resulted in a significant increase in mean crash rate during a simulated drive. The highest risk of death for young drivers (aged 25 years or less) involved in a road crash occurs during the night-time hours; especially nearing midnight and into the early morning hours, and during these times on weekends.

Failure to Wear a Seatbelt or Helmets:

Failure to use a seat-belt is a major risk factor for road traffic deaths and injuries among vehicle occupants. Passengers who were not wearing their seat-belts at the time of a collision account for the majority of road traffic fatalities among this group. In addition, passengers who do not wear seat-belts and have a frontal crash are most likely to suffer a head injury. Failure to wear a seatbelt substantially increases the risk of injury in the event of a road crash (Ball ,2005). Wearing a helmet is the single most effective way of reducing head injuries and fatalities resulting from motorcycle and bicycle crashes. Not wearing a helmet: increases the risk of sustaining a head injury; o increases the severity of head injuries; o increases the time spent in hospital; o increases the likelihood of dying from a head injury; o increases the likelihood of long-term disability.

Using a Mobile Phone Whilst Driving:

The risk of crashing when using a mobile phone increases four-fold, while the risk of driver death is between 4-9 times higher than when not using a phone. Young drivers are also more likely to be severely injured in a crash when distracted by a mobile telephone.

Figure 2: Use of mobile phone cause road accidents. Source (Google)

Operational Definition

The risky driving behaviour is defined as those who often, or fairly often engaged in either of driving fast for thrills, taking deliberate risks for fun, driving under the influence of alcohol, driving under the influence of drugs, excessive speed, dangerous overtaking, and close following (tailgating), driver fatigue, failure to wear a seatbelt, using mobile phones while driving (including text messaging), driving during high-risk night time hours, and driving older vehicles.

2.6. Road Geometric Characteristics

Overtaking manoeuvre on multi-lane roads without the assistance of additional passing lanes is a complex driving task Nicholas et al., 2001). It requires critical information-processing and decision-making skills, and a lengthy section of road to complete the manoeuvre. The rate of overtaking crashes is related to the provision and geometric design of passing lanes. When passing lanes are not provided on long sections of road lengths, there is increased potential for risky or misjudged overtaking manoeuvres, particularly when sight distance is short.

If design practices for passing lanes are not be appropriate for many drivers to pass slow traffic or multiple vehicles in a safe manner would be difficult. Moreover, number of lanes, lane width, and presence of a median, median width, type of median, shoulder width, access density, speed limit, vertical grade, horizontal curvature, and weather condition has strong relationship with crash occurrences. The relationship between safety on the highway and factors listed above is the primary focus in crash reduction and predictions (Deo, 2004). In addition, some of the primary geometric design elements that can affect road safety are

carriageway, grade, horizontal curvature, shoulder, median, vertical curve (Iyinamet et al., 1997).

2.7. Geometric Parameters Affecting Road Safety

An accident is always characterized by multiple causes. The alignment of road is an important influence factor: dimension of radii, ratio of consecutive curves, dimension of vertical curves and sight distance conditions. In many evaluation studies of safety effects of road design elements, it turns out the present poor capacity to explain accidentally phenomenon; in fact, the main causes of accident are behaviour of driver, which is mainly influenced by his personality, skills, and experience. Furthermore, external impacts like weather conditions, road conditions, time of day, or light conditions influence the driver behaviour as well. It is out of question that analysing accidents and their dependence on technical values or human factors has always to consider these interactions.

The relation between accidents (all, property damage only, slight injuries, severe injuries, fatalities) and road geometry is proved but it is also a question of the driving behaviour, especially of the velocity. Again, and again investigations show that comparable curves (similar geometry) are characterized by different accident occurrence. One reason could be a different driving behaviour: lower speeds are less critical than higher speeds in curves. Several studies, oriented to create relationships between accidentally and independent variables, were obtained in a particular context; so, in every other different condition, weather conditions, user behaviour, etc. The influence of these factors should be considered, e.g. calibration procedure. Summarized, accidents do not depend on only one factor; accidents are caused rather by a combination of several factors (Hameed Aswad Mohammed, 2017).

2.8. Effects of Characteristics of Road geometric Design Elements on Traffic Accidents

Some of the primary geometric design elements that can affect on highway safety are carriageway, grade, horizontal curvature, shoulder, median, vertical curve. The relationship between some characteristics of these elements and traffic accidents, including studies made in different countries are classified into groups: Cross-section effects and Alignment effects.

Cross-Section Effects

The widths of the various cross section elements affect the capability of driver to perform evasive manoeuvres and determine the lateral clearances both between vehicles and between vehicles and other road users.

Lane Width: The wider lanes for multilane highways result in higher free-flow speeds. On the other hand, very little has been found on the safety implications of wider lanes. It is reasonable to assume that wider lanes may provide additional space to the driver to correct potential mistakes and thus avoid crashes. However, a driver could be expected to adapt to the available space, and the positive safety effects from the wider lanes may be offset by the higher speeds. Generally, most studies agree that lower accident rates are attributed to wider lanes. But it seems that there is an optimal lane width around 3.5m.

Shoulders

A shoulder is the portion of the roadway contiguous to the carriageway for the accommodation of stopped vehicles; traditional and intermediate non-motorised traffic, animals, and pedestrians; emergency use; the recovery of errant vehicles; and lateral support of the pavement layers.

Medians

The median is the total area between the inner edges of the inside traffic lanes of a divided road, and includes the inner shoulders and central islands. The purpose of the median is to separate opposing streams of traffic hence reducing the possibility of vehicles crossing in to the path of opposing traffic. This is accomplished by the selection of the width of the median or by a physical barrier such as a guardrail.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1. Study Area

The study was conducted in Wolaita Sodo Town. The town is located 327 km from Addis Ababa. The latitude and longitude of 6°54′N 37°45′E. The terrain features of the area are mountainous. The zone is one of densely populated area in the country where motorcycle and the three-wheeler Bajaj are widely used.

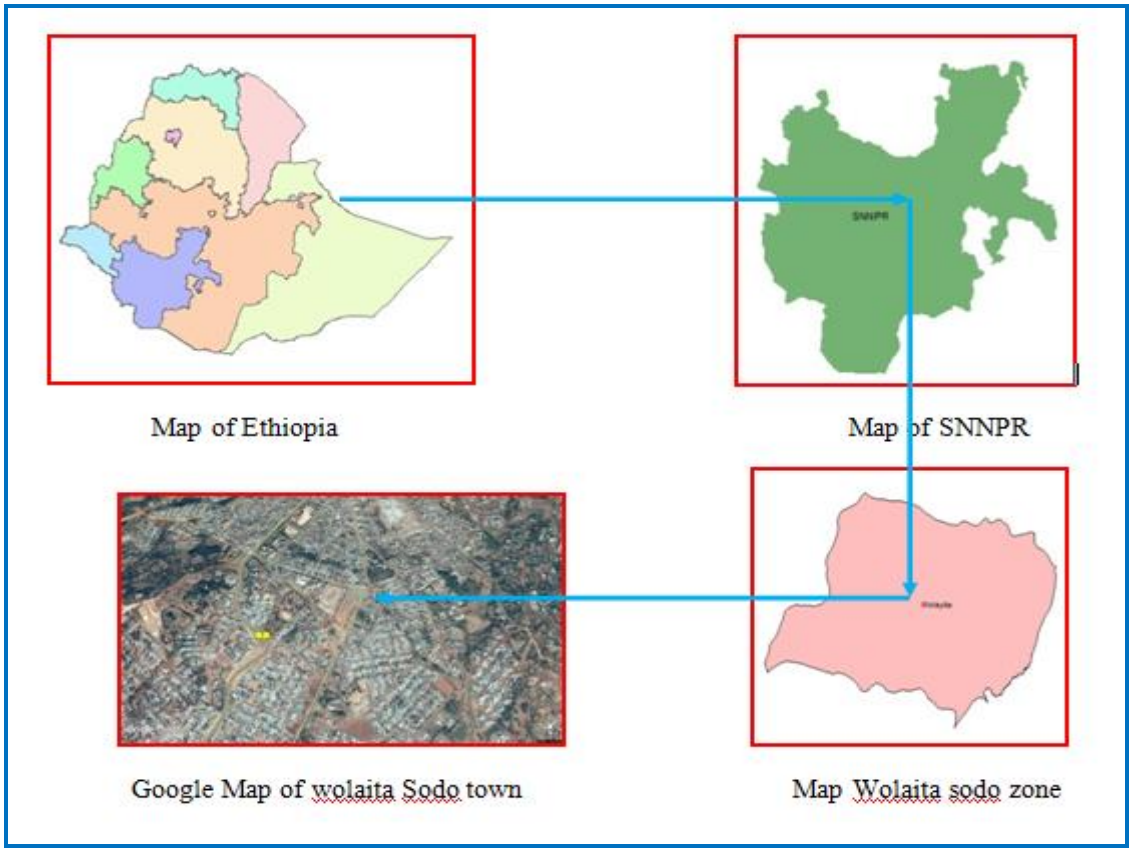


Figure 3: Geographic Location of the study Area. Source from Google and GIs, 2019

3.2. Research Design

The study will employ a mix of qualitative and quantitative study design.

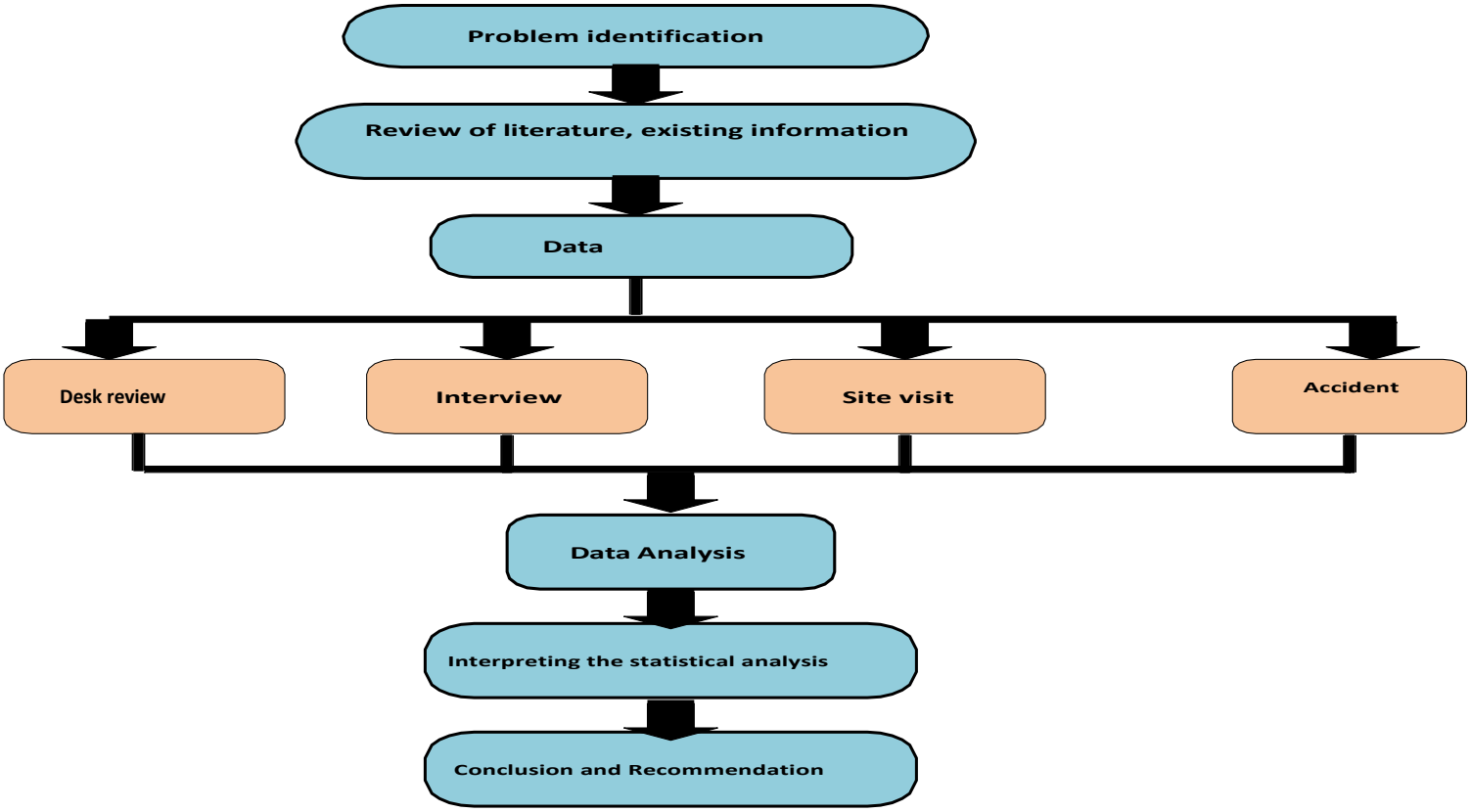


Figure 4: Schematic presentation of the research method

3.3. Study Variables

Dependent variable: road traffic accidents

Independent variables: road user's characteristics like socio-demographic factors, risky driving behaviours including driving fast for thrills, taking deliberate risks for fun, driving under the influence of alcohol, driving under the influence of drugs, excessive speed, dangerous overtaking, and close following (tailgating). Geometric elements like number of lane, lane width, median width and type, Shoulder Width, Gradients, Road surface Conditions.

3.4. Population and Sampling Method

The number of participants for risky behaviour was estimated by applying a single population proportion formula

$$n = \frac{(Cv)^2(Z)^2}{(d)^2}$$

Where

n: Required sample size,

Cv: Estimate of variance (proportion of road traffic accidents) = 62.5%

d: Desired precision rate or acceptable margin of error for proportion being estimated (= 0.05)

$$n = \frac{(0.625)^2(1.96)^2}{(0.05)^2} = 249$$

Participants were enrolled to the study by proportional allocation technique from different age and car type they drive. Traffic officers were also interviewed.

The sample size of road segments collected for road geometric design elements is also calculated by using single population proportion

Where;

n: Required sample size,

Cv: Estimate of variance (at low variance) = 0.1,

d: Desired precision rate or acceptable margin of error for proportion being estimated (= 0.05)

Z: Value of the standard normal statistic for an alpha confidence interval of two-sided = 1.96, 95%.

$$n = \frac{(0.1)^2(1.96)^2}{(0.05)^2} = 15.4 \approx 16$$

Convenience-sampling technique was used to select samples for the study. Convenience sampling method which is a non-random sampling method that relies on data collection from population members who are conveniently available (i.e. easily accessible) to data collectors.

3.5. Source of Data

Data were collected from primary and secondary sources. Primary sources were drivers, traffic officers whereas the secondary sources were traffic accident data record in Sodo town's road transport and safety office.

3.6. Data Collection Procedure

Data were collected from drivers and, traffic officers by face to face interview and by measuring road geometric design element using meter tape.

3.7. Data Presentation and Analysis

The collected data were checked for completeness and accuracy manually, then coded and entered in to Epi data version 3.5.3 computer software. Then it was subsequently transferred to SPSS version 20 for analysis. The result was presented in narrative, tables and charts.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1. Descriptive result of Road Users Characteristic

4.1.1. Demographic characteristics of drivers

A total number of 249 drivers were interviewed resulting in a response rate of 100%. Among the respondents, 94.7% were between 15- 30 years and the rests were over 30 years. The result shows majority of the respondents were at young age. This study found that females were at lower risk of crashing than males at all ages, however, the difference was high for young and novice drivers.

Table 1: Socio-demographic characteristic among road user in wolaita sodo town, SNNPR Ethiopia 2019 (n=249)

Variables		Frequency	Percent
Age of the driver	15-17 years	8	3.2
	18-20 years	88	35.3
	21-30 years	140	56.2
	Greater than 30 years	13	5.2
Sex	Male	226	90.8
	Female	23	9.2
Education level	First cycle 1-4	37	14.9
	Second cycle--5-8	104	41.8
	Third cycle 9-12	51	20.5
	Diploma and above	28	11.2
	No education	29	11.6
Vehicle type	Motorcycle	50	20.1
	three-wheel vehicle	100	40.2
	Automobile	20	8.0
	Truck	61	24.5
	Other	18	7.2
Driving experience	Less than 2 year	25	10.0
	2-4 year	72	28.9
	Greater than 4 year	152	61.0

Young novice drivers aged 17–25 years constitute a major public health concern. This group comprises inexperienced drivers who are involved in a large number of crashes with high rates of crash involvement (Scott-Parker et al. 2014). They are over-represented in crashes among all classes of road users across the world (WHO 2004), including Ethiopia (Hailemichael, Suleiman & Pauolos 2015), at high societal cost. According to the collected date majority (90.8%) of the drivers were male. Male drivers are more at risk of crash occurrence compared to female drivers.

According to study conducted in New Zealand (Begg, D, Langley, J.D., 2004) the group, who they labelled 'persistent risky drivers', were predominantly male and were more likely to have been involved in serious crashes resulting in injury than other drivers (Begg, DJ, Gulliver, P., 2008). Members of this group were characterized by higher aggression and alienation and lower traditionalism (Gulliver 2007).

4.1.2. DRIVERS RISKY BEHAVIOR

Quarter (24.5%) of respondents admitted that they have history of drink driving where as 75.5% have no. Three fourth (75.1%) of the study participants have habit of chewing chat whilst driving, the remaining 24.9% of respondents have no history of chewing chat and driving. Experience of driving at excessive speed was reported by 24.1% of participants whereas 75.9% report driving within the standard speed limit. Experience of taking deliberate risk for fun whilst driving was disclosed by 32.1% of the respondents. Generally 65.5% of the drivers have had traffic accident. Table4. 2 show the result of risky behaviour or road users in wolaita sodo town.

Table 2: Drivers behavior among road user in wolaita sodo town, SNNPR Ethiopia 2019 (n=249)

Variables		Frequency	Percent
Drunk and driving	Yes	61	24.5
	No	188	75.5
Driving while chewing chat	Yes	187	75.1
	No	62	24.9
Excessive speed	Yes	60	24.1
	No	189	75.9
Talking deliberate risk for fun	Yes	80	32.1
	No	169	67.9
Close following	Yes	133	53.4
	No	116	46.6
Driving fast for trill	Yes	163	65.4
	No	86	34.6

4.2. Road traffic accident among road users

Magnitude of respondents who had ever experienced road traffic accident was 86(34.7%). Among those respondent who experienced road traffic accident, 98.6% were males drivers.

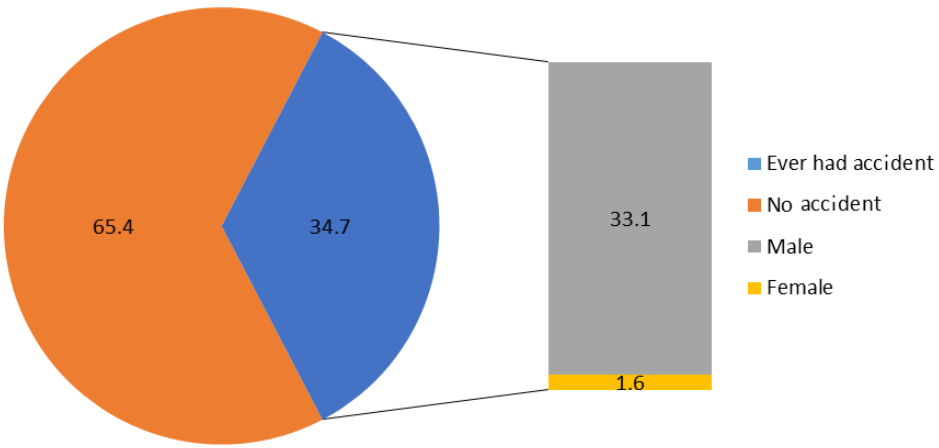


Figure 5: Magnitude of ever had road traffic accident among road user in wolaita sodo town, SNNPR Ethiopia 2019 (n=249)

4.3. Discussion of result road geometric elements

Table 3: Location of accident areas, wolaita sodo town, 2019

Locations	Accident no.	Lane width	Median width	Shoulder width	Gradient	Design speed
Yohannes Church	6	7	0	0	3	30
Kidanemiheret	8	7	0	1	3	30
Arada	10	7	0	1.5	4	30
Lideta	6	7	0	1.8	0	30
Keymeskel	9	8	0.6	0	4	30
Merkato	11	7	0	2	4	30
Tsegawyebzahe	8	7	0	0	4	30
Otona	6	7	0	0	4	30
Gofamazoria	14	7	0.8	0	6	40
Finance	8	8	0.8	1.5	0	30
Golla	25	8	0	2.4	8	40
Agip	7	8	0	0	6	30
Fikercaffe	12	8	0	0	4	30
Menaheria	8	8	0	0	4	30
Bruhetesfa	10	8	0	0	4	30
University	13	8	0.8	1.5	0	40

Figure 6: High accident areas, wolaita sodo town, 2019

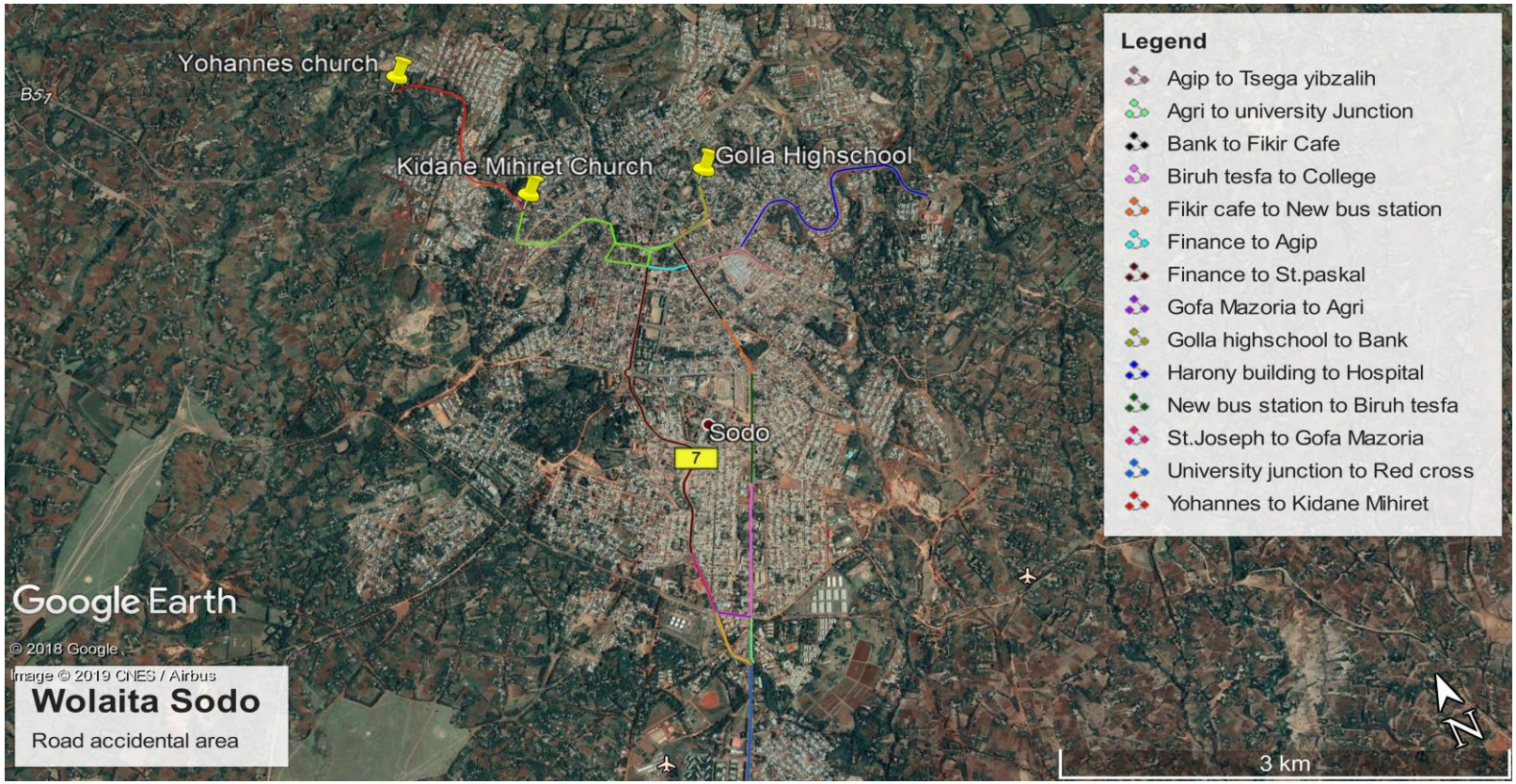


Figure 7: Google earth picture of Road accident area, Wolaiata Sodo town, 2019

Table 4: Multiple linear regressions out put

Regression Statistics	
Multiple R	0.951814741
R Square	0.905950
Adjusted R Square	0.858925
Standard Error	1.758874741
Observations	16

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	5	298.0011	59.6002	19.2654	0.0001
Residual	10	30.9364	3.0936		
Total	15	328.9375			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-31.6293	8.3462	-3.7897	0.0035	-50.2257	-13.0328	-50.2257	-13.0328
lane width	2.2829	0.9266	2.4637	0.0335	0.2183	4.3476	0.2183	4.3476
median width	-1.0220	2.0616	-0.4957	0.6308	-5.6154	3.5715	-5.6154	3.5715
shoulder width	2.1447	0.6026	3.5590	0.0052	0.8020	3.4874	0.8020	3.4874
Gradient	0.9520	0.2883	3.3026	0.0080	0.3097	1.5943	0.3097	1.5943
design speed	0.6194	0.1762	3.5144	0.0056	0.2267	1.0120	0.2267	1.0120

MODEL

Y=-31.6293+2.2829 LW-1.0220 MW+2.1447 SW+0.9520 G+0.6194 DS

Where; Y=traffic accident

LW=lane width

MW=median width

SW=shoulder width

G=gradient

DS=design speed

With R^2=0.90 and significance 0.0001 which is less than 0.005

Some of the predictor variables were found statistically significant in the analysis of the model. Explanatory variables such as; lane width, vertical grade, median width and design speed were in the model.

The model shows the lane width of road segment variable has a positive coefficient. This explains that when the lane width gets wider, road traffic crash frequency also increases which affect road safety. The finding is consistent with study conducted in Wolaita Sodo. (Hameed Aswad Mohamed volume 4, 2013) states that wider lanes are traditionally associated with higher operating speeds and increased safety. The Highway Capacity Manual (HCM) documents those wider lanes for multilane highways result in higher free-flow speeds. On the other hand, very little has been found on the safety implications of wider lanes. It is reasonable to assume that wider lanes may provide additional space to the driver to correct potential mistakes and thus avoid crashes. However, a driver could be expected to adapt to the available space, and the positive safety effects from the wider lanes may be offset by the higher speeds. Another reason is the higher speed on wider lanes could lead to more accidents.

Median width is another significant explanatory variable to crash occurrence with a negative estimated coefficient. The finding implies road crash frequency decrease as the width of the median increase. When the median width decreases and the lane gets wider this could lead to higher speed that results in crash occurrence. The roads in the study area have only raised type of median. Study conducted in Las Vegas Valley inferred that the road segments with raised median had lower rear-end, sideswipe and injury crash rates by 18.7%, 21.7%, and 23.7%, respectively (Timur, 2010). The shoulder width variable shows positive coefficient which implies wider shoulder is associated with higher traffic crashes on road segments.

Gradients are another variable that have positive relationship with road traffic crash occurrence on the road segments in the model. This is due to the fact that the higher grade is risk for traffic accident. Glennon et al. in their study in the United States, stated that grade sections have higher accident rates than level sections, steep gradients have higher accident rates than mild gradients and down gradients have higher accident rates than up gradients.

Model validation

The comparison between predicted accidents estimated by the proposed model and the real data, the results indicate that if the number of accidents is 0, 1 or equal or more than 2, model predicts correctly the probability of accidents (winter, 2012).

Table 5: Validation result

Residual Output			
Observation	**Observed accident value**	**Predicted accident no.**	**Residuals**
1	6	5.788053243	0.211946757
2	8	7.932745305	0.067254695
3	10	9.957079321	0.042920679
4	6	6.792535001	-0.792535001
5	9	8.409781601	0.590218399
6	11	11.02942535	-0.029425352
7	8	6.740041227	1.259958773
8	6	6.740041227	-0.740041227
9	14	14.02007932	-0.020079324
10	8	7.614474339	0.385525661
11	25	24.17181054	0.82818946
12	7	10.92693782	-3.926937823
13	12	9.022961854	2.977038146
14	8	9.022961854	-1.022961854
15	10	9.022961854	0.977038146
16	13	13.80811014	-0.808110136

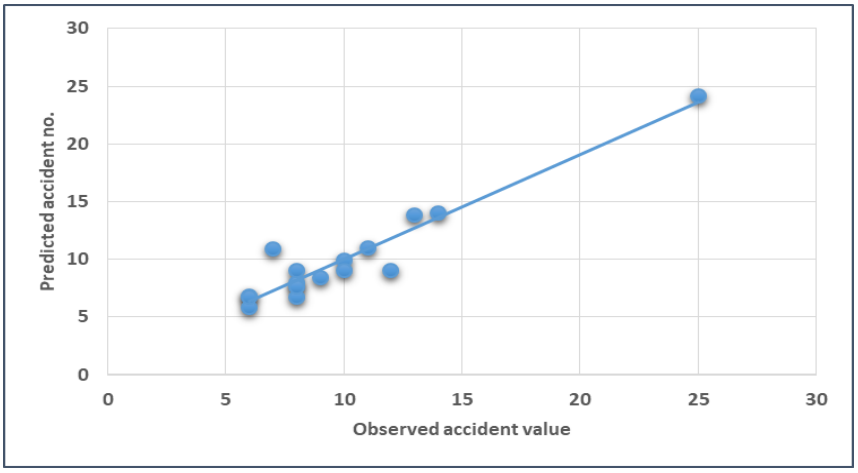


Figure 8: Observed and predicted accident number validation test

4.4. Road Traffic Crashes In Wolaita Sodo Town

The data below gives information about the general trends of crash occurrence in Wolaita Sodo town over the last five years from (2006 to 2010) the total number of accidents are 161. The figure also shows that the general crash records of road traffic accidents in Wolaita Sodo have been increasing from year to year.

Table 6: General crush records in wolaita sodo 2006-2010

Year (E.C)	Total no of accident	Fatal	Injuries	PDO
2006	33	3	20	10
2007	35	3	18	14
2008	23	3	12	8
2009	34	11	14	9
2010	36	13	16	7
Total	161	33	80	48
Percentage (%)	100	20.5	49.7	29.8

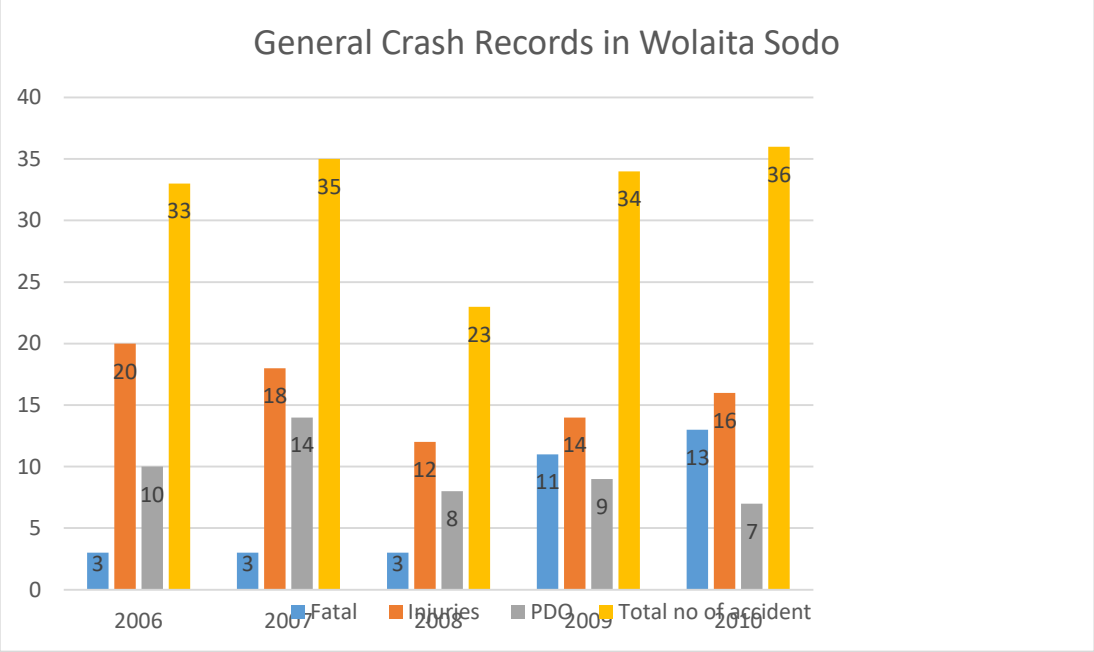


Figure 9: Total number of accidents distributed over the five years of analysis period.

4.4.1. Accident by vehicle type

Table 7: Accident by vehicle type, wolaita sodo town, 2019

Types of Severity	Motor	Three-wheel vehicles	Truck	Minibus
Fatal	16	10	5	2
Injury	30	23	17	10
Property damage	10	6	18	14
Sum	56	39	40	26
%	34.8	24.22	24.88	16.15

Among the four categories shown in the above table motors and three-wheel vehicles share 34.8% and 24.22% whereas Trucks and Minibuses share 24.88% and 16.15 % of fatalities, injury and property damage respectively.

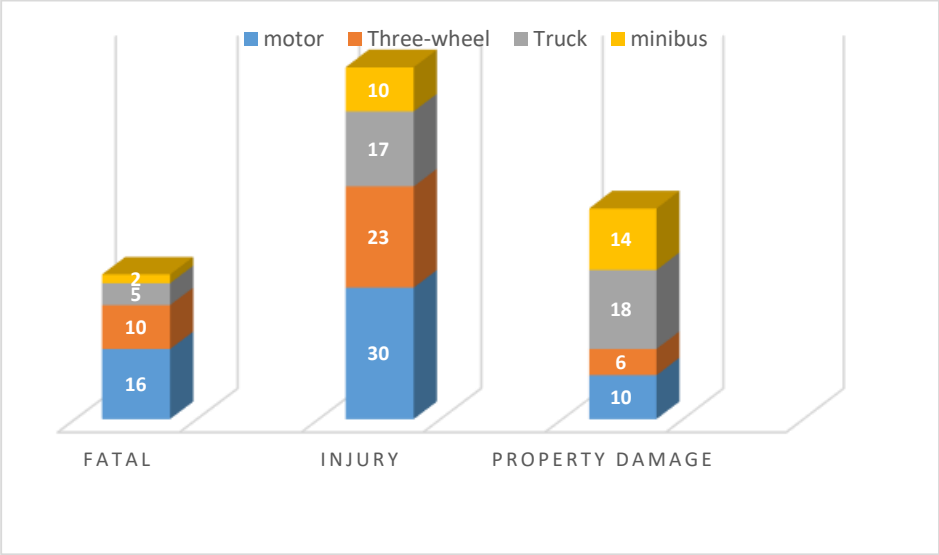


Figure 10: Shows accident by vehicle type

4.5. Cause of road traffic crashes

According to the traffic police reports there are different causes of road traffic crashes drunk driving, driving without respecting the right-hand rule, failure to give-way for the other vehicles, failure to give-way for pedestrians, tailgating, improper turning after overtaking, driving above speed limit, improper overtaking, improper turning, not respecting traffic rules, and others. Major causes of road traffic crashes for the consecutive five years from 2006-2010 were; tailgating (15%) failure to give-way for the other vehicles (25.2%), and failure to give way for pedestrians (55.5%) whereas, some other factors had almost negligible contribution to crashes (drink driving, drug driving, improper turning after overtaking not respecting traffic sign and others. the causes of road traffic crashes were generally classified into human factors; related to driver, passenger, and pedestrian which accounts about 95.5% of the total crashes (i.e. main causes of road crashes) and non-human factors; those factors related to weather conditions, road characteristics and mechanical defects of vehicles, which accounts only 2.5% of total crashes. Furthermore, other causes of road crashes that are not mentioned were about 1% and unidentified causes of crashes estimated (1%) were included in the report.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The research has assessed the relation of road users' behavior and geometric elements to traffic accident in wolaita sodo town. For the assessment of road users' behavior, the geometric data, and the traffic accident data were analyzed. The cause of traffic accident in Sodo town was identified and discussed. This helps to suggest possible solutions to prevent and reduce traffic accidents.

In wolaita sodo town 161 road traffic accidents were recorded during the last five years. This indicates an average of 52.2 road traffic accidents have occurred every year. Major causes of road traffic crashes for the consecutive of five years 2006-2010 were; tailgating (15%), failure to give-way for the other vehicle (25.2%), and failure to give-way for pedestrians (55.5%) whereas other factors like drink driving, drug driving, improper turning after overtaking and not respecting traffic sign had almost negligible contribution to crashes. The causes of road traffic crashes were generally classified into human factors; related to driver, passenger, and pedestrian which accounts about 95.5% of the total crashes (i.e. main causes of road crashes) and non-human factors; those factors related to weather conditions, road characteristics and mechanical defects of vehicles, which accounts only 2.5% of total crashes. Furthermore, other causes of road crashes that are not mentioned were about 1% and unidentified causes of crashes estimated (1%) were included in the report.

Selected road geometric parameters in the study were: lane width, median width, shoulder width, gradient and design speed. The study used sixteen representative road segments to achieve the stated objectives using convenience sampling. The model shows that road traffic frequency in selected road segment in the town. The model shows the lane width of road segment variable has a positive coefficient. This explains that wider lane width increases road traffic crash frequency and thereby affect road safety.

Median width is another significant explanatory variable to crash occurrence with a negative estimated coefficient. When the median width decreases and lane gets wider it leads to higher speed which results in crash occurrence. The shoulder width variable shows positive coefficient which implies the wider the shoulder, the higher traffic crashes on road segments. Gradients are another variables that showed positive relationship with road traffic crash occurrence among road segments. Because, higher grade are risky for traffic accident.

5.2. Recommendation

To minimize road traffic accident in Wolaita Sodo town, following recommendations are given to the authority.

- To provide adequate shoulders
- Provide speed breakers
- Provide medians
- Create awareness for driver's on speed limit

- Maintenance of roads and pavement markings
  - ✓ Posting speed limits to minimize
  - ✓ Marking of Zebra crossings
  - ✓ Widening of road way and construction of adequate side walk
  - ✓ Construction of parking areas and relocating markets in urban centers
  - ✓ Traffic safety office should provide traffic signals,
  - ✓ Create awareness for pedestrians, passengers, about traffic accident
  - ✓ The vehicle-to-vehicle crash is the second most common type of RTAs in this study area next vehicle to pedestrian crash. Hence, continuous and participatory public campaigns concerning the use of roads should be given to pedestrians in the town.
  - ✓ Most of the motor drivers in the town very young and at the interval of 15 – 17 this leads to increase the accident to the town so, the concerned body should be considered. Which gives the driving license should be seriously assessing the capability of drivers and monitor the training given to learners by private agencies.

REFERENCES

Arnedt, JT, Geddes, A.C., MacLean, A.W., 2005, 'Comparative sensitivity of a simu-lated driving task on self-report, physiological, and other performance measuresduring prolonged wakefulness. Journal of Psychological Research 58, 61–71.'.

Ball, CG, Kirkpatrick, A.W., Brenneman, F.D., 2005, 'Noncompliance with seat-beltuse in patients involved in motor vehicle collisions. Canadian Journal of Surgery48, 367–374'.

Begg, D, Langley, J.D., 2004, 'Identifying predictors of persistent non-alcohol ordrug-related risky driving behaviours among a cohort of young adults. Accid.Anal. Prev. 36, 1067–1071,'.

Begg, DJ, Gulliver, P., 2008, 'A longitudinal examination of the relationshipbetween adolescent problem behaviours and traffic crash involvement duringyoung adulthood. Traffic Inj. Prev. 9, 508–514,'.

Begg, DJ, Langley, J., 2001, 'Changes in risky driving behavior from age 21 to 26years. J. Saf. Res. 32, 491–499,'.

CDC 2013, *Web-based injury statistics query and reporting system (WISQARS) [Online]. (2013). National Center for Injury Prevention and Control, Centers for Disease Control and Prevention.*

Delhomme, P 1991, 'Comparing one's driving with others': Assessment of abilities and frequency of offences. Evidence for a superior conformity of selfbias? Accident Analysis & Prevention, 23(6), 493–508.'.

Donaldson, LH, Brooke, K & Faux, SG 2009, 'Orthopaedic trauma from road crashes: is enough being done?', *Australian Health Review*, vol. 33, no. 1, pp. 72-83.

Glendon, AI, Dorn, L., Davies, D. R., Matthews, G., & Taylor, R. G. 1996, 'Age and gender differences in perceived accident likelihood and driver competences. Risk Analysis, 16(6), 755–762. '.

Gregersen, NP 1996, 'Young drivers' overestimation of their own skill—An experiment on the relation between training strategy and skill. Accident Analysis & Prevention, 28(2), 243–250. '.

Gulliver, P, Begg, D., 2007, 'Personality factors as predictors of persistent riskydriving behaviour and crash involvement among young adults. Inj. Prev. 13,376–381,'.

Hailemichael, F, Suleiman, M & Pauolos, W 2015, 'Magnitude and outcomes of road traffic accidents at Hospitals in Wolaita Zone, SNNPR, Ethiopia', *BMC research notes*, vol. 8, no. 1, p. 135.

Hilton, J 2006, 'Race and Ethnicity in Fatal Motor Vehicle Traffic Crashes 1999–2004, Washington, DC: National Highway Traffic Safety Administration.'.

Horswill, MS, Waylen, A. E., & Tofield, M. I., 2004, 'Drivers' ratings of different components of their own driving skill: A greater illusion of superiority for skills that relate to accident involvement. Journal of Applied Social Psychology, 34(1), 177–195.'.

Iversen, H 2004, 'Risk-taking attitudes and risky driving behaviour', *Transportation Research Part F: Traffic Psychology and Behaviour*, vol. 7, no. 3, pp. 135-150.

Iversen, H 2004, ' Risk-taking attitudes and risky driving behaviour. TransportationResearch Part F: Traffic Psychology and Behaviour 7 (3), 135–150'.

Iyinam, A, Iyinam, S & Ergun, M 1997, 'Analysis of relationship between highway safety and road geometric design elements: Turkish case', *Technical University of Istanbul, Faculty of Civil Engineering, Turkey*.

Jaffar Hussain, S 2006, *Road traffic injuries: a hidden epidemic and grow-ing public health concern, and the WHO response to the problem. In:Proceedings from the Regional Road Safety Conference (Road Safety with-out Borders Conference), 6–7 November 2006,* , Dubai, UAE, , <http://www.roadsafety2006dubai.com>.

Jonah, BA 1986, 'Accident risk and driver risk-taking behaviour among youngdrivers. Accident Analysis and Prevention 18, 255–271.'.

Lajunen, T, Parker, D & Summala, H 2004, 'The Manchester driver behaviour questionnaire: a cross-cultural study', *Accident Analysis & Prevention*, vol. 36, no. 2, pp. 231-238.

Lardelli-Claret, P, de Dios Luna-del-Castillo, J, Jiménez-Mejías, E, Pulido-Manzanero, J, Barrio-Anta, G, García-Martín, M & Jiménez-Moleón, JJ 2011, 'Comparison of two methods to assess the effect of age and sex on the risk of car crashes', *Accident Analysis & Prevention*, vol. 43, no. 4, pp. 1555-1561.

Lawton, R, Parker, D, Stradling, SG & Manstead, AS 1997, 'Predicting road traffic accidents: The role of social deviance and violations', *British Journal of Psychology*, vol. 88, no. 2, pp. 249-262.

Mayhew, DR, Donelson, A.C., Beirness, D.J., Simpson, H.M., 1986, ' Youth, alcoholand relative risk of crash involvement. Accident Analysis and Prevention 18,273–287.'.

Moore, VM, Dolinis, J., Woodward, A.J., 1995, ' Vehicle speed and risk of a severecrash. Epidemiology 6, 258–262.'.

NHTSA 2013a, *2011 YOUNG DRIVERS Traffic Safety Fact Sheet. (DOT HS 811 744). Washington DC: US Department of Transportation* <http://www-nrd.nhtsa.dot.gov/Pubs/811744.pdf.>.

NHTSA 2013b, *2011 YOUNG DRIVERS Traffic Safety Fact Sheet. (DOT HS 811 744). Washington DC: US Department of Transportation Retrieved from* <http://www-nrd.nhtsa.dot.gov/Pubs/811744.pdf>.

Parker, D, Reason, JT, Manstead, AS & Stradling, SG 1995, 'Driving errors, driving violations and accident involvement', *Ergonomics*, vol. 38, no. 5, pp. 1036-1048.

Parker, D, Reason, J.T., Manstead, A.S.R., Stradling, S.G., 1995, 'Driving errors, drivingviolations and accident involvement. Ergonomics 38, 1036–1048.'.

Peden M, SR, Sleet D, Mohan D, Hyder AA, Jarawan E, editors 2004, *World report on road traffic injury prevention. Geneva: World Health Organization;* , <http://www.wpro.who.int/philippines/topics/injuries/world_report_traffic_injury_prevention.pdf>.

Pronin, E, Gilovich, T., & Ross, L. 2004, 'Objectivity in the eye of the beholder: Divergent perceptions of bias in self versus others. Psychological Review, 111(3), 781.'.

Reason, J, Manstead, A, Stradling, S, Baxter, J & Campbell, K 1990, 'Errors and violations on the roads: a real distinction?', *Ergonomics*, vol. 33, no. 10-11, pp. 1315-1332.

Rhodes, N, Brown, D & Edison, A 2005, 'Approaches to understanding young driver risk taking', *Journal of safety research*, vol. 36, no. 5, pp. 497-499.

Scott-Parker, B, Watson, B, King, MJ & Hyde, MK 2014, '"I drove after drinking alcohol" and other risky driving behaviours reported by young novice drivers', *Accident Analysis & Prevention*, vol. 70, pp. 65-73.

Shope, JT 2007, 'Graduated driver licensing: review of evaluation results since 2002', *Journal of safety research*, vol. 38, no. 2, pp. 165-175.

Stephens, AN, & Ohtsuka, K. 2014, 'Cognitive biases in aggressive drivers: Does illusion of control drive us off the road? Personality and Individual Differences, 68, 124–129. '.

Svenson, O 1981, 'Are we all less risky and more skillful than our fellow drivers? Acta Psychologica, 47(2), 143–148. '.

Taylor, SE, & Brown, J. D. 1988, 'Illusion and well-being: A social psychological perspective on mental health. Psychological Bulletin, 103(2), 193.'.

Tooth, R 2010, *The Cost of Road Crashes*, <http://www.econ.mq.edu.au/Econdocs/research>.

Tursz, A 2000, 'Adolescents' risk-taking behavior, myth or reality: evidence from international data. In Injury Prevention and Control, Edited by: Mohan, D and Tiwari, G. 149–166. London: Taylor & Francis. '.

Vanlaar, W, Mayhew, D, Marcoux, K, Wets, G, Brijs, T & Shope, J 2009, 'An evaluation of graduated driver licensing programs in North America using a meta-analytic approach', *Accident Analysis & Prevention*, vol. 41, no. 5, pp. 1104-1111.

Vassallo, S, Smart, D., Spiteri, M., Cockfield, S., Harris, A., Harrison, W., 2014, 'Stability of risky driving from late adolescence to early adulthood. Accid. Anal.Prev. 72, 161–168,'.

Vernon, DD, Cook, L.J., Peterson, K.J., Michael Dean, J., 2004, ' Effect of repeal of thenational maximum speed limit law on occurrence of crashes, injury crashes,and fatal crashes on Utah highways. Accident Analysis and Prevention 36,223–229.'.

WHO 2013, *Road traffic injuries. Fact Sheet No 358. Retrieved July 6, 2013,*, <http://www.who.int/mediacentre/factsheets/fs358/en/.>.

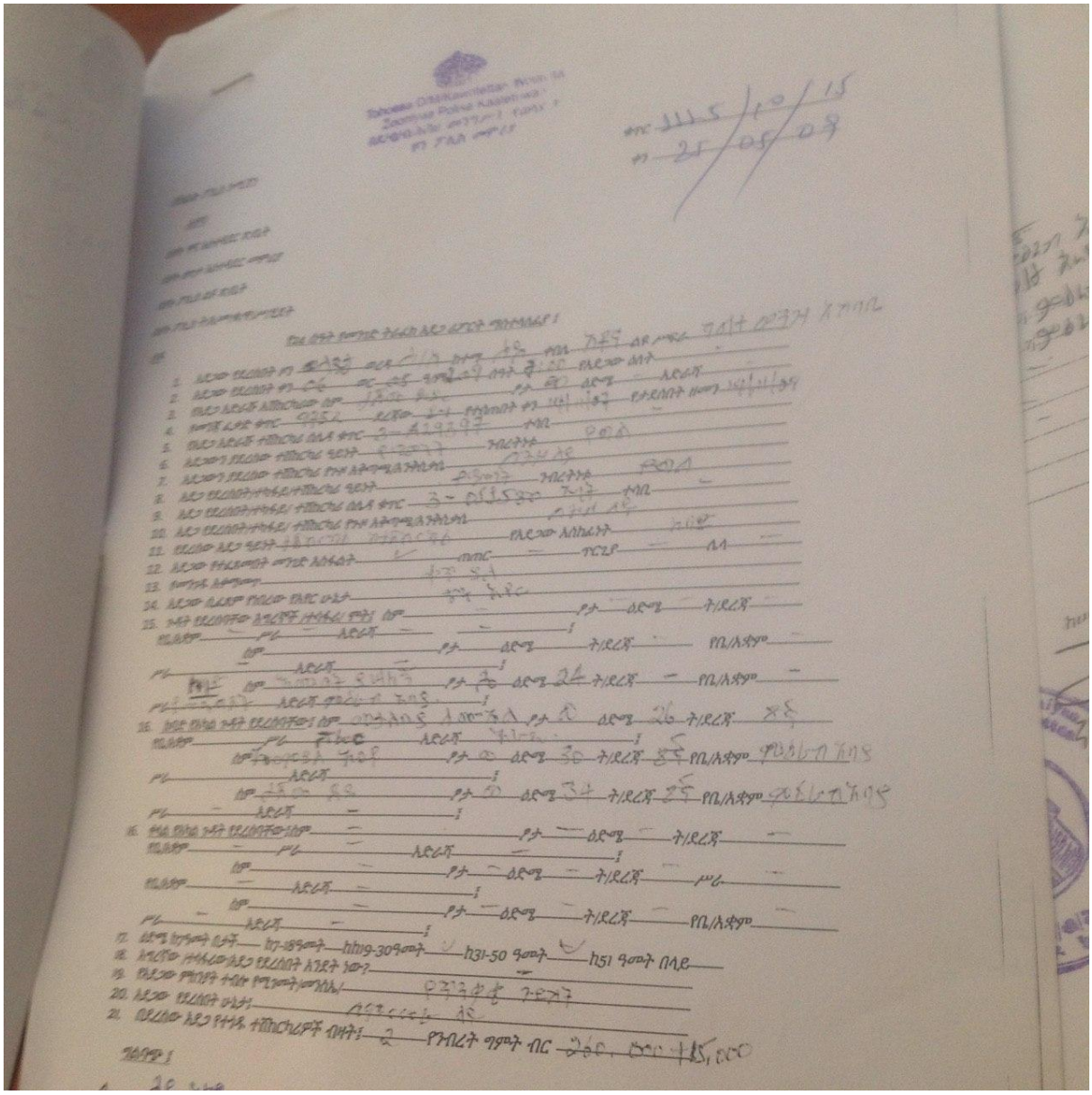
WHO 2004, *The World Health Report 2004: Changing History*, <http://www.who.int/whr/2004/en/report04>.

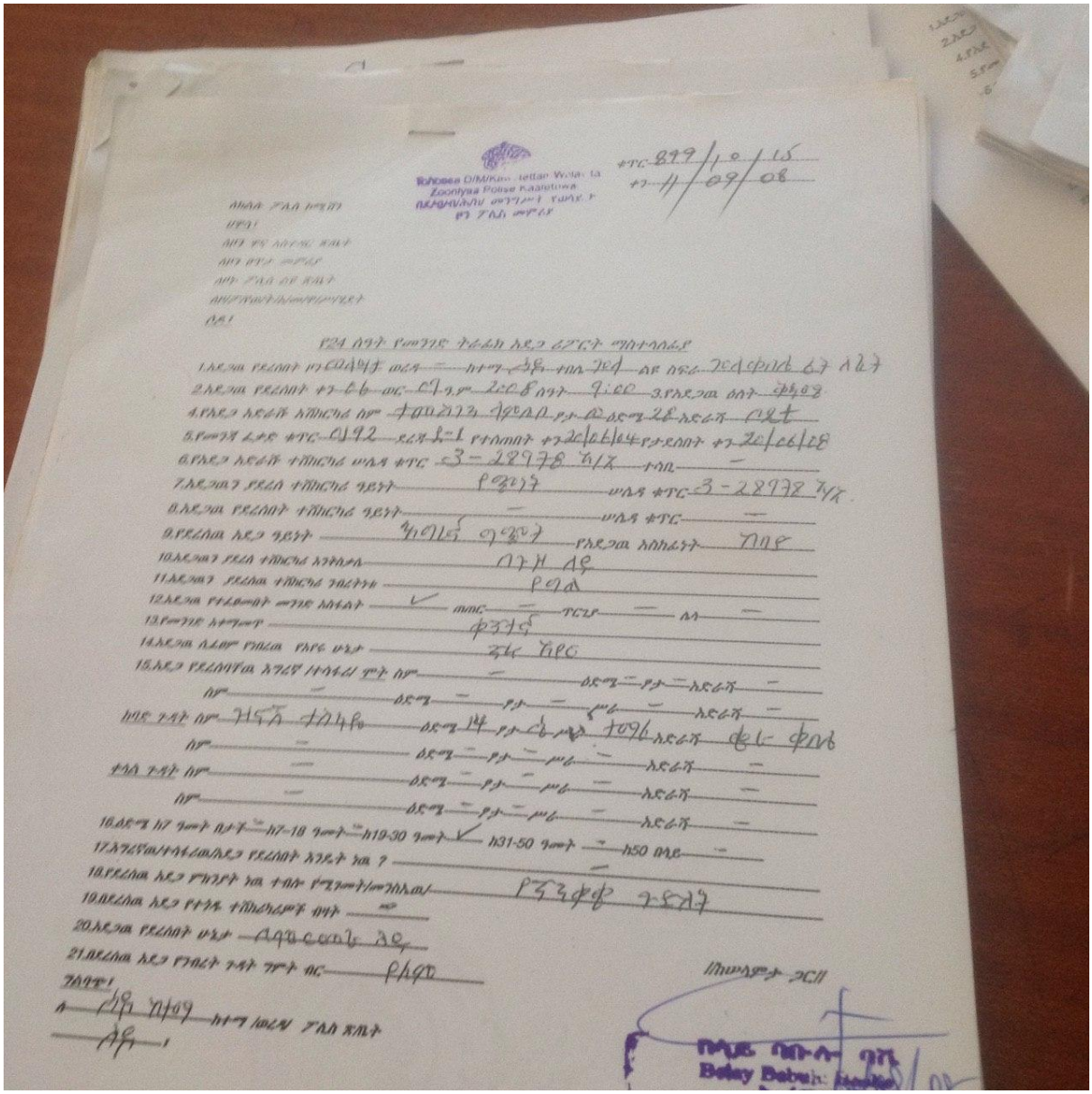
Williams, AF 2003, 'Views of US drivers about driving safety. Journal of Safety Research, 34(5), 491–494. '.

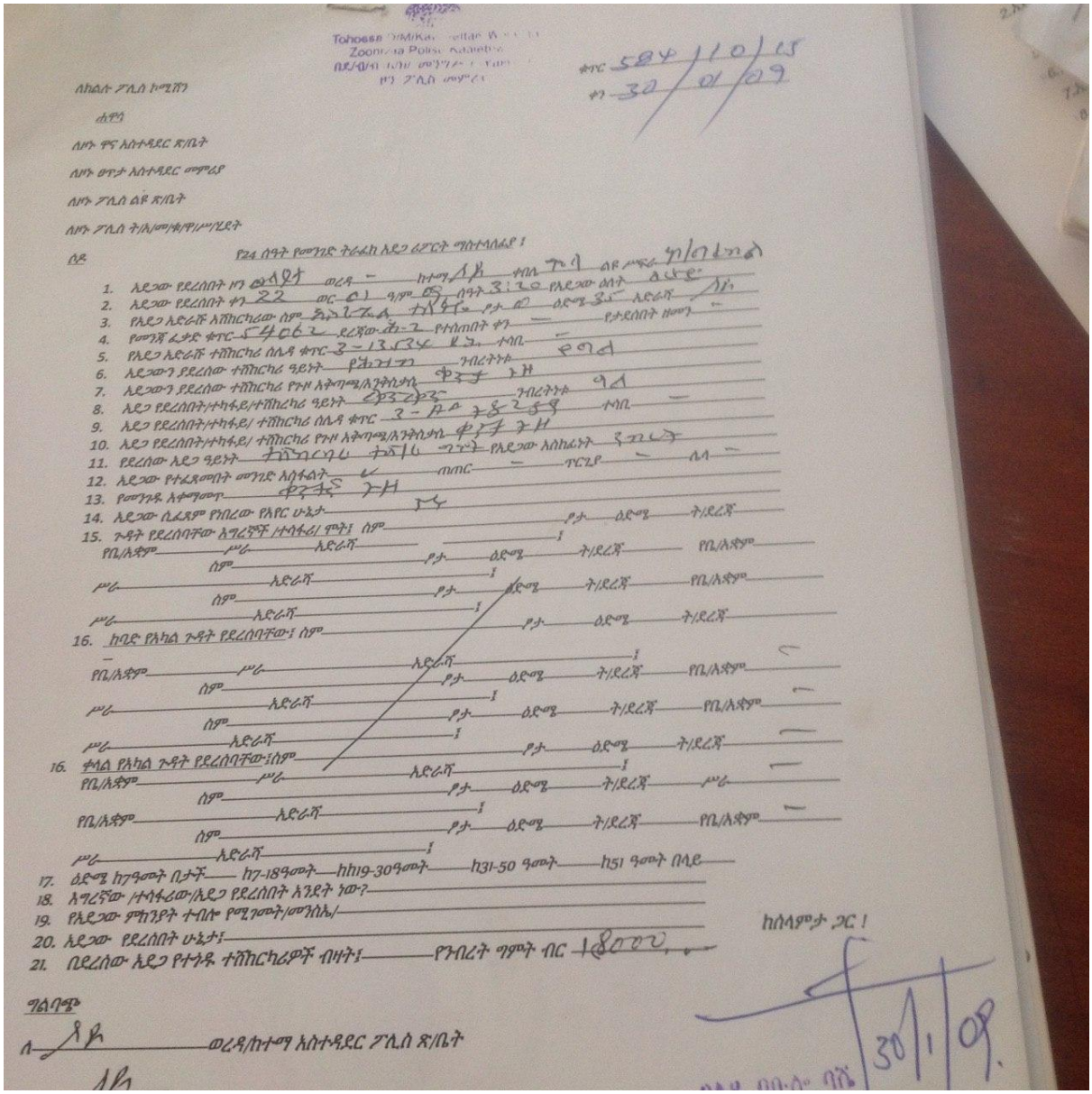
World Health Organization 2015, *Global Status Report on Road Safety 2015.* , <http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/.>.

APENDEX A

Road Traffic Sample Records in Wolaita Sodo Town







ለክልሉ ፖሊስ ኮሚሽን

ሐዋሳ

ለዞኑ ዋና አስተዳደር ጽ/ቤት

ለዞኑ ወጥታ አስተዳደር መምሪያ

ለዞኑ ፖሊስ ልዩ ጽ/ቤት

ለዞኑ ፖሊስ ት/ቤ/መ/ቁ/ዋ/ሥ/ሂደት

ለዶ የ24 ሰዓት የመንገድ ትራፊክ አደጋ ሪፖርት ማስተላለፊያ ፣

1. አደጋው የደረሰበት ዞን ወላይታ ወረዳ – ከተማ ሶዶ ቀበሌ ጉሎ ልዩ ሥፍራ ካ/ባቴል
2. አደጋው የደረሰበት ቀን 22 ወር 01 ዓ/ም 09 በሰዓት 3:30 የአደጋው ዕለት ሰኞ
3. የአደጋ አድራሹ ለሽከርካሪው ሰም ኃ/ገብርኤል ታ/ዮሐ ፆታ ወ ዕድሜ 35 አድራሻ ሶዶ
4. የመንጃ ፈቃድ ቁጥር 54062 ደረጃው ሲ1-2 የተሰጠበት ቀን — የታደሰበት ዘመን —
5. የአደጋ አድራሹ ተሽከርካሪ ሰሌዳ ቁጥር 3-13524 ዩኒ. ተሳቢ —
6. አደጋውን ያደረሰው ተሽከርካሪ ዓይነት የሕዝብ ንብረትነቱ የግል
7. አደጋውን ያደረሰው ተሽከርካሪ የጉዞ አቅጣጫ/አንቅስቃሴ ቀጥታ ነዘ
8. አደጋ የደረሰበት/ተሳፋይ/ተሽከርካሪ ዓይነት ሚኒባስ ንብረትነቱ ግለ
9. አደጋ የደረሰበት/ተሳፋይ/ ተሽከርካሪ ሰሌዳ ቁጥር 3-ኮ0 ተ2598 ተሳቢ —
10. አደጋ የደረሰበት/ተሳፋይ/ ተሽከርካሪ የጉዞ አቅጣጫ/አንቅስቃሴ ቀጥታ ነዘ
11. የደረሰው አደጋ ዓይነት ተሽከርካሪ ተሽከ ግጭት የአደጋው አስከፊነት ንብረት
12. አደጋው የተፈጸመበት መንገድ አስፋልት ሬ ጠጠር — ጥርጊያ — ሌላ —
13. የመንገዱ አቀማመጥ ቀጥተኛ ነዘ ኮ
14. አደጋው ሲፈጸም የነበረው የአየር ሁኔታ
15. ጉዳት የደረሰባቸው አግረኛች /ተሳፋሪ/ ሞት፤ ሰም ፆታ ዕድሜ ት/ደረጃ
የቤ/አድም ሥራ አድራሻ
ሰም ፆታ ዕድሜ ት/ደረጃ የቤ/አድም
ሥራ አድራሻ
ሰም ፆታ ዕድሜ ት/ደረጃ የቤ/አድም
ሥራ አድራሻ
16. ከባድ የአካል ጉዳት የደረሰባቸው፤ ሰም ፆታ ዕድሜ ት/ደረጃ
የቤ/አድም ሥራ አድራሻ
ሰም ፆታ ዕድሜ ት/ደረጃ የቤ/አድም
ሥራ አድራሻ
16. ቀላል የአካል ጉዳት የደረሰባቸው፤ሰም ፆታ ዕድሜ ት/ደረጃ
የቤ/አድም ሥራ አድራሻ
ሰም ፆታ ዕድሜ ት/ደረጃ ሥራ
የቤ/አድም አድራሻ
ሰም ፆታ ዕድሜ ት/ደረጃ የቤ/አድም
ሥራ አድራሻ
17. ዕድሜ ከ7ዓመት በታች ከ7-18ዓመት ከ19-30ዓመት ከ31-50 ዓመት ከ51 ዓመት በላይ
18. አግረኛው /ተሳፋሪው/አደጋ የደረሰበት አገደት ነው?
19. የአደጋው ምክንያት ተብሎ የሚገመት/መንስኤ/
20. አደጋው የደረሰበት ሁኔታ፤
21. በደረሰው አደጋ የተጎዱ ተሽከርካሪዎች ብዛት፤ የንብረት ግምት ብር 1ሺ000

ከሰላምታ ጋር !

ግልባጭ

ለ ኦ/ኦ ወረዳ/ከተማ አስተዳደር ፖሊስ ጽ/ቤት

30/1/09