DETERMINANTS OF SEVERITY OF ROAD ACCIDENTS INVOLVING BUSES ALONG KENYAN ROADS: A CASE OF NAIROBI - KISUMU HIGHWAY, KENYA

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DECLARATION

This research report is my original work and has never been presented for a degree or any other award in any other Institution of higher learning.

Signed…….. Date…….

ADM NO. L50/68212/2011
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This research report has been submitted for examination with my approval as the University supervisor.

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DEDICATION

To my family members: Leon Mutugi, Anne Gichuki and Beatrice Njoki for their support and understanding when I was not there for them working on this study. Also I dedicate this work to my immediate boss – Mr. James Njoroge for the support and encouragement throughout this course. Thank you for your endurance and cover-up when I was not available during the study.

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ABBREVIATIONS AND ACRONYMS

AKI – Association of Kenya Insurers

BAC – Blood Alcohol Concentration

DALY - Disability-Adjusted Life Year

FMVSS - Federal Motor Vehicle Safety Standard

GVWR – Gross Vehicle Weight Rating

HIV/ AIDS – Human Immunodeficiency Virus infection / Acquired Immunodeficiency Syndrome

KEBS – Kenya Bureau of Standards

KeNHA – Kenya National Highways Authority

KNH – Kenyatta National Hospital

LSHS – Labh Singh Harnam Singh

NCST – National Council for Science and Technology

ROPBs – Roll over Protection Bars

PSVs – Public Service Vehicles

RTA – Road Traffic Accident

RTI – Road Traffic Injury

SPSS - Statistical Packages for the Social Sciences

TLB – Transport Licensing Board

UK – United Kingdom

USA – United States of America

ABSTRACT

This study sought to analyze severity of road accidents occurring along Nairobi – Kisumu highway involving buses. It took particular interest in the main causes of accident and relationship between the severity of the road accident to the occupants and speeding, drunk-driving, seat belt use and incorporation of roll over protection bars in the vehicle body structure. The Government of Kenya through the previously known Ministry of Transport has implemented structures to enforce traffic rules aimed at reducing the road traffic accidents. The ministry introduced speed governors installation on all public service vehicles and enforced it by ensuring that road traffic police were patrolling and checking compliance randomly all over the country. All drivers including personal car drivers were required not to drink and drive. To curb this, the ministry introduced alcohol blow gadgets aimed at enforcing the drunk-driving regulations. The traffic police set barriers randomly all over the country to ensure compliance. Those found drunk were fined heavily and this made drivers to comply with the regulation. The ministry also introduced use of seat belt in all public service vehicles (PSV) by ensuring that the vehicles were fitted with functional belts and regular checks by police which led to compliance. The ministry however, has not made installation of roll over protection bars in the PSV a requirement. This study involved an in-depth literature review on similar or related cases on factors that affect the severity of an accident which includes speed, drunk-driving, seat belts use, inclusion of roll over protection bars in the bus body structure. Each objective was researched on and results examined on their effects on the severity of the road traffic accident. An ex-post facto research design was adopted and research survey method incorporated to gather data from various stakeholders. An open ended questionnaire approach was used to gather data. To enhance validity of the instrument, a pre-test study was carried out and results analyzed so as to ensure that the true phenomenon under study was captured. The questionnaires were also subjected to test whereby triangulation method was conducted to check on research instrument reliability. Data was collected from the Insurance Company's assessors who insure public service vehicles and bus body builders. Secondary data was gathered from books, websites, among other relevant sources. An inferential analysis was utilized to establish present relationships between the independent variables and the dependent variable. Karl Pearson's measure of relationship, measure of dispersion such as standard deviation and measure of asymmetry was utilized for analysis. The data findings were then presented in frequency and correlation tables. Researcher found that speed and availability of roll over protection bars were the major determinants of road accident severity. It was also noted that most passengers do not fasten their seat belts while travelling in a bus and few bus crews encourage them to fasten the belts. The few buses installed with roll over protection bars recorded very few fatalities compared to the buses without roll over protection bars. There is insufficient data recorded and documented in regard to alcohol abuse by drivers involved in road accidents. The researcher recommended that all buses to be fitted with roll over protection bars, government to enforce use of tamper proof speed governors, police to enforce use of seat belts and Breathalyzer to be reinstated in the Kenya roads. Police and doctors to record and document the blood alcohol concentration levels in all drivers who are involved in road traffic accidents.

CHAPTER ONE
INTRODUCTION

1.1 Background of study

Growing number of motor vehicles is one of the main factors contributing to global road crash injuries. Much has been done in relation to the growth and increase in exposure to the risk, but not enough to curb the menace. Motor industry growth has brought societal benefit and cost, of which road accidents contribute significantly to the latter. As old as this reference is, in 1988 Agoki noted that two deaths were recorded in 1896 in Great Britain and one in the USA in 1899 due to motor vehicles accident. From these small beginnings a terrible stream of roads deaths and injuries has followed. See Figure 3, A-07 and A-08.

An analysis of Road Traffic Accidents (RTA) in Great Britain as noted by Agoki (1988), there was a steady increase of the total number of casualties for period between 1939 and 1960. In Federal Republic of Germany, Fraboose (as noted by Agoki 1988) despite the great increase in traffic volumes the risk of becoming involved in a RTA decreased. And motorways were found to be the safest roads for motorized traffic. According to Peden, Scurfield, Sleet, Mohan D, Hyder, Jarawan and Mathers, (2004) about 1.2 million persons are killed in road traffic crashes every year and 20 million to 50 million more are injured or disabled in these crashes worldwide. Road traffic fatalities account for 2.1% of global mortality and 23% of all injury deaths worldwide. The position of road traffic injuries as a contributor to the global burden of disease is predicted to rise from tenth place in 2002 to eighth place by 2020, (Peden, et al, 2004). See table 4.

Road accidents in developed countries have decreased since 1960s due to sound implementation of traffic laws such as speed limit enforcement, safety belt, alcohol and driving, better and safer vehicle design, well designed and maintained roads and effective traffic controls. According to World Health Organization report (2002) mentioned by Worley (2008) Road Traffic fatalities declined by 27% in the United States of America and by 63% in Canada from 1975 to 1988. This shows that an increase in traffic volume does not necessary translate to increase in road traffic accidents.

Eighty-eight countries have however reduced the number of deaths on their roads – but the total number of road traffic deaths remains unacceptably high at 1.24 million per year. The overall global road traffic fatality rate is 18 per 100 000 population. Middle-income countries have the highest

annual road traffic fatality rates, at 20.1 per 100 000, while the rate in high-income countries is lowest, at 8.7 per 100 000, (Global Status Report on Road Safety, 2013). See figures A-01 and A-03.

Road traffic accidents in Tanzania rose by 44% between 1990 and 2000 according to Museu, Mcharo and Lashabai, (2002). A total of injured passengers were 56% followed by pedestrians at 25%. Similar trends have been reported across East Africa. Tanzanian police attributed over 50% of accidents occurring due to reckless driving, while un-road worthy vehicles contributed about 15% of all accidents. However, lack of side pavements for pedestrians and pedal cyclist on the roads caused some accidents and this was referred to as poor road design, see Figure 11. Tanzanian police attributed alcohol abuse to only 1% as a cause of accident whereas their counterparts in Zambia found that 30% of road traffic accidents (RTA) had high levels of blood alcoholic concentration (BAC). Lack of gadgets to measure BAC levels in the victims on Tanzania could have led to conclusion that alcohol abuse minutely contributed to RTAs. Most probably some of the reckless drivers who caused over 50% of accidents on Tanzanian roads could have been under the influence of alcohol.

In Kenya, according to Bhushan 1993, cited by Muyia 1995, out of 333000 vehicles registered in the country by the year 1990, 17600 were matatus. And by 2003, the number of Matatus operating in both urban and rural areas were estimated at 40,000 (Asingo, 2004). They comprised Nissan Caravan (Matatus), mini-buses and pickups. They provided vast employment to nearly 160000 people and also generated revenues to the Government through charges for licenses, Value-added tax, duty, levies, and fines among others. Unfortunately, the industry growth has led to increased road traffic accidents, and the main casualties being economically productive young adults.

Accidents tripled from 3578 in 1963 to 10,106 in 1989 and 11,785 in 1994 according to Muyia (1995). In these accidents, 2014 persons were killed, 6650 were seriously injured and 11,094 had minor injuries. The causes of the accidents included reckless driving, non-roadworthy vehicles and poor conditions of the roads.

Odero, Khayesi and Heda (2003) observe that nearly 3,000 people are killed on Kenyan roads annually. The numbers of reported accidents have been showing an increasing trend from 10,300 in 1990 to 16,800 in 2000 and 17,400 in 2009, (Odero, et al. 2003 & Kenya Roads Board, 2010). The

annual economic cost of road traffic accidents is 5% of the country's Gross National Product, (Kenya Roads Board, 2010 & Yerrel, 1984).

1.2 Statement of the problem

It has been noted that an outcry occurs whenever an accident arises and most people view at the cause within a limited number of determinants and mostly, over speeding, driver carelessness, drunk-driving, bad roads, careless overtaking and few people analysis the occurrence in regard to the design safety factor on the vehicle during the impact and after the impact. It has been observed by other researchers that in any event of an accident many people perish despite wearing their safety belts (Nader, 1972 & Henderson, 1996). For this reason the researcher felt the need to focus more on the vehicle design amongst other determinants in reference to safety of the occupants.

In 2004 the Government revamped the road transport and PSV regulations by developing very stringent rules which cost the law breakers hefty fines. These rules were famously known as the 'Michuki' rules in reference to the then minister for transport the late Honorable John Michuki. PSV industry was highly affected as the crew members were mandated to wear special uniform, vehicles to be fitted with speed governors and functional seat belts, (Agutu, 2004). Most PSVs complied across the country and during this period the number of accidents significantly reduced. The Government of Kenya through the department of transport established structures to enforce and monitor compliance with the road traffic accidents.

Speed governors are installed in PSVs to ensure that the speed limit regulation is observed. Vehicles driving at high speed are purported to cause severe injuries to the occupants in case of an accident. This is due to the impact and force of inertia acting on the occupants. Alcohol blow gadgets were introduced on the roads to ensure that the drivers are not driving while drunk. According to WHO global status report on road safety 2013, drivers who drink and drive have a greatly increased risk of being involved in a crash as well as increased severity of the resulting injuries due to the associated tendency of over speeding. In Kenya the rule was introduced and orchestrated in year 2004 leading to country wide compliance in the PSV industry. There has been little efforts shown however, in regard to incorporation of roll over protection bars in the structure of bus bodies.

The road traffic accidents deaths reduced by 25% from 3004 in year 2003 to 2264 in year 2004 (Public transport, 2007), when most of the road traffic rules were introduced and firmly enforced;

though the number of those perished reduced it remained significant. Consequentially, this triggered the researcher to study the selected determinants in reference to road accident severity and included incorporation of roll over protection bars on bus bodies during the design phase and assembly process.

1.3 Purpose of the study

The purpose of this study was to establish the determinants of severity of road accidents in an event of accident on Kenyan roads.

1.4 Objective of the study

1. To establish how the speed of the vehicle determines the severity of a road traffic accident
2. To find out how use of seat belts determines the severity of a road traffic accident.
3. To assess how drunk-driving determines severity of a road traffic accident.
4. To scrutinize how incorporation of roll over protection bars on the vehicle determines the severity of a road traffic accident.

1.5 Research questions

1. How does the speed of a vehicle determine the severity of a road traffic accident?
2. To what extent does use of seat belts determine the severity of a road traffic accident?
3. How does drunk-driving determine severity of a road traffic accident?
4. How does incorporation of roll over protection bars on the vehicle determine the severity of a road traffic accident?

1.6 Justification of the of the study

The study focused on determinants of severity of road accidents involving buses along Kenya roads and took into consideration speed, seat belt use, drunk-driving and incorporation of roll over protection bars on the bus body. This study researched on the stated determinants of severity of the road accident and also incorporated the importance of focusing on aspects that can be introduced during the design phase and assembly process of a bus body. The researcher conducted a study on

the four objectives and critically analyzed them and gave a true contribution of each objective as found out in the field.

Focus on incorporation of roll over protection bars during the design stage and assembly process of bus body superstructure the researcher a relatively viable way of minimizing fatalities in an event of accident. This was based on the fact that most passengers are hurt by the crumbling of the bus body and roof after the accident, and sometimes people succumb as rescuers try to remove them from the body trappings.

1.7 Significance of the study

If the findings of this study are accepted in the public domain, it will seek to persuade the stakeholders of bus industry to implement and incorporate safety aspects noted as research objectives so as to reduce fatalities in the event of an accident. Commuters and members of public at large may greatly benefit by being more secure by implementation and enhancement of safety gadgets on the commuter buses and roads used.

This report may be of great benefit to the National transport and safety board of Kenya, Kenya Bureau of Standards, Bus body builders association among other relevant stakeholders as they seek the to reduce the number of road fatal injuries. Therefore, incorporation of roll over protection bars and breath analyzer gadgets may be added as a mandatory requirement from a safety point of view. The study also compared and contrasted the effects of all the above noted objectives in regard to severity of an accident and gave recommendation on new findings on enhancing safety in a commuter bus.

The beneficiaries are mostly the long distance commuters who are at a risk of perishing in an occurrence of the rampant road accidents. Most of the casualties are the productive young adults who contribute enormously to the development of the Kenyan Government, therefore the Government will eventually benefit (Kenya Red Cross yearly journal, 2011). See Figure 10. The accident creates huge burden on the Government's resources (health bill) which would otherwise be used on other important developments like road infrastructure, education, security and many more.

It is hoped that the Government, National Transport and Safety board and bus body builders will make right decision when reviewing safety of the commuter buses in our country after analyzing this

study. This study is also a source of knowledge to the scholars who may need to use this information in future.

1.8 Basic assumptions of the study

There was an assumption that majority of Kenyan commuter bus bodies are locally designed and assembled. This was for the reason that the researcher was not in a position to interview foreign bus body builders. There was a presumption that Insurance company and Bus body builders' respondents will give the researcher honest and reliable information; the information was given was cross checked for consistency and clarification sought whenever there was unclear response.

1.9 Limitations of the study

Kenya Police Department was the main custodian of information regarding accidents and due to few alternative access routes to this information there could have been delays and bureaucracies which could have posed a limitation to the progress of this study. Therefore, the researcher sought alternative and reliable sources of information which was the insurance companies insuring PSVs.

Sometimes some accidents go unreported and their causes unknown therefore the researcher misses out on such scenarios. The main cause could be lack of coverage or no survivor makes it to tell the incident. This could have been an impediment to the progression of the study, but the researcher relied on covered incidents either reported by survivors, reporters, eye witnesses or rescuers such as Kenya Red Cross, Kenya police or any other voluntary organization.

1.10 Delimitation's of the study

This study will be conducted on Nairobi – Kisumu highway. Many trucks, buses and small vehicles traverse this highway daily at all times of the day and night as it links Kenya to her landlocked neighbor country – Uganda. The road is characterized by potholes, sharp corners and the rift valley escarpment ranges which pose a lot of danger to the drivers and all commuters at large. Therefore, this clearly explains the reason why the study will be confined on Nairobi – Kisumu highway as it bears all the expected characteristics and environments necessary for the study.

The study was confined between years 2011 to 2013. This was due to the reason that the information was recent and easy to get. Also, this took into account the various road improvements like re-carpeting that has been going on to avoid the perception that most accidents occur due to poor road conditions.

1.11 Definitions of significant terms used in the study

Bus Body builders – these are the accredited companies which construct and assemble the vehicle bodies per the customer requirements but adhering to the Government set standards

Daly - One Daly can be thought of as one lost year of "healthy" life. The sum of these Daly's across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced age, free of disease and disability. Daly's for a disease or health condition are calculated as the sum of the Years of Life Lost (YLL) due to premature mortality in the population and the Years Lost due to Disability (YLD) for incident cases of the health condition.

Drunk-driving – Driving while under the influence of alcohol.

Roll over protection bars – this is an advanced roof design for vehicle roll over protection. In an event of accident an automobile rolls as an essentially rigid and roughly cylindrical body without crushing into the passengers' survival space. Seat belt fastening is purported to increase the chances of a victim to incur minor injuries. This is mostly incorporated in vans and commuter buses.

Matatus –These are small scale transport vehicles mostly used to ferry passengers over short distances and in towns. They are mostly used to flout traffic rules and regulations and often leading to perennial accidents. They are designed to carry 14 seated passengers at a go but sometimes they are overloaded to carry up to 24 passengers or more.

Road traffic fatality - death occurring within 30 days of the road traffic crash.

Severity – this is defined as the degree of injury to a road accident victim. This may range from mere limb breakages, head and neck injuries among other severe injuries which would lead to death of the victim.

Tata – automobile manufacturing company situated in India. Its main motor vehicle brand is Tata ranging from light to heavy duty trucks and other motor series as well.

1.12 Organization of the study

Chapter one covered the introductory part of the study and also justified the importance of carrying out the study. It also notes the expected challenges to be faced during the study. All objectives of the study and their significance were clearly outlined in this chapter and also prepares the reader about the expected research results.

Chapter two showed the in depth literature review conducted against the research topic and the different views of other researchers across the World, Africa, East Africa and different Kenyan regions. It also, clearly brought forth the big gap of knowledge about the main determinants of the severity of an accident. Most of them have shallowly noted different causes without breaking down to segments as the researcher did. Most of the researchers focused on totally different aspects of road traffic accident, leaving a great opportunity of study which could have brought forth a viable engineering and designing method of drastically reducing severity of fatalities occurring on commuter buses. This chapter also showed the conceptual framework the researcher used.

Chapter three majorly outlined the research design and the methodology which was used to gather and analyze data. This could change the readers' perception about the study and either get or lose his or her confidence and credibility on the outcome of the study.

Chapter four outlined the analysis, presentation and interpretation of data gathered in chapter three and also the return rate of the questionnaires administered. Chapter five details the conclusion on the findings in chapter three and four as per the analysis of the data. The researcher also gave his recommendations based on the findings to the beneficiaries of the study.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter covered literature review under the following themes: global trend on RTA severity, the Kenya trend in RTA severity, speed as a determinant of RTA severity, drunk-driving as a determinant of RTA severity, seat belt use as a determinant of RTA severity, incorporation of roll over protection bars as a determinant of RTA severity, conceptual frame work and diagram, and finally summary of literature review in the chapter.

Similar analysis was presented for some developed and developing countries and a comparative picture given against the Kenyan occurrences. Determinants of severity of road traffic accidents were discussed in detail using the views of other researchers and authors. Various theories and concepts on causes of the road traffic accident were discussed by large and far.

2.2 Trend of Road Traffic Accidents globally

In developed countries, the USA had the highest number of persons injured on road traffic accidents. Between the year 2001 and 2003, 10.21 persons out of 1000 people were injured on RTA. Canada had 7.18 persons out of 1000 people injured during the same period, while Denmark had the least with number of people injured standing at 1.59 people out of 1000 population, followed closely by Finland with 1.64. An average 4.39 people out of 1000 population were injured due to road accidents, (Organization for Economic Cooperation and Development, 2007).

The total annual costs of road crashes to low-income and middle-income countries were estimated to be about US$ 65 billion, which was more than the total annual amount received in development assistance (Jacobs, et al., 2000). Road crashes in developing countries were more than double that of developed countries at 13.4/100,000 and 32.2/100,000 people in Europe and Africa respectively (Peden, et al., 2004).

2.3 Trend of Road Traffic Accidents in Kenya

In 1986 a research study done by UK Transport Research Laboratory (TRRL) rated Kenya as 5th out of 29 worldwide selected countries in terms of highest number of accidents per licensed vehicles. Since then, the reported accidents continued to rise. In 1990, 10300 people were injured while in the year 2000 13900 were injured. This translated to a 3 percent growth rate per annum. During the

same period an average of 0.8 percent growth of vehicle population was realized rising from 350,000 vehicles to 530,000 vehicles, (Ministry of Transport, 2007 mentioned in Theuri, 2008).

RTA fatalities laid big burden to the victim's families, dependents, society and government at large, therefore if ways of minimizing the occurrences could have been discerned a great relief would have been realized. In 1991, RTIs were estimated to cost Kenyans approximately US$3.8 billion annually, corresponding to 5 percent of the annual gross national product (Odero, et al., 2003). This was however thought to be a conservative estimate because it did not include costs associated with lost productivity and other related costs due to the years of life lost (Peden, et al., 2004 mentioned in Abdulgafoor M. Bachani, Pranali Koradia, Hadley K. Herbert, Stephen Mogere, Daniel Akungah, Jackim Nyamari, Eric Osoro, William Maina & Kent A. Stevens 2012).

The overall RTI rate in Kenya was 59.96 per 100,000 populations in 2009, with vehicle passengers being the most affected. Fatalities due to RTIs increased at an annual rate of 7 percent for the period 2004 to 2009. (Bachani, et al., 2012, p. 2) See Figure 6 and A-06. According to Abdulgafoor and his colleagues the mean age of death due to road traffic injuries (RTI) was 35 years, with the highest proportion of RTI fatalities occurring among individuals aged between 25 and 34 years. Also they noted that 75% of the victims were male, (Abdulgafoor et al., 2012).

In Kenya males are the bread winners in most families and they are at their peak economically in the age bracket of 15years to 45 years, therefore loss of such people is a big blow to many families and society at large. See Figure 10. Nairobi-Kisumu highway has claimed many lives through fatal road traffic accidents and the number of deaths has steadily risen over time. National Traffic Commandant Benson Kibui said Kenya lost 3,097 people in road accidents 2012 compared to 3,249 in 2011. But despite the reduction, Nairobi-Kisumu highway has continuously claimed highest number of lives when compared to other major roads like Nairobi-Mombasa, Nairobi-Meru, Nairobi-Nyeri and others, Mayabi (2012, December).

2.4 Determinants of road accidents

According to WHO on Global Plan for the Decade of Action for Road Safety (2011), the five key risk factors for road traffic injuries include; speed, drunk-driving, lack of use of motor cycle helmets, lack of use of seat belts and lack of use of child restraints while driving.

According to the study conducted by Pukose (2007) on severity of road accidents as reported in Kenyatta National Hospital (KNH), there was a notable decline in the number of accidents, fractures, severity of injuries suffered between the 2003/2004 and 2006/2007 study periods. The incidence in 2003/2004 was 2.24 per 10000 in a period of 4 months while an incidence of 0.55 per 10000 was observed in 2006/2007. This presented a 71.3% decrease in the incidence of PSV accidents reported in KNH. The study revealed that careless driving and negligence by pedestrians were the principal causes of accidents, and both pedestrians and passengers were affected in road accidents suffering injuries that resulted in morbidity and time loss due to hospitalization. Large populations of injuries seen at KNH were as a result of public service related road traffic accidents (Pukose, 2007). The famous 'Michuki' regulations were imposed to the public during the year 2004 onwards. However, these rules lost popularity after death of the former minister and accidents began to rise again.

In Kenya the main source of road traffic accident data is the traffic police department, but also city and municipal councils of various townships keep record of accidents which happen in their jurisdiction. Some of the main causes of accidents were over speeding, cutting in on highways, alcohol abuse, use of un-road worthy vehicles, poorly designed and maintained highways, lack of good traffic control and law enforcement. Design of bus and lorry bodies play a significant role in balancing the vehicle while in high motion and also securing the passengers during an accident.

Characteristics of crashes vary depending on urban and rural settings. Pedestrians were more likely to be involved in an accident in the urban areas whereas passengers traversing rural areas or intercity highways were the main casualties. In Kenya the latest fatal includes an accident which took place on 27th February, 2013 at around 3.15am where a 68 passenger bus headed to Garissa on Thika – Garissa highway near Mwingi town in Kitui county lost control and veered off the road crashing and rolling three times killing 37 people in total, (Daily Nation, 2013, February 28). See Figure 13. A similar incident occurred on 14th June 2013 in Kisii county, Sameta district on the Itumbe-Nyamache road when a 56 seater-bus rolled on a sharp corner while carrying 87 passengers (students from different secondary schools and their teachers) while heading to Gucha for the annual Kisii secondary school ball games. 15 lives were claimed and over 15 passengers sustained very severe injuries, Muraya, July 20, 2013). See figure 14. This was one of the many incidents whereby with use of the roll over protection bars the death toll could have been highly minimized. The roll over protection bars not only create a tunnel like environment in case a bus rolls but also, restrains the

roof from snapping at the window level. This was achieved by incorporating the bars during the design of a commuter bus super structure.

In regard to the researchers and authors noted in this report, it was clear that very few attribute the safety of the vehicle to its structural design and gadgets installed during the design stage other than use of seat belts and vehicle roadworthiness. This study was ventured more into the one of the structures that can be installed in a vehicle such as a public service vehicle and make it safer in an event of accident.

Roll over protection bars are largely used in Brazil, part of India and South Africa on bus bodies mostly built by Marcopolo Company. As noted on the monthly TATA Motors website, most of their vehicles are fitted with front and rear roll over protection bars based on safety point of view.

Buses fitted with these bars are safer in an event of accident in the sense that, when a vehicle loses control and rolls most fatalities occur due to the crumbling of the vehicle despite passengers using safety belts. Therefore, a bus with roll over protection bars may not crumble but offers resistance to crumbling and rolling and also ensure that the occupants are safe in the sense that the roof is left intact and the headroom enough for occupants' safety.

2.4.1 Speed as a determinant of RTA severity

Driving speed highly affects the potential effects in case of a crash. Buses moving at high speed (above 50Km/hr.) may be difficult to control in case of an accident or an obstruction which requires emergency stopping. Modern cars have high rates of acceleration and can easily reach very high speeds in short distances. The physical layout of the road and its surroundings can both encourage and discourage speed. Crash risk increases as speed increases, especially at road junctions and while overtaking – as road users underestimate the speed, and overestimate the distance, of an approaching vehicle (World Report on Road Traffic Injury Prevention, 2013).

Due to persistent lawlessness in public service vehicle (PSV) industry in Kenya, the Government encouraged formation of Savings and Credit Cooperative Organizations (SACCO) to take over the industry. They reached out to the SACCO management to self-regulate themselves by observing the traffic rules and formalizing the industry. It was noted that most PSV drivers had little formal education, an issue which by far contributes to the erratic and indiscipline behaviors.

The Transport Licensing Board (TLB) a state -run organization that oversees road transport made efforts to curb road traffic accidents. In 2004, the Kenya Government mandated that all PSVs to install speed governors install seat belts and the crew members to wear specified uniforms while on duty. In Kenya buses were required not exceed 80km/hr. speed in any road and 50Km/hr. speed limit within city, towns or crowded areas. After implementation of these rules and regulations the number of road accidents reduced by 25 percent in 2004 to 2264 from 3004 in 2003 (Public Transport: SACCOs keeping PSV business on track, 2007). This clearly shows that despite the enforcement of safety belts and speed governors RTAs were still rampant across the board.

A Government initiative put in place to ensure that all buses are fitted with the speed governors was later abused, most bus owners tampered with the gadget despite fitment by bus assemblers and body builders for their own gain. The reason as to why bus owners' tampers with these gadgets was to make more trips to and fro while ferrying passengers hence making more money but pausing a risk to all road users. After tampering with the speed governor the bus drivers exceed the 80km/hr. speed limit, and sometimes driving up to a speed exceeding 120km/hr. This practice saw many pedestrians, passengers and other road users perish. The traffic regulates that small vehicle such as saloons to travel at a speed limit of 110Km/hr., 80Km/hr. for Lorries, buses and pick-ups and 65Km/hr. for trailers and heavy commercial trucks.

Most drivers do not bother too much about speed limits. It is the traffic environment that determines the speed. Mostly, it depends with the road width, visibility, road condition and amount of traffic on a particular road. This can also be related to flexible speed limits within towns and built up areas (Swedish National Road Institute, 2007).

2.4.2 Drunk-driving as a determinant of RTA severity

''Do not drink and drive'' was a slogan highly spread by the beer manufacturing industries in Kenya through the media. Drinking and driving increases the risk of being involved in a crash, as well as the severity of resulting injuries. Impairment of senses starts at very low levels of alcohol with the risk of crash involvement growing rapidly as consumption increases. According to the WHO Global status report on road safety, 2013 majority of adult drivers get impaired with a BAC level of 0.05 g/dl, while at 0.1 g/dl the risk of crashing is five times higher than that of a sober person (Hurst PM, Harte D, Frith WJ., 1994). See Figure 5.

Young and beginner drivers who drink and drive have a greatly increased risk of a crash compared to more experienced drivers, (Zador, 1991 & Peden, et al., 2004). The effects of alcohol impairment are exaggerated when combined with fatigue. Commercial drivers who spend long hours on the road ferrying passengers or cargo are highly at risk if they involve themselves in drunk-driving. In Kenya, buses and heavy commercial trucks are the commonly used mode of transport over long distances and these drivers are highly vulnerable to fatigue and also some take alcohol while on duty.

In Kenya enforcement of drunk-driving laws for some time were enforced by introduction of Breathalyzer instruments duped Alco blow but ended up not being very effective. However, enforcement of these laws have shown to be more effective when it includes random breath tests and when carried out at times and in locations when drunk-driving is more likely to occur. Such measures which increase drivers' perception of the likelihood of being apprehended plays a crucial role to success of this intervention, (Elder, et al., 2002 & Police enforcement strategies to reduce traffic casualties in Europe, 1999).

When the Breathalyzer were introduced drivers were randomly subjected to breath tests to obtain an indication of the proportion of alcohol in their blood. The prescribed limit was 35 micrograms of alcohol in 100 milliliters of breath. The prescribed limit was said to be 80 milligrams of alcohol in 100 milliliters of blood. For urine, the prescribed concentration was 107 milligrams of alcohol in 100 milliliters of urine. Any police officer in uniform who has reasonable cause to suspect that a person driving appears to have consumed alcohol may require the person to provide a specimen of breath for a test, (Angira, 2011).

2.4.3 Seat belt as a determinant of RTA severity

There has been significant progress in enforcing fastening of seat belts by passengers and drivers in some countries including Kenya. In 2004 during the famous 'Michuki' traffic laws many passengers and drivers adhered to these rules due to the hefty fines and repercussions if caught defying the rules. Failure to use the seat belt is a major risk factor for road traffic injuries because when a motor vehicle crashes the occupants without a seat belt continues to move forward at the same speed (inertia force) at which the vehicle was travelling before the collision hence getting injured.

The drivers are mostly banged against the steering column, front seat passenger against the dash board or windshield for the buses or even thrown out of the vehicle which is more dangerous,

(Nader, 1972 & Henderson, 1996). The rear seat passengers are catapulted against the seats or even ejected out of the vehicle, greatly increasing the risk of serious injury or death (Barss, et al., 1998 & Mackay, 2001).

According to WHO report on accidents (2013), wearing of seat belt reduces the risk of a fatal injury by 40-75% for drivers and front seat occupants, while for rear seat occupants' it reduces risk by between 25-75%. Seat-belt wearing rates vary greatly between countries, and to a large extent are governed by the existence and enforcement of mandatory seat-belt laws. Many countries have legislation on mandatory seat belt use Kenya included, (Barss, et al., 1998 & Mackay, 2001). According to WHO research Kenya scores poorly on enforcement of core traffic rules which directly aim at reducing the number of fatalities on the roads. On a scale of 0 to 10 Kenya scores 3 on enforcement of seat belt use, helmet use, speed limit observation and drunk-driving abstinence rules, (World Report on Road Traffic Injury Prevention, 2013). See table 7.

2.4.4 Incorporation of roll over protection bars as a determinant of RTA severity

According to Donald Friedman and Carl, (1994), the primary cause of serious head, face and neck injuries to occupants who are not ejected in rollovers is the roof crushing into the occupants' survival space. In a rollover, the front seat and other occupants move and fall with the vehicle whether they are restrained or not. The forces faced by a vehicle occupant in a rollover are only violent if the roof intrudes rapidly into the occupant's survival space. If the roof and its supporting structure are sufficiently strong that they do not deform significantly, an automobile rolls as an essentially rigid, roughly cylindrical body (Donald, 1994). This safe guards the occupants from injuries and increases chances of survival as per the findings on the influence of roof strength on injury mechanics (Orlowski, Bundorf, & Moffatt, 1985).

In the U.S.A the Federal Motor Vehicle Safety Standard (FMVSS) No. 216, Roof Crush Resistance, establishes a minimum requirement for roof strength to "reduce deaths and injuries due to the crushing of the roof into the occupant compartment in rollover crashes". In this test, a rigid plate is pushed into one side of the roof at a constant speed. The roof must be strong enough to prevent the plate from moving 5 inches when pushed at a force equal to 1½ times the weight of the vehicle. The test went into effect in 1973 and remained essentially unchanged until an updated rule was announced in 2009, (National Highway Traffic Safety Administration, 2012).

According to the U.S.A National Highway Traffic Safety Administration, 2012 the new rule will require that a roof withstand an applied force equal to 3 times the vehicle's weight while maintaining sufficient headroom for an average size adult male. While both sides of a vehicle's roof were required to meet the former standard, only one side was tested on any given vehicle. The new rule requires a second test of the same vehicle's roof on the opposite side. The new standard is being phased in beginning with 2013 model vehicles, and by the 2017 model year, 100 percent of each manufacturer's fleet must comply, (National Highway Traffic Safety Administration, 2012).

The updated FMVSS 216 will regulate the roof strength of many SUVs and pickup trucks by extending coverage to vehicles with gross weight ratings (GVWRs) up to 10,000 pounds. (GVWR is the weight of the vehicle plus the maximum load of passengers and cargo specified by the manufacturer.) In the past, the standard applied only to vehicles with GVWRs up to 6,000 pounds, which meant about 44 percent of the SUV and pickup fleets were exempt, notice for the proposed rulemaking in the Office of the Federal Register, (2005). While the updated roof strength regulation applies to these vehicles, they won't be subject to the same force requirements. Instead of a force equal to 3 times the vehicle's weight, vehicles with GVWRs over 6,000 pounds will be subject to a force equal to 1½ times their weight, (notice for the proposed rulemaking in the Office of the Federal Register, 2006).

Roof strength and injury risk in rollover crashes have a significant relationship, (Brumbelow, Teoh, Zuby, & McCartt, 2009). In most roll overs serious neck injuries which are fatal are sustained by occupants of the vehicles due to the crumbling of the roof, (Rechnitzer, Lane, McIntosh, & Scott, 1998). Huelke, Lawson & Marsh, 1977) found that small cars experienced much less roof crush in rollover crashes than large cars. These authors, in a finding that has been confirmed by later research by Partyka, Sikora, Surti and Vandyke, 1987 and Council and Reinfurt, 1987, established that larger cars in rollovers tend to have higher injury rates than small cars in rollovers. This led to the conclusion that roof crush in the larger cars may be positively associated with injury in rollover, and confirmed assumptions that roof crush may be the cause of occupant injury.

2.5 Conceptual frame work

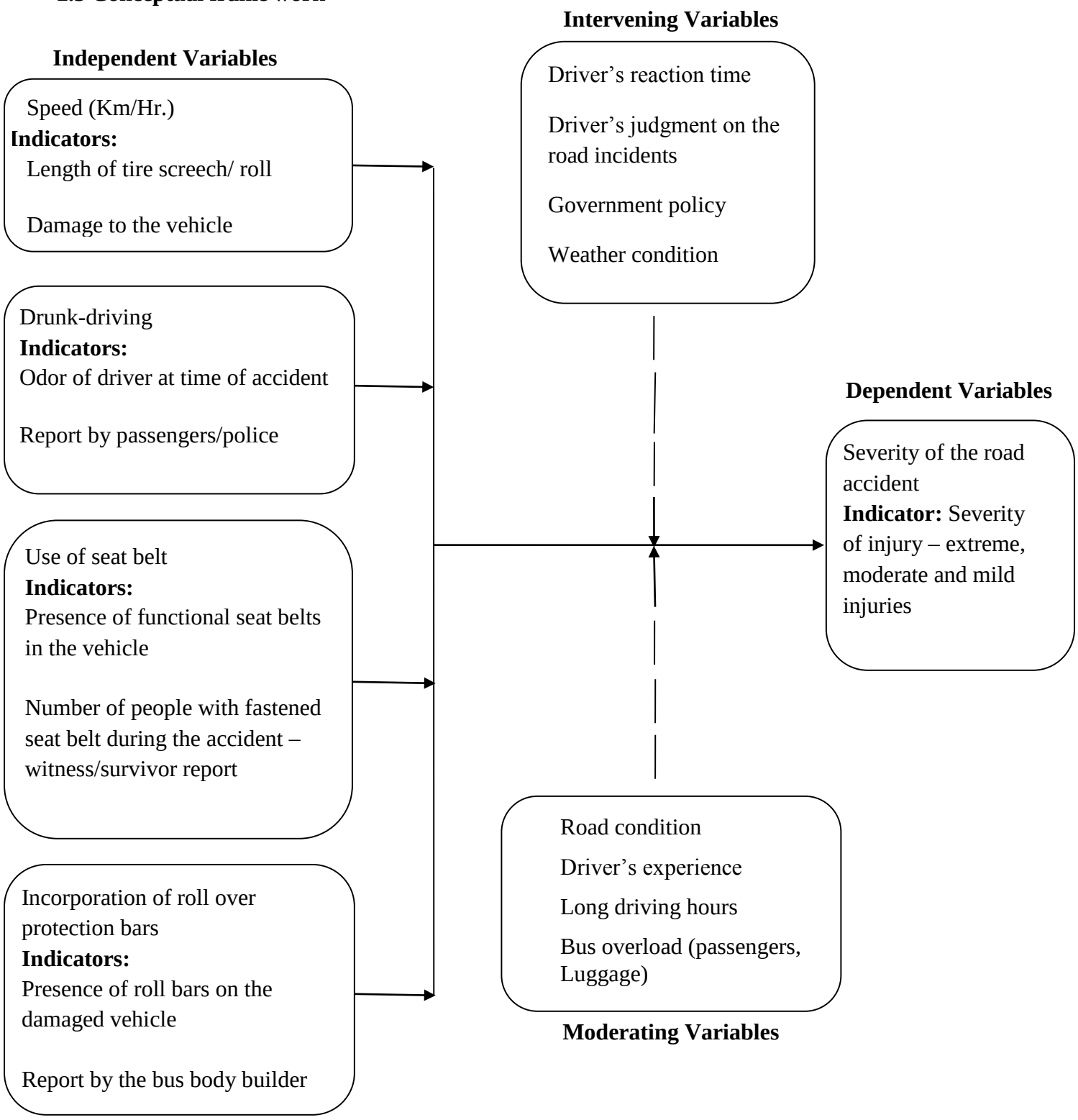

Figure 1: Conceptual framework of variables

The study consisted four independent variables and one dependent variable. Speed, drunk-driving, seat belt use and incorporation of roll over protection bars were the independent variables, and severity f road accident was the dependent variable. The researcher referred to the works of other authors while establishing the effects of each independent variable to the dependent variable. Data regarding each independent variable was gathered and analyzed in relation to dependent variable – severity of road traffic accident.

There were various moderating variables which had significant effect on the severity of an accident in a bus. Some of them included; road condition, driver's experience, long driving hours and bus overload with passengers and or their luggage. These variables were however recognized by the researcher, but he did not study them during this dissertation.

The following variables were rated as intervening variables because they could affect the severity of the road accident but it was difficult to measure or see the nature of their influence taking into account that most accidents happens within a fraction of a second. The researcher did not study them as well. They could include; driver's reaction time and driver's judgment on the road incidents, weather condition and Government policy.

2.6 Chapter two summary

It was noted that despite the use and reinforcement of speed governor, seat belt use, drunk-driving checks, passengers had been perishing due to severe road accidents. There had been little research on effects of incorporating roll over protection bars in the design and assembly of bus bodies therefore, this was a gap which had brought curiosity of studying the four objectives in the view of establishing their relationship with severity of the road accident. There was no known researcher who had studied the impact of installing roll over protection bars in the bus body contrasting it against speed, drunk-driving, safety belt use and severity of a road accident.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Research methodology is divided into the following sub-sections; research design, target population, sample, sampling procedure, research instruments, validity of the instruments, reliability of the instruments, data collection procedure, data analysis techniques, ethical considerations of the study and finally operational definition of variables.

3.2 Research Design

This study undertook an ex-post facto design, which according to Cohen and Manion (1980), tests out possible antecedents of events that have happened and cannot be re-engineered or manipulated by the researcher due to the former fact. An ex-post facto design was selected for this study because the researcher could not be in a position to manipulate the variables and aspects of the study such as number of people who perished in a given accident, speed of the vehicle at the time of accident, number of people who had fastened seat belts at the time of the accident, driver's sobriety at the time of accident and design of the body of the vehicle involved in an accident. This was for the simple reason that all variables under study were items which had happened in the past.

3.3 Target population

The total target population was forty five (45) registered Insurance Companies in Kenya dealing with public service vehicles, (The Insurance Regulatory Authority, 2013). See table 2. The sample population was forty (40) Insurance Companies as explained in section 3.4. The subordinate total target population was all bus body builders established and operating in Kenya. They amounted to an approximate number of fourteen (14) by May 2013. See table 3. The sample population was fourteen (14) Insurance Companies as explained in section 3.4.

3.4 Sample

First, sample target population was forty (40) Insurance Companies dealing with buses plying Nairobi – Kisumu highway, and whose buses were involved in an accident between years 2011 – 2013. The contact persons were the specific assessors dealing with the route indicated. The researcher delved specifically into accidents which involved rolling due to any factor either loss of

control, collision, poor road condition, driver fatigue, drunk-driving, driver incompetency among other factors. According to the table for determining sample size from a given population developed by Krejcie and Morgan, (1970) the sample size for a population size of forty five (45) was forty (40). See table 6. Therefore, the researcher considered forty (40) Insurance companies as the sample size which was selected purposively depending with the company reputation and popularity in the PSV market.

The other sample target was fourteen (14) bus body builders in Kenya who designs and assembles bus bodies. Contact persons were the company representatives or someone in the managerial level with the ability of retrieving data and dispersing it without hierarchical approvals which may lead to delay and or distortion of data. According to the table for determining sample size from a given population developed by Krejcie and Morgan, (1970) the sample size for a population size of fourteen (14) was fourteen (14). See table 6. Therefore, the researcher considered fourteen (14) vehicle body builders as the sample size which was selected purposefully depending with the popularity in the PSV market and the guide given by the Insurance companies.

3.5 Sampling procedure

Purposive sampling technique was employed due to the fact that the population was known and according to the PSV industry there were limited number of trusted and respected Insurance companies owing to the sensitivity and nature of business. Many PSV insurers had collapsed while others faced imminent financial crisis. This had led to many insurers avoiding PSV markets particularly 'matatus', (Wekesa, 2010) due to the careless driving leading to high turn up of claims. The sampling procedure used was a non-probabilistic method, whereby a desired number of sample units were selected purposefully as per the object of inquiry so that only the important items representing the true characteristics of the population were included in the sample.

Similarly, there were a few qualified bus body builders who were supported by the vehicle assemblers and sellers. This had led to having a few selected body builders gain popularity in the business. Based on the above justifications, purposive sampling technique was deemed to be the best suited technique for this particular sample. Random sampling ordinarily was not feasible, since the researcher wanted to ensure that he obtained a sample that was uniquely suited to the intent of the study.

These two sample populations were interviewed at different times, starting with the 40 Insurance assessors. This gave a guide to the sample bus body builders to be interviewed so as to match the data gathered. For researcher to have sufficient data, he interviewed the 14 bus body builders of the buses reported to have been involved in an accident during his interview with the Insurance company respondents but within the sample size.

3.6 Data collection Instruments

Questionnaires were administered, whereby open and close ended questions were used to gather data from all the respondents. The respondents were required to give short answers to the questionnaires developed by the researcher and tick appropriate boxes in the choices provided. The questionnaires had three sections namely. Letter of transmittal, personal details excluding name and anything that can directly reveal the respondent's anonymity and data input in regard to accident cases recorded. See appendices 1.

The letter of transmittal described the researcher's details, reason for the research and a brief description on the expectations to the respondent by researcher. It also requested the respondent to give consent to participate in the study by way of signing on the document. The respondent was requested to give personal information such gender, age bracket, job designation and years of experience in their current career. Most of questions in this section required the respondent to tick the appropriate boxes as per the provided choices. The last part of the questionnaire required information regarding accident that involved a bus along Nairobi to Kisumu Highway. Questions were structured to get data input from the respondent. The researcher engaged the respondent to a brief discussions for clarification and more information regarding their responses.

3.7 Validity of the Instruments

Validity is the degree to which results gathered from data represents the phenomenon under study. Mugenda and Mugenda (1999) describes validity as the quality of measurement procedure that provides respectability and accuracy of the data gathered. To enhance validity of the instrument, a pre-test study was carried out on a population equivalent to the target population (Mulusa, 1988) and results analyzed so as to ensure that the instrument accurately reflected what it was supposed to capture. The purpose of the pilot study was to determine the clarity and relevance of the instrument structure so that questions found inappropriate for measuring the variables could either be discarded or adjusted to ensure that the right data was gathered.

3.8 Reliability of the Instruments

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated tests are done a number of times (Mugenda, & Mugenda, 1999). To enhance the reliability of the instrument, triangulation method was used on Oriental Insurance company respondent and LSHS body builder respondent. The responses to the questionnaires administered to the two respondents were checked against their responses they gave when asked the same questions in a face-to-face interview conducted after one week. Therefore, the analysis of the findings were done to establish whether the instruments used were reliable. The instruments were found to be consistent therefore reliable.

3.9 Data collection Procedure

After the approval of the proposed research, the researcher applied for permission to collect data from the University of Nairobi Extra Mural department and also recruited the research assistant in a week's time. The following week the questionnaires were administered by the researcher and the assistant to the respondents and collected after one week. Permission was sought from the companies involved and respondents prior to issuance of questionnaires.

A brief pre-screen interrogatory meeting was conducted prior to issuing of the questionnaire so as ensure that the right people were responding to the questionnaires. This opportunity helped the researcher to evaluate the respondent based on their position and experience in their firms to ensure that they had the capacity to adequately answer the questionnaires.

The filled questionnaires were picked after 5 days and same procedure followed when administering the questionnaires to the bus body building companies mentioned by the Insurance Companies. Any clarifications were sought during that brief discussion to ensure that no ambiguous responses were recorded. The whole procedure took two weeks to finalize, but two Insurance Companies did not respond despite the persistent follow up. They explained that the cases at hand were in court of law and it was not appropriate for the respondent discuss any matter in court as this could lead to breach of legal requirements. Questionnaires were availed for further data processing.

3.10 Data Analysis Techniques

Data analysis refers to the computation of certain measures along with searching for patterns of relationship that exists among data groups. In regard to the research objectives, data analysis process

determined with what validity could be said to indicate any conclusion. After gathering data from the field the researcher used the following mentioned procedure for data analysis.

Data editing which involved examination of the collected raw data to detect errors and omissions and to correct where possible. This involved careful scrutiny of the completed questionnaires and ensured that data gathered were accurate, consistent, uniformly entered and well arranged for further processing. Errors or omissions detected while in the field the researcher contacted the respondent for correction before parting.

When all questionnaires were completed and returned to the researcher's office, central editing was done to address obvious errors such as right entry in the wrong cell or vice-versa among other errors. All the wrong replies, which were quite obvious, were dropped from the final results.

Data coding which comprised of assigning numerals to responses to enable categorization of the information gathered was done. These categories possessed the characteristics of exhaustiveness (there must be a class for every data item) and also that of mutual exclusivity. This meant that a specific answer could be placed in one and only one cell in a given category set. Another rule observed was that of uniform dimensionality by which was meant that every class was defined in terms of only one concept. Coding helped the researcher to reduce several responses to a small number of classes that contained the critical information required for analysis.

Data gathered was classified into homogeneous groups so as to get meaningful relationships. This helped arrange the voluminous raw data into groups of similar characteristics depending on their attributes. Data was then tabulated in a concise and logical order by the researcher. Raw data was summarized and displayed in a compact form of statistical tables for further analysis. The researcher use Statistical Packages for the Social Sciences (SPSS).

Due to the nature of the study and the expected form of data gathered from the field as directed by the questionnaires which drew heavily from the study objectives, the researcher conducted descriptive data analysis. Descriptive analysis describes patterns and general trends in data sets. Each variable was examined at a time and interpretation drawn from the findings. This helped in the determination of relationships and differences which were considered real or just a chance of fluctuation.

The researcher used central tendency, measure of dispersion and measure of relationships as the statistical tools to summarize and analyze the survey data. Relationship was sought against each research question response (dependent variables) as noted in the questionnaire versus the dependent variable stated as the severity of a road accident whose data was also gathered through the same questionnaire.

Measures of dispersion and relationship were used to analysis the collected data sets. Finally, the data gathered was presented in frequency graphs, statistical tables and charts. This was deemed to be the most efficient tools for presenting research data for easier interpretation and analysis.

3. 11 Ethical considerations of the Study

The researcher followed ethical considerations in the course of the data collection process. Respondents participated at their own will without coercion from the researcher nor their bosses. The researcher sought permission from the Insurance Companies, Vehicle body building Companies and National Council for Science and Technology (NCST) before undertaking the study. The researcher guarded the privacy and confidentiality of the research participants' identities and no names were noted or presented in the study.

3.12 Operational definition of variables

Table 1: Operationalization Table

Objective/Research Question	Variable	Indicator	Measurement	Level of measurement	Research Design	Data Collection method	Data analysis
How does the speed of a vehicle determine the severity of a road traffic accident?	**Independent:** Speed at the time of accident	- Severe injuries to the passengers - Major damage to the vehicle	Low speed ranged from 1Km/hr. and 49 Km/hr. Moderate speed ranged from 50 Km/hr. and 80Km/hr. High speed ranged from 81 Km/hr. and above Km/hr.	Ratio scale	Ex-post facto	Questionnaire	Descriptive analysis – measure of relationships
	Dependent: Severity of the road accident	Severity of injury	Extreme head, face and neck injuries were rated as very severe. Actual number recorded Chest, back, hands and abdomen injuries were rated as moderately severe. Actual number recorded Lower limbs injuries and minor injury to any other body parts were rated as mild severe. Actual number recorded	Ratio scale	Ex-post facto	Questionnaire	Descriptive analysis – measure of relationships
How does seat belts use determine the severity of a road traffic accident?	**Independent:** Seat belt use at the time of accident	-Presence of seat belts in the vehicle -Number of people with fastened belt at the time of accident	Seat belts available, was assigned 1 No seat belts available, was assigned 0 Fastened, actual number was recorded Not fastened, actual number was recorded	Nominal scale Ratio scale	Ex-post facto	Questionnaire	Descriptive analysis – measure of relationships
How does drunk-driving determine severity of a road traffic accident?	**Independent:** Drunkenness of the driver at the time of accident	-Odor of the driver at the time of accident -Revelations by passengers	Drunk, was assigned 1 Not drunk, was assigned 0	Nominal scale	Ex-post facto	Questionnaire	Descriptive analysis –measure of relationships
How does incorporation of roll over protection bars on the vehicle determine the severity of a road traffic accident?	**Independent:** Incorporation of roll over protection bars on vehicle involved in an accident	-Presence of roll over protection bars on the vehicle	Installed, was assigned 1 Not installed, was assigned 0	Nominal scale	Ex-post facto	Questionnaire	Content analysis

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter focuses on questionnaire return rate, background information of the respondents, accuracy of reporting and standard report forms, treatment of data, tabular presentation of data, graphical presentation of data and descriptive data analysis. The chapter presents collected data on the four objectives of this study as they have been outlined in chapter one. The data is arranged according to the objectives of the research and the sample groups. The data was broken down and summarized using tables and graphs to facilitate interpretation. The data analysis was done qualitatively and quantitatively by use of descriptive statistics. SPSS was used to do the analysis of the data sets for fast and accurate presentation and interpretation.

4.2 Questionnaire Return Rate

Table 4.1 shows the Insurance Companies' Assessors Questionnaire return rate was 95% whereby 38 out of 40 questionnaires were returned. The table also shows that the Bus Body Building Companies responded to all 14 (100%). These return rates were sufficient for data processing and analysis as per Mugenda and Mugenda (2003).

Table 4.1: Questionnaire return rate

No.	Sample Group	Total Issued	Total Returned	Total Percentage (%)
1	Insurance Companies	40	38	95
2	Vehicle Body Builders	14	14	100

The reasons which attributed to failure of getting all responses on questionnaires were mainly lack of unavailability of the authorized respondents, decline to participation and un-returned questionnaires within the set timeline.

4.3 Demographic characteristics of respondents

This section of research entailed questions that helped the researcher obtain general background information about the respondents. This helped the researcher to identify the best respondents to the

research; this is in regard to their job designation and experience. The questionnaire required information on the respondent's gender, age, job designation and experience in the current job.

4.3.1 Respondents' distribution by gender for the Insurance and Bus body building Companies sample populations

The respondents were required to fill their gender in the questionnaire administered to them. From the data gathered from the Insurance Companies as shown in table 4.2, it emerged that 15% of the respondents were women while the men made 80% of the returned questionnaires among the respondents. 5% of the total questionnaires administered were missing (no response).

Table 4.2: Gender of Insurance Company's Respondents

Status	Gender	Frequency	Percent
Valid	Male	32	80
	Female	6	15
	Total	38	95
Missing	0	2	5
Total		**40**	**100**

Data gathered from the Bus body building Companies showed that 14.3% of the respondents were women and 85.7% were men as shown in table 4.3. This showed that men were more willing to respond and they had dominated the career.

Table 4.3: Gender of Bus body building Respondents

Status	Gender	Frequency	Percent
Valid	Male	12	85.7
	Female	2	14.3
	Total	**14**	**100**

4.3.2 Respondents' distribution by age for the two sample populations

The respondents from the two sample groups were required to tick their appropriate age brackets where four categories were provided. The categories were as follows: 18 to 24 years, 25 to 30 years, 31 to 40 years and 41 and above years. These age brackets were formulated so as to help the researcher establish the categorization of the respondents for easier tabulation. Persons between ages between 18 and 40 years are regarded as youth. The age bracket made it easy for respondent to disclose their ages because most people do not like disclosing the actual age especially the women.

From table 4.4, (0) 0% of the Insurance Company's respondents were between the ages of 18 and 24 years, (25) 58.1% between the ages 25 and 30 years, (10) 23.3% between the ages 31 – 40 years and (0) 0% between the ages 41 and above years. This shows that majority of the respondents were of ages between 25 and 30 years who were young employees pursuing their careers. The respondents of ages 41 and above years were mostly the senior managers in the Insurance Company.

Table 4.4: Age bracket for Insurance Company's Respondents

Description		Frequency	Percent
Valid	25 - 30 years	25	62.5
	31 - 40 years	10	25.0
Missing	0	5	12.5
Total		**40**	**100.0**

Table 4.5: Age bracket for Bus Body Builder's Respondents

Status	Age Bracket	Frequency	Percent
	25 - 30 years	5	35.7
Valid	31 - 40 years	6	42.9
	41 - Above years	2	14.3
Missing	0	1	7.1
	Total	**14**	**100**

From the table 4.5, (0) 0% of the Body Builder's respondents were between the ages of 18 and 24 years – no one was within that range, (5) 35.7% between the ages 25 and 30 years, (6) 42.9% between the ages 31 – 40 years and (2) 14.3% between the ages 41 and above years. This shows that majority of the respondents were of ages between 31 and 40. The respondent of age 41 and above years was the director of the Company.

4.3.3 Respondents' distribution by years of experience for the two sample populations

The questionnaires administered required the respondents to indicate their years of experience in their work. This helped the researcher to establish the kind of respondent he was engaging and this had impact on quality of information gathered; new employees were left out of this study.

From the data gathered from the Insurance Companies as shown in table 4.6, the 69.8% of respondents had experience ranging from 1 to 3 Years, 14% had experience ranging between 4 to 7 years and 0% had 8 and above experience. Majority of respondents had experience of 0 to 3 years in their job and most of them being young people pursuing their careers. People with greater

experiences had either been promoted to other jobs or were not available to respond. Accident assessment job is mostly for the new entrants in the Insurance Companies. 4.7% did not respond.

Table 4.6: Experience bracket for Insurance Company Respondents

Description		Frequency	Percent
Valid	1 - 3 years	30	75.0
	4 - 7 years	6	15.0
Missing	0	4	10.0
Total		**40**	**100.0**

Table 4.7 showed that 28.6% of respondents had experience spanning between 1 – 3 years, majority were between 4 – 7 years of experience with 57.1% response rate. Two respondents had experience exceeding 8 years amounting to 14.3% response rate.

Table 4.7: Experience bracket for Bus Body Builder's Respondents

Status	Experience Bracket	Frequency	Percent
Valid	1 - 3 years	4	28.6
	4 - 7 years	8	57.1
	8 - Above years	2	14.3
	Total	**14**	**100**

In reference to the question asking the bus body builders whether they fit alcohol detectors in their vehicles, all respondents said that they do not fit any gadget in regard to detection of a drunk driver.

4.4 Accuracy of reporting and standard report forms

While great care was taken in data handling, incidents of biasness such as over-reporting and under-reporting, particularly in self-reported accidents may have gone undetected. This was inevitable since the researcher was limited to the data available and further verification would have meant delaying the timely completion of the study. Three classes of level of injury severity were recorded which consisted: very severe injuries, moderate injuries and mild injuries. The insurance claim forms data indicated year, month, region, police details, vehicle type, manner of accident, age of victims, time of injury and type of injury. Data collected in the study comprised accidents which occurred for the period 1st January 2011 to 30th June 2013.

4.5 Treatment of data

The data analysis tool used was the SPSS computer software version 17, where various variables were considered and their relationships examined in data coding, each question representing the study objectives were recorded as a variable filled in columns. The responses were filled in rows against the relevant columns and the number of rows represented the number of responses recorded. Using the SPSS software the researcher analyzed across various functions and presented it in tables, relationship comparative statements and charts.

4.6 Tabular presentation of data

The questionnaire administered to Insurance Companies had asked the respondent to indicate the recorded speed of the vehicle during the accident which is usually gathered by police when collecting information regarding a particular accident. The table 4.8 discusses the findings.

Table 4.8: Frequency table for Speed

Description		Frequency	Percent
Valid	70	5	12.5
	80	7	17.5
	85	8	20.0
	90	7	17.5
	100	9	22.5
	110	2	5.0
Missing	0	2	5.0
Total		**40**	**100.0**

It was also noted that 64.3% bus body building companies confirmed that the vehicles were fitted with speed governors before releasing them to the client, whereas 35.7% did not bother to check. The 35.7% who did not bother to check expected the client and the chassis assembler to ensure that the vehicle was fitted with the required speed governor as per the traffic regulations. See table 4.9.

Table 4.9: Frequency table for vehicles fitted with speed governors

Status	Yes/ No	Frequency	Percent
Valid	Yes	9	64.3
	No	5	35.7
	Total	**14**	**100**

The questionnaires administered to the Insurance Companies had asked the respondent to indicate whether the driver was drunk or not during the accident which is usually gathered by police when collecting information regarding a particular accident. It was recorded that 79.1% were not drunk and only 7% were reported to be under the influence of alcohol. Nonetheless, it was argued that there were no specific gadgets provided for the test. The table 4.10 discusses the findings.

Table 4.10: Frequency table for Drunk Drivers

Description		Frequency	Percent
Valid	Yes	3	7.5
	No	34	85.0
Missing	0	3	7.5
Total		**40**	**100.0**

The questionnaires administered to Insurance Companies' had asked the respondents to fill the number of passengers who sustained very severe injuries due to each particular accident. This category was described as for people who either died, went to a coma, taken to ICU, got very severe head or neck injuries. The table 4.11 shows the details.

Table 4.11: Frequency table for passengers with very severe injuries

Description		Frequency	Percent	Total passengers injured
Valid	2	1	2.5	2
	3	7	17.5	21
	4	3	7.5	12
	5	8	20	40
	6	1	2.5	6
	7	2	5	14
	8	4	10	32
	9	6	15	54
	10	5	12.5	50
	11	1	2.5	11
Missing	0	2	5	0
Total		**40**	**100**	**242**

The questionnaires administered to Insurance Companies' had requested the respondents to fill the number of passengers who sustained moderate severe injuries due to each particular accident. This category was described as for people who either had chest or ribs injuries and were admitted to ordinary ward in the hospital, no special care was required and were released after 2 or more days after undergoing treatment. The table 4.12 shows the details.

Table 4.12: Frequency table for passengers with moderate injuries

Description		Frequency	Percent	
	8	3	7.5	24
	9	3	7.5	24
	10	4	10	27
	11	3	7.5	40
	12	4	10	33
	13	2	5	48
Valid	14	3	7.5	26
	15	3	7.5	42
	16	4	10	45
	17	3	7.5	64
	18	4	10	51
	23	1	2.5	72
	24	1	2.5	23
Missing	0	2	5	0
Total		**40**	**100**	**519**

The questionnaires administered to Insurance Companies had asked the respondents to fill the number of passengers who sustained mild severe injuries due to each particular accident. This category was described as for people who either were not injured at all or were treated and left within a day. The table 4.13 shows the details.

Table 4.13: Frequency table for passengers with mild severe injuries

Description		Frequency	Percent	Cumulative
	25	1	2.5	25.0
	26	2	5.0	52.0
	28	2	5.0	56.0
	29	3	7.5	87.0
	30	3	7.5	90.0
	31	2	5.0	62.0
	32	2	5.0	64.0
	34	2	5.0	68.0
	36	1	2.5	36.0
Valid	37	3	7.5	111.0
	38	1	2.5	38.0
	40	2	5.0	80.0
	41	2	5.0	82.0
	42	1	2.5	42.0
	44	7	17.5	308.0
	45	1	2.5	45.0
	46	1	2.5	46.0
	50	1	2.5	50.0
	51	1	2.5	51.0
Missing	0	2	5.0	.0
Total		**40**	**100**	**1393**

The table 4.14 gives findings as reported by respondent when responding to the question requiring them to state whether they fit buses with seat belts or not. All respondents stated that it is a mandatory gadget in all passenger vehicles and they comply.

Table 4.14: Frequency table for buses fitted with seat belts

Status		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	14	100	100	100

The questionnaires administered to the bus body building Companies had asked the respondents to fill whether they fit their vehicles with roll over protection bars. This information helped the researcher establish whether there was a relationship between the roll over protection bars and severity of road accidents. The table 4.15 shows the details.

Table 4.15: Frequency table for buses with ROPBs

Status	Yes/No	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	12	85.7	85.7	85.7
	Yes	2	14.3	14.3	100
	Total	**14**	**100**	**100**	

Table 4.16 shows a cross tabulation data for number of passengers who sustained very severe injuries versus number of vehicles installed with ROPBs. For the cases sampled, only 33 passengers travelling in buses fitted with ROPBs sustained very severe injuries whereas 209 passengers travelling in buses without ROPBs sustained very severe injuries.

Table 4.16: Very Severe Injuries * Roll over Protection Bars Cross tabulation

Description		Roll over protection bars				Total Occurrences
		Available (A)	Total Severely Injured (A)	Not Available (B)	Total Severely Injured (B)	
Very severely injured passengers	2	1	2	0	0	1
	3	7	21	0	0	7
	4	0	0	3	12	3
	5	2	10	6	30	8
	6	0	0	1	6	1
	7	0	0	2	14	2
	8	0	0	4	32	4
	9	0	0	6	54	6
	10	0	0	5	50	5
	11	0	0	1	11	1
Total		**10**	**33**	**28**	**209**	**38**

Table 4.17 shows a cross tabulation data for number of passengers who sustained moderate severe injuries versus number of vehicles installed with ROPBs. For the cases sampled, only ninety seven

(97) passengers travelling in buses fitted with ROPBs sustained moderate severe injuries whereas four hundred and twenty two (422) passengers travelling in buses without ROPBs sustained moderate severe injuries.

Table 4.17: Moderate Injuries * Roll over Protection Bars Cross tabulation

Description		Roll over protection bars				
		Roll over Protection Available (A)	Total injured (A)	Roll over Protection NOT Available (B)	Total injured (B)	Total occurrences
Moderately injured passengers	8	2	16	1	2	3
	9	3	27	0	0	3
	10	2	20	2	20	4
	11	2	22	1	11	3
	12	1	12	3	36	4
	13	0	0	2	26	2
	14	0	0	3	42	3
	15	0	0	3	45	3
	16	0	0	4	64	4
	17	0	0	3	51	3
	18	0	0	4	72	4
	23	0	0	1	23	1
	24	0	0	1	24	1
Total		**10**		**28**		**38**

4.7 Descriptive statistics: Interpretation of the correlation coefficient

For the researcher to reach valid conclusions it was essential that clear interpretation of correlation coefficient amongst various variables was defined. According to Lucey, (2002) the product moment coefficient of correlation is denoted by 'r'. It provides a measure of the strength of association between two variables; one dependent variable and the other independent variable. Product Moment Correlation Coefficient 'r' is between -1.0 and +1.0. The closer the correlation is to +1.0 or -1.0, the closer it is to a linear relationship, where +1.0 is a perfect positive correlation, 0.0 there is no correlation, and -1.0 there is a perfect negative correlation (inverse). The correlations are further interpreted as follows:-

+0.7 to 1.0 – strong positive correlation

+0.3 to 0.7 – weak positive correlation

-0.3 to +0.3 – little or no correlation

-0.7 to -0.3 – weak negative correlation

-1.0 to 0.7 – strong negative correlation.

4.7.1 Data analysis using Pearson Correlation coefficient

This analysis was conducted using Pearson correlation coefficient denoted as r. The researcher used data detailed in section 4.6 to establish the relationship across various variables as shown in the following tables:-

Table 4.18: Correlation table for Speed and very severely injured Passengers

Description		Speed	Injured Very Severely
Speed	Pearson Correlation	1	.771**
	Sig. (2-tailed)		0
	N	38	38
Injured Very Severely	Pearson Correlation	.771**	1
	Sig. (2-tailed)	0	
	N	38	38

**. Correlation is significant at the 0.01 level (2-tailed).

r = 0.771 interpreted as strong positive correlation

Table 4.18 shows that there was a strong positive correlation between speed and the number of very severely injured passengers. The higher the speed the higher the fatality in case of an accident. Buses which exceeded the speed limit (80Km/Hr.) and were involved in an accident injured many of its occupant compared to the buses driven below and within the set speed limit.

Table 4.19: Correlation table for Speed and moderately injured Passengers

Description		Speed	Moderately injured
Speed	Pearson Correlation	1	.764**
	Sig. (2-tailed)		0
	N	38	38
Moderately injured	Pearson Correlation	.764**	1
	Sig. (2-tailed)	0	
	N	38	38

**. Correlation is significant at the 0.01 level (2-tailed).

r = 0.764 interpreted as strong positive correlation

Table 4.19 shows that there was a strong positive correlation between speed and the number of moderately severely injured passengers. The higher the speed the higher the fatality in case of an accident. Buses which exceeded the speed limit (80Km/Hr.) and were involved in an accident ended up injuries many of its occupant compared to the buses driven below and within the set speed limit.

Table 4.20: Correlation table for ROPBs and very severely Injured Passengers

Description		Rollover Protection bars	Injured Very Severely
Rollover Protection bars	Pearson Correlation	1	-.687**
	Sig. (2-tailed)		0
	N	39	38
Injured Very Severely	Pearson Correlation	-.687**	1
	Sig. (2-tailed)	0	
	N	38	38

**. Correlation is significant at the 0.01 level (2-tailed).

r = -0.687 interpreted as weak negative correlation.

Table 4.20 shows that there was a weak negative correlation between vehicles installed with ROPBs and number of very severely injured passengers. The higher the number of vehicles fitted with ROPBs the lower the number of passengers who sustained very severe injuries. Buses involved in an accident and were installed with ROPBs ended up having few people sustaining very severe injuries. According to these findings, if all buses were installed with ROPBs the number of road accident fatalities would be minimized. Table 4.15 shows that only 14.3% of bus body builders installs ROPBs in the bus superstructure design.

Table 4.21: Correlation table for ROPBs and moderately injured Passengers

Description		Rollover Protection bars	Moderately Injured
Roll over Protection bars	Pearson Correlation	1	-.606**
	Sig. (2-tailed)		0
	N	39	38
Moderately Injured	Pearson Correlation	-.606**	1
	Sig. (2-tailed)	0	
	N	38	38

**. Correlation is significant at the 0.01 level (2-tailed).

r = -0.606 interpreted as weak negative correlation

Table 4.21 shows that there was a weak negative correlation between vehicles installed with ROPBs and number of moderately severely injured passengers. The higher the number of vehicles fitted with ROPBs the lower the number of passengers who sustained moderate severe injuries. Buses involved in an accident and were installed with ROPBs ended up many passengers sustain mild injuries.

Table 4.22: Correlation table for No. of drunk drivers and very severely injured Passengers

Description		Drunk driver	Injured Very Severely
Drunk driver	Pearson Correlation	1	-0.082
	Sig. (2-tailed)		0.629
	N	37	37
Injured Very Severely	Pearson Correlation	-0.082	1
	Sig. (2-tailed)	0.629	
	N	37	38

r = -0.082 interpreted as no correlation

Table 4.23: Correlation table between No. of drunk drivers and moderate severely Injured Passengers

Description		Drunk driver	Moderately injured
Drunk driver	Pearson Correlation	1	-0.213
	Sig. (2-tailed)		0.205
	N	37	37
Moderately injured	Pearson Correlation	-0.213	1
	Sig. (2-tailed)	0.205	
	N	37	38

r = -0.213 interpreted as no correlation

Tables 4.22 and 4.23 shows that there was no correlation (r = -0.213) between drunk-driving and number of passengers who sustained very severe and moderate injuries. This was attributed to the fact that there was no sufficient information from the respondents regarding drunk-driving. The police, doctors and insurance assessors do not record nor document such data.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter begun with summarizing the findings in chapter four by giving the relationship amongst the severity of road accidents and their determinants along Nairobi – Kisumu Highway, then discussion and conclusion on the relationship found among specified objectives. The chapter ends with recommendation by the researcher to various stakeholders such as bus body builders, law makers of the Government of Kenya, KEBS, police department, readers, passengers and mainly fellow scholars.

5.2 Summary of findings

From the descriptive statistics presented in chapter four section 4.7, it was observed that the major determinants of a road traffic accident in buses were speed of the vehicle, seat belt use and unavailability of roll over protection bars. The tables in section 4.7 showed significant relationships between the variables. The researcher summarized all the determinants found from the data in chapter four which were the objectives of the study to get conclusion of this study.

From the analysis of the data set, it was observed that speeding is the single most critical cause of road traffic accidents along Nairobi Kisumu Highway. Out of the forty (40) cases sampled, a total of twenty seven (27) accidents were attributed to driving at excessive speed (exceeding 80Km/Hr.) without regard to critical road and vehicle conditions. This was found to be worrying because in an urban environment, speed is regulated to be 50Km/Hr. and in highways buses are required to travel at a maximum speed of 80Km/Hr. and for this reason they are fitted with speed governors. The possible explanation is that the bus owners tamper with speed governing gadgets so as to make more trips to and fro and end up colluding with traffic police officers whenever caught over speeding. It was noted that traffic police officers had slackened in traffic law enforcement whereas drivers disobeyed the law and some of them tampered with the installed speed governors.

From the data table 4.14 it was recorded that all bus body builders fitted the buses with seat belts as it is a Government requirement. The researcher was not able to establish the data for people who had

fastened their seat belts during the occurrence of the accident. There was no report gathered by the respondents giving the number of passengers who had worn seat belts during the accident. Since the pass on of former head of transport late Hon. John Michuki the passengers, bus crew and police have slackened in following this requirement which in long run has cost many lives through road traffic accidents.

Severe injuries have been incurred by passengers without seat belts due to the laws of inertia whereby the occupants of a moving vehicle are catapulted against the objects in front of them or even ejected out of the vehicle in case of an accident, (Barss, et al., 1998 & Mackay, 2001). A person without seat belt on may sustain more severe injuries than one who has put on his seat belt. The possible explanation is lack of enforcement of this particular regulation by the police and also lack of self-regulation by passengers on seat belt use.

A stirring feature of the study was that driving under the influence of alcohol only three cases were recorded. This meant that the aspect of drunk driving as a determinant in the severity of road traffic accident involving buses along Nairobi-Kisumu Highway was insignificant! This could simply be explained by lack of means to measure Blood Alcohol Concentration (BAC) levels to the drivers involved in an accident.

It was noted that the police do not have relevant gadgets to ascertain the level of BAC in the drivers blood and the doctors do not gather that data as well. It was also noted in the questionnaires that all bus body builders in Kenya do not install alcohol detector gadgets in the driver's cabin which restricts the driver from starting the vehicle if drunk. This procedure necessarily requires support by legislation to be curbed, but which is currently non-existent in Kenya. Many accidents caused by drunk-driving will therefore go unreported as long as the situation continues.

From data table 4.15, only three bus body builders out of fourteen (14) installs the roll over protection bars in their vehicles. Cross tables 4.16 and 4.17 shows that there is a significant relationship between severity of the road accidents and incorporation of roll over protection bars. Vehicles without the roll over protection bars registered two hundred and nine (209) very severely injured passengers as compared with vehicles with roll over protection bars where only thirty three (33) passengers sustained similar injuries. From the data table 4.15, it was recorded that only 14.3% of vehicles sampled had roll over protection bars and 85.7% did not have. Most severe injuries

occurred in vehicles without roll over protection bars. This was a clear indication that if this procedure is supported by legislation which is currently missing in Kenya, severity of road traffic accident in buses would be highly minimized.

It was also noted that due to lack of standardization there is no control on specification of the best suited roll over protection bars thus quality and strength of materials used are compromised therefore not effective in protection from crumbling during accident. This can be improved if this procedure is legislated in Kenya as it will ensure standardization after trial and testing through the Kenya Bureau of Standards, National Transport and Safety Board among other relevant bodies. This is evident through table 4.15 which shows that 14.3% of passengers still sustained very severe injuries despite fitment of roll over protection bars in the few buses sampled.

5.3 Discussions

The findings in chapter four were examined and discussed against other researchers' findings and conclusions noted in literature review section under chapter two. The researcher analyzed the two inputs and summarized the conclusions in the last paragraph of this section.

Accident risks increase with speed increase as well as increase in the magnitude of injury to the vehicle occupants as discussed in chapter two section 2.4.1 according to World Report on Road Traffic Injury (2013). The findings of this study confirms that vehicles exceeding the set limit are vulnerable to fatal accident which eventually results in severe injuries. See table 4.8.

As noted in chapter two section 2.4.2, the Kenyan Government had commenced use of Breathalyzer to detect drivers driving under the influence of alcohol but with time the exercises became inefficient hence infrequent. This led to relaxation of police force on enforcement of Breathalyzer use after some drivers went to court claiming that the gadget was not safe, (Angira, 2011). The Government has not come up with safer gadgets and this has led to little effort put to curb the menace. The researcher was not able to get sufficient data regarding drunk-driving due to the fact that Kenya Police forces and doctors do not record such information. It is therefore adamant that such data is recorded and documented for analysis which could help the Government make informed decisions on issues pertaining to road safety.

According to World Report on Road Traffic Injury Prevention (2013), Kenya scored poorly on enforcement of core traffic rules which directly aimed at reducing the road accident fatalities.

Among these rules was enforcement of seat belt use by drivers and passengers. The Government gave a directive that all PSV must bear seat belts and according to this study it was established that all bus body building companies installs the specified seat belts. See table 4.14.

On the other hand, it was noted that most passengers do not fasten the seat belts and this has greatly contributed to the severity of road accidents as explained by Nader, 1972 and Henderson, 1996 in section 2.4.3. The researcher was not able to get sufficient data regarding seat belt use as it was not feasible to gather. The respondents clarified that they did not record such data as it is not possible to tell after the accident has occurred. They also noted that very few buses encourage their passengers to use the belt despite their availability in each and every commuter bus seat.

If the roof of a bus and its supporting structure are sufficiently strong that they do not deform significantly, an automobile rolls as an essentially rigid, roughly cylindrical body, Donald (1994). The buses with roll over protection bars safe guards the occupants from injuries and increases chances of survival as per the findings on the influence of roof strength on injury mechanics by Orlowski, Bundorf and Moffatt, 1985.

This study established that only 14.3% (table 4.15) of the Kenyan bus body builders install roll over protection bars in the superstructure of their buses. There was a negative correlation ($r = -0.687$; -0.606 respectively) between number of severe injuries sustained by passengers and buses with roll over protection bars, therefore indicating that the vehicles with roll over protection had fewer fatal cases in the accidents sampled. The vehicles with roll over protection bars caused thirty three (33) very severe injuries whereas the buses without roll over protection bars caused two hundred and nine (209) very severe injuries to the passengers. See table 4.16. The researcher feels that if this procedure was legislated and standardized through the relevant bodies' severity of road accidents would be highly reduced.

5.4 Conclusion

Objectives analyzed in this chapter using product moment coefficient of correlation are further summarized and discussed before drawing conclusion in section 5.4.2. The following opportunities were identified based on the findings of the main determinants of severity of road traffic accidents and presented as recommendations under section 5.5.

5.4.1 Accident severity by the major determinants of road accidents

In reference to section 4.6 the data set showed that there was a strong positive correlation (r = 0.771) between speed of the vehicle during accident and severity of road accidents. The researcher therefore concludes that it is essential for body builders, insurance companies, vehicle assemblers, bus drivers, policemen, road users and passengers to observe the set speed limits by any reasonable means. Speed limits are expressly defined in traffic act and installation of speed governors are a requirement but the stakeholders need to emphasize on enforcement and adherence for the full benefits to be realized.

The researcher was not able to establish the relationship between seat belt use and injuries because there was no significant data for processing. It was also noted that very few people use seat belt because of various reasons which could be ignorance, dirt or excess passengers among other factors. The researcher concluded that the use of seat belt is essential as far as severity of the road accident is concerned, therefore passengers and drivers should use them regularly.

Due to the few cases in regard to drunk-driving, it was not possible for the researcher to establish any significant relationship to severity of road accident. Nevertheless, a sound measure should be put to ensure that the correct data is collected to ensure sound decisions are reached at. The government should make a requirement that drivers BAC levels are taken and documented as part of accident analysis.

From the correlation table in section 4.8, it was recorded that there was a negative correlation (r = -0.606) between incorporation of roll over protection bars and the severity of road accident. This showed that the presence of roll over protection bars in the bus body are essential as they protect the occupants from severe injuries due to their resistance to roof crumbling and snapping of the upper part of the bus body. This concept is not a requirement in the traffic act and KEBS KS 372:2011 and may require legislation for it to be enforced.

5.4.2 Other observations relating to determinants of severity of road accidents

It was noted that there were other causes of accident which contributed to severity of the road accident. Some of the causes recorded included road and weather conditions. Mostly some roads do not have bumps which compels the driver to slow down while others had potholes which destabilized the vehicle therefore leading to occurrence of an accident. Rainy and foggy weather

conditions were noted to contribute to accident occurrence. It is essential for the Kenya National Highway Authority (KeNHA) to incorporate better informative signage in black spot areas as well as use bumps to compel road user to slow down.

5.5 Recommendations

Arising from the findings and summary of the study, it was concluded that the three objectives namely, speed, seat belt use and incorporation of roll over protection bars play a key role in determination of severity of a road accident. Based on those conclusions therefore, several recommendations were made so as to reduce the menace of the problem. Those recommendations were enumerated as follows:-

5.5.1 Legislation of incorporation of ROPBs in the passenger vehicle body construction

In relation to the finding that ROPBs can greatly reduce road accident severity, the researcher strongly felt that this concept should be implemented by legislating the procedure, standardizing through KEBS and enforcing use across the country. These bars protects the occupants of the vehicle from crumbling of the roof and snapping of the body of the bus which eventually inflicts very severe injuries to the passengers. Legislation may necessitate amendment of Laws of Kenya – Traffic Act chapter 403 and also KEBS KS 372:2011 - Passenger vehicle body construction specification (Third Edition). Similar concept was adopted in the USA in 2005, (Notice of proposed rulemaking. Docket no. NHTSA-2005-22143, 2005). In Canada every school buses and passenger buses with a GVWR greater than 2,722 kg was required to conform to Technical Standards Document No. 220 – Roll over Protection, (Canada Gazette, 2013 June).

5.5.2 Improvement of data recording instruments

As noted in chapter four, there was no data recorded and documented in regard to BAC levels on the drivers involved in the accident by police and other stakeholders, the researcher felt that the instruments used in recording data will require improvement to capture more relevant information which can assist the data analyzers to make right decisions. These tools include the accident recording forms used by police, doctors and Insurance companies. They require to reflect whether the driver was under any drug influence. The researcher also felt that records pertaining to the bus body builder, bus owner and accidents involved in by the vehicles should be harmonized as this information would help trace the history of the vehicle and its design procedures.

5.5.3 Incentives for traffic police officers

The government will need to put in place measures to motivate police officers working in traffic departments to ensure that they do not engage in corrupt deals which has seen relaxation in implementation of traffic rules. Police can be given incentives for working towards the reduction of accidents and enforcing the rules. Currently, many bus owners exceed the limit of 80km/hr. by tampering with the speed governors in the full knowledge of the traffic police officers.

5.5.4 Speed control systems

Bus over speeding was found to be one of the major contributors to severity of road accident as depicted in the findings of this study, therefore the researcher strongly felt that the government needs to speed up the project of installing speed monitoring gadgets installation on highways. This will help in tracking deviant drivers by installing cameras which can detect vehicle's registration number and speed. An efficient and transparent way of fines and punishments should be set to ensure that the offenders are punished. The vehicle owners should be charged and prompted to pay the fines; an up-to-date database needs to be created and maintained – a similar system exists in South Africa.

Despite the finding that all bus body builders fits the vehicles with speed governors, most drivers tamper with the gadget hence allowing them to exceeding the set speed limits. The government should also recommend and certify tamper free speed governors as this would ensure that all vehicles are operating as per the point of inspection specifications.

5.5.5 Driver training and standardization of the curriculum

It was also noted that all vehicles are fitted with seat belts but few vehicles encourage their passengers to use the provided safety gadgets. The drivers also rarely uses the seat belts. It is therefore essential to train the drivers and conductors on road safety. Education and enforcement campaigns may not be totally successful in reducing excessive speed but there is need to address the training of drivers in the driving schools. The driving school curriculum currently followed need to be standardized and enriched to include more of defensive driving, road safety precautions and behavioral change. The time spent by drivers in school is too short to inculcate the right driving skills and behavior on the road. Driving school instructors too require to undergo checks before being allowed to train new drivers. Certain minimum qualifications must be set to ensure that the

driving task is given the importance it deserves. Licensing of driving schools needs to be regulated and monitored through out to ensure the required standards are maintained and sustained.

5.6 Suggestions for further Research

The researcher recommends that a similar study should be conducted in other highways to ascertain the determinants of severity of the road accidents involving buses in Kenya by other scholars.

If this study is accepted in the public domain the researcher recommends that all the beneficiaries categorized in section 1.7 of this study should be involved to ensure acceptance and full implementation is achieved.

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APPENDICES

Appendix 1

LETTER OF TRANSMITTAL

MURIMI LEWIS,

P.O BOX 36082 – 00200,

NAIROBI.

Date……

Dear Respondent,

RE: INVITATION TO PARTICIPATE IN A RESEARCH STUDY

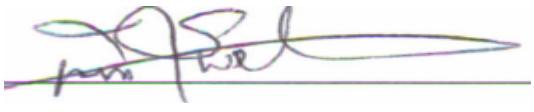
I am a post graduate student from the University of Nairobi, Department of Extra Mural Studies pursuing a Master of Arts in Project Planning and Management. You have been selected to take part in the study as a respondent. In the study, you will be issued with a questionnaire aimed at gathering information on the study titled; **"Survey on the Causes of Accident involving Buses".**

I kindly request you to take time and respond to the questionnaire items and give honest information to the best of your knowledge. The information given shall be treated with confidentiality and your identity shall not be quoted or released in the study or any presentation whatsoever. While you may not experience any direct benefits from the participation, information collected from the study may help our transport sector enhance safety in our buses therefore reduce the number of and level of severity currently experienced in the rampant road traffic accidents. In case the study will be of interest to your organization, it can be availed once the study is complete.

By signing the section below, you are indicating your consent to participate in the study.

Signature ……..

Your participation is highly appreciated.



Murimi Lewis

University of Nairobi.

Appendix 2

SURVEY ON THE CAUSES OF ACCIDENT INVOLVING BUSES

Part A.

My name is Murimi Lewis, a student at the University of Nairobi pursuing M.A in Project Planning & Management. I am carrying out a research study on the determinants of severity of road accidents involving buses along Nairobi – Kisumu Highway in Kenya. This questionnaire is designed to gather specific information about the study. I assure you that your identities shall be treated with confidentiality. Hence do not provide your name. Please give the accurate information to the best of your knowledge by writing on the space provided. You may attach relevant documents if need be or if the space provided is not enough. Your support is highly regarded.

Your job designation ……..…….....

Sex (Tick as appropriate):- Male [ ] Female [ ]

Age bracket (Tick as appropriate):- 18-24Yrs. [ ] 25–30Yrs. [ ] 31–40Yrs. [ ] 41 – over Yrs. [ ]

Experience in the current job (Years):- 0 - 3 Yrs. [ ] 4 – 7 Yrs. [ ] 8 – Above Yrs. [ ]

Name of Company you work for……

Part B.

Commuter Bus Route…….

1. What was the cause of the accident?

   ……..

   ……..

……..

2. At what speed was the vehicle moving at when the accident occurred?

……..

……..

……..

3. How many people had fastened their seat belts?

……..

……..

……..

4. Was the driver drunk? YES [ ] NO [ ]

EXPLAIN……...……

……..

……..

5. Who is the body builder of the bus?

……..

……..

……

6. How many people were injured?

a.) Very severe (died, coma, taken to ICU, very severe head/ neck injuries)

……..

b.) Moderately severe (chest/ ribs injuries, admitted to ordinary ward – no special care required, released after a short stay more than two days while undergoing treatment)

……..

c.) Mild severe (not injured, treated and left within a day)

……..

7. Any other comments regarding the accident (personal/ general observation)

……..

……..

……..

……..

……..

……..

……..

……..

--- Thank you --

Appendix 3

SURVEY ON THE CAUSES OF ACCIDENT INVOLVING BUSES

My name is Murimi Lewis, a student at the University of Nairobi pursuing M.A in Project Planning & Management. I am carrying out a research study on the determinants of severity of road accidents involving buses along Nairobi – Kisumu Highway in Kenya. This questionnaire is designed to gather specific information about the study. I assure you that your identities shall be treated with confidentiality. Hence do not provide your name. Please give the accurate information to the best of your knowledge by writing on the space provided. You may attach relevant documents if need be or if the space provided is not enough. Your support is highly regarded.

1.0 Part A: Respondent's details and introduction

1.1 Your job designation……...…….....

1.2 Sex (*Tick as appropriate*):- Male [ ] Female [ ]

1.3 Age bracket (*Tick as appropriate*):- 18-24Yrs. [ ] 25–30Yrs. [ ] 31–40Yrs. [ ] 41 – over Yrs. [ ]

1.4 Experience in the current job (*Years*):- 0 - 3 Yrs. [ ] 4 – 7 Yrs. [ ] 8 – Above Yrs. [ ]

1.5 Name of Company you work for……

1.6 Location of your Company…….

2.0 Part B: Case details (Minimum of 3 Cases which happened between years 2011 and 2013)

2.1 How many buses do you build in a month (*average for the year*)? …….. …….. ……..

2.2 Do you install/ check availability of certified speed governors in the buses before releasing them to the customers? YES [_____] NO [_____]

2.3 Do you install belts in all seats? YES [_____] NO [_____]

2.4 Do you install alcohol analyzer sensors which can immobilize the vehicle if above a set threshold in the bus? YES [_____] NO [_____]

2.5 Do you install roll over protection bars in the design phase and assembly of the bus body super structure? YES [_____] NO [_____]

2.6 Do you collect, analyze data and review safety aspects based on vehicles which you built and were involved in an accident? YES [_____] NO [_____]

If yes explain how…..……..

……

……

……

2.7 Any other comments regarding the accident (*Personal/ general observation*)

……

……

……..……

……..……

……..…..……

……..……..……

……

--- Thank you ----

Table 2: List of Registered Insurance Companies in Kenya

LIST OF REGISTERED INSURANCE COMPANIES IN KENYA		
Srl. No.	**Company Name**	**Address**
1	A P A Insurance Limited	P.O. Box 30065 – 00100, NAIROBI
2	Africa Merchant Assurance Company Limited	P.O. Box 61599 – 00200, NAIROBI
3	Apollo Life Assurance Limited	P.O. Box 30389 – 00100, NAIROBI
4	British-American Insurance Company (K) Limited,	PO Box 30375 – 00100, NAIROBI
5	Cannon Assurance Limited	P.O. Box 30216 – 00100, NAIROBI
6	CfC Life Assurance Limited	P.O. Box 30364 – 00100, NAIROBI
7	Chartis Kenya Insurance Company Limited	P.O. Box 49460 – 00200, NAIROBI
8	CIC General Insurance Limited	P.O. Box 59485 – 00200, NAIROBI
9	CIC Life Assurance Limited	P.O. Box 59485 – 00200, NAIROBI
10	Concord Insurance Company Limited	P.O Box 30634 – 00100, NAIROBI
11	Corporate Insurance Company Limited	P.O. Box 34172 – 00100, NAIROBI
12	Direct line Assurance Company Limited	P.O. Box 40863 – 00100, NAIROBI
13	East Africa Reinsurance Company Limited	P.O. Box 20196 – 00200, NAIROBI
14	Fidelity Shield Insurance Company Limited	P.O. Box 47435 – 00100, NAIROBI
15	First Assurance Company Limited	P.O. Box 30064 – 00100, NAIROBI
16	GA Insurance Limited	P.O. Box 42166 – 00100, NAIROBI
17	Gateway Insurance Company Limited	P.O. Box 60656 – 00200, NAIROBI
18	Geminia Insurance Company Limited	P.O. Box 61316 – 00200, NAIROBI
19	ICEA LION General Insurance Company Limited	P.O. Box 30190 – 00100, NAIROBI
20	ICEA LION Life Assurance Company Limited	P.O. Box 46143 – 00100, NAIROBI
21	Intra Africa Assurance Company Limited	P.O. Box 43241 – 00100, NAIROBI
22	Invesco Assurance Company Limited	P.O Box 52964 – 00200, NAIROBI
23	Kenindia Assurance Company Limited	P.O. Box 44372 – 00100, NAIROBI
24	Kenya Orient Insurance Limited	P.O. Box 34530-00100, NAIROBI
25	Kenya Reinsurance Corporation Limited	P.O. Box 30271 – 00100, NAIROBI
26	Madison Insurance Company Kenya Limited	P.O. Box 47382 - 00100, NAIROBI
27	Mayfair Insurance Company Limited	P.O. Box 45161 – 00100, NAIROBI
28	Mercantile Insurance Company Limited	P.O. Box 20680 – 00200, NAIROBI
29	Metropolitan Life Kenya Limited	P.O. Box 46783 – 00100, NAIROBI
30	Occidental Insurance Company Limited	P.O. Box 39459 – 0063, NAIROBI
31	Old Mutual Life Assurance Company Limited	P.O. Box 30059 – 00100, NAIROBI
32	Pacis Insurance Company Limited	P.O. Box 1870 – 00200, NAIROBI
33	Pan Africa Life Assurance Limited	P.O. Box 44041 – 00100, NAIROBI
34	Phoenix of East Africa Assurance Company Limited	P.O. Box 30129 – 00100, NAIROBI
35	Pioneer Assurance Company Limited	P.O. Box 2033 00200, NAIROBI
36	REAL Insurance Company Limited	P.O Box 40001 – 00100, NAIROBI
37	Shield Assurance Company Limited	P.O Box 25093 – 00100, NAIROBI
38	Takaful Insurance of Africa	P.O. Box 1811 – 00100, NAIROBI
39	Tausi Assurance Company Limited	P.O. Box 28889-00200, NAIROBI
40	The Heritage Insurance Company Limited	P.O. Box 30390 – 00100, NAIROBI
41	The Jubilee Insurance Company of Kenya Limited	P.O. Box 30376-00100, NAIROBI
42	The Kenyan Alliance Insurance Co Ltd	P.O. Box 30170 – 00100, NAIROBI
43	The Monarch Insurance Company Limited	P.O. Box 44003 – 00100, NAIROBI
44	Trident Insurance Company Limited	P.O. Box 55651 – 00200, NAIROBI
45	UAP Insurance Company Limited	P.O Box 43013 – 00100, NAIROBI

Table 3: List of Registered Bus Body Builders in Kenya

LIST OF REGISTERED VEHICLE BODY BUILDERS IN KENYA	
Srl. No.	**Company Name**
1	LSHS Vehicle Body Builders
2	Master Vehicle Body Builders
3	Banbros Vehicle Body Builders
4	Agro Vehicle Body Builders
5	Dynacorp Vehicle Body Builders
6	Midland Vehicle Body Builders
7	Autocare Vehicle Body Builders
8	Workhaus Vehicle Body Builders
9	Sairaj Vehicle Body Builders
10	Axel Vehicle Body Builders
11	Dodi Vehicle Body Builders
12	Engineering Development Vehicle Body Builders
13	Spur Engineering Vehicle Body Builders
14	Master Fabricators Vehicle Body Builders

Table 4: Predicted Road traffic fatalities adjusted for under reporting

Predicted road traffic fatalities by region (in thousands), adjusted for underreporting, 1990–2020

Region[a]	Number of countries	1990	2000	2010	2020	Change (%) 2000–2020	Fatality rate (deaths/ 100 000 persons)	
							2000	2020
East Asia and Pacific	15	112	188	278	337	79	10.9	16.8
East Europe and Central Asia	9	30	32	36	38	19	19.0	21.2
Latin America and Caribbean	31	90	122	154	180	48	26.1	31.0
Middle East and North Africa	13	41	56	73	94	68	19.2	22.3
South Asia	7	87	135	212	330	144	10.2	18.9
Sub-Saharan Africa	46	59	80	109	144	80	12.3	14.9
Sub-total	121	419	613	862	1 124	83	13.3	19.0
High-income countries	35	123	110	95	80	–27	11.8	7.8
Total	156	542	723	957	1 204	67	13.0	17.4

[a] Data are displayed according to the regional classifications of the World Bank.

Source: reproduced from reference *1*, with minor amendments, with the permission of the authors.

Table 5: WHO 2013, Kenya Statistics on road safety regulations

KENYA

Population: 40 512 678
Income group: Low
Gross national income per capita: US$ 810

INSTITUTIONAL FRAMEWORK

Lead agency	National Road Safety Council
Funded in national budget	Yes
National road safety strategy	Yes
Funding to implement strategy	Partially funded
Fatality reduction targets set	Yes (2009–2014)
Fatality reduction target	50%

SAFER ROADS AND MOBILITY

Formal audits required for new road construction	Yes
Regular inspections of existing road infrastructure	Yes
Policies to promote walking or cycling	No
Policies to encourage investment in public transport	Yes
Policies to separate road users to protect VRUs	No

SAFER VEHICLES

Total registered vehicles (2010)	1 389 864
Cars and 4-wheeled light vehicles	—
Motorized 2- and 3-wheelers	—
Heavy trucks	—
Buses	—
Other	—
Vehicle standards applied	
UN World forum on harmonization of vehicles standards	—
New car assessment programme	—
Vehicle regulations	
Front and rear seat-belts required in all new cars	Yes
Front and rear seat-belts required all imported cars	Yes

DATA

Reported road traffic fatalities (2010)	3 055[a]
Estimated GDP lost due to road traffic crashes	—

[a] Police records. Defined as died within a year of crash.

SAFER ROAD USERS

Penalty/demerit point system in place	No
National speed limits	Yes
Local authorities can set lower limits	Yes
Maximum limit urban roads	50 km/h
Enforcement	0 1 2 ③ 4 5 6 7 8 9 10
National drink–driving law	Yes[b]
BAC limit – general population	—
BAC limit – young or novice drivers	—
BAC limit – professional/commercial drivers	—
Random breath testing and/or police checkpoints	No[c]
Enforcement	0 1 ② 3 4 5 6 7 8 9 10
% road traffic deaths involving alcohol	—
National motorcycle helmet law	Yes
Applies to drivers and passengers	Yes
Helmet standard mandated	Yes
Enforcement	0 1 2 3 ④ 5 6 7 8 9 10
Helmet wearing rate	—
National seat-belt law	Yes
Applies to front and rear seat occupants	Yes
Enforcement	0 1 2 ③ 4 5 6 7 8 9 10
Seat-belt wearing rate	—
National child restraint law	No
Enforcement	—
National law on mobile phones while driving	Yes
Law prohibits hand-held mobile phone use	Yes
Law also applies to hands-free mobile phones	Yes

[b] Not based on BAC.
[c] Cases suspected of drink-driving are further investigated.

POST-CRASH CARE

Vital registration system	Yes
Emergency Room based injury surveillance system	No
Emergency access telephone number(s)	Multiple numbers
Seriously injured transported by ambulance	≤10%
Permanently disabled due to road traffic crash	—
Emergency medicine training for doctors	—
Emergency medicine training for nurses	—

Table 6: Table for determining sample size from a given population

Table for Determining Sample Size from a Given Population

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size.
S is sample size.

Table 7: Summarized Data from Insurance Companies

No.	Name of the Insurance Company	Gender	Age Bracket	Experience Bracket	Speed of the Bus at	Was the driver drunk ?	No. of very injured passengers	No. of moderately injured passengers	No. of mild injured passengers	Insured Capacity	Roll Bars	No. of persons on board	Name of Bus Body Builder	Commuter Bus Route
1	Kenya Reinsurance Corporation Ltd.	2	3	1	85	2	5	12	45	62	0	62	Axel Vehicle Body Builders	Nairobi - Kisumu
2	GA Ins. Ltd.	1	2	1	90	2	9	16	37	62	0	63	Kenya Coach Industries	Nairobi - Kisumu
3	CIC Life Assurance Ltd.	1	3	1	100	2	10	18	26	51	0	52	Kenya Coach Industries	Nairobi - Kisumu
4	British-American Ins. Co. (K) Ltd.,	1	3	1	100	2	9	15	44	62	0	63	Kenya Coach Industries	Nairobi - Kisumu
5	Cannon Assurance Ltd.	1	2	1	100	2	11	18	31	62	0	61	Agro Vehicle Body Builders	Nairobi - Kisumu
6	Chartis Kenya Ins. Co. Ltd.	2	2	1	100	1	8	16	40	0	0	0	Kenya Coach Industries	Nairobi - Kisumu
7	A P A Ins. Ltd.	1	2	1	85	2	3	11	37	62	1	62	Banbros Vehicle Body Builders	Nairobi - Kisumu
8	Kenindia Assurance Co. Ltd.	1	3	1	100	2	3	9	30	51	1	50	Banbros Vehicle Body Builders	Nairobi - Kisumu
9	CIC General Ins. Ltd.	1	2	0	110	2	10	23	44	42	0	42	Dynacorp Vehicle Body Builders	Nairobi - Kisumu
10	Trident Ins. Co. Ltd.	1	2	2	90	2	8	14	41	67	0	67	Axel Vehicle Body Builders	Nairobi - Kisumu
11	East Africa ReIns. Co. Ltd.	1	2	2	80	2	5	10	51	62	1	61	Banbros Vehicle Body Builders	Nairobi - Kisumu
12	Pioneer Assurance Co. Ltd.	1	2	1	85	2	5	12	44	67	1	66	LSHS Vehicle Body Builders	Nairobi - Kisumu
13	Kenya Orient Ins. Ltd.	1	2	1	85	2	5	13	34	62	0	61	Master Vehicle Body Builders	Nairobi - Kisumu
14	Mayfair Ins. Co. Ltd.	2	0	1	80	2	5	8	29	51	0	52	Dynacorp Vehicle Body Builders	Nairobi - Kisumu
15	Shield Assurance Co. Ltd.	1	3	1	70	2	4	11	34	42	0	42	Midland Vehicle Body Builders	Nairobi - Kisumu
16	The Kenyan Alliance Ins. Co Ltd	1	2	1	85	2	7	14	44	51	0	52	Autocare Vehicle Body	Nairobi - Kisumu

													Builders	
17	Madison Ins. Co. Kenya Ltd.	1	2	1	110	2	10	24	38	67	0	68	Sairaj Vehicle Body Builders	Nairobi - Kisumu
18	The Monarch Ins. Co. Ltd.	1	2	1	80	2	5	12	44	67	0	68	Axel Vehicle Body Builders	Nairobi - Kisumu
19	Phoenix of East Africa Assurance Co. Ltd.	1	3	1	90	2	8	17	32	62	0	61	Engineering Development Vehicle Body Builders	Nairobi - Kisumu
20	First Assurance Co. Ltd.	1	3	2	90	2	9	17	32	62	0	60	Engineering Dv Vehicle Body Builders	Nairobi - Kisumu
21	Jubilee Ins. Co. of Kenya Ltd.	1	0	1	70	2	3	9	29	0	1	0	LSHS Vehicle Body Builders	Nairobi - Kisumu
22	ICEA LION General Ins. Co. Ltd	1	2	1	70	2	2	10	50	62	1	59	LSHS Vehicle Body Builders	Nairobi - Kisumu
23	UAP Ins. Co. Ltd.	1	2	1	100	2	9	16	26	42	0	42	Dodi Vehicle Body Builders	Nairobi - Kisumu
24	Gateway Ins. Co. Ltd.	1	2	2	90	2	4	10	37	62	0	62	Sairaj Vehicle Body Builders	Nairobi - Kisumu
25	CfC Life Assurance Ltd.	1	0	2	80	2	3	8	31	51	1	52	Banbros Vehicle Body Builders	Nairobi - Kisumu
26	Geminia Ins. Co. Ltd.	1	2	1	100	2	8	18	29	51	0	50	Kenya Coach Industries	Nairobi - Kisumu
27	REAL Ins. Co. Ltd.	1	2	1	90	2	9	15	28	42	0	42	Agro Vehicle Body Builders	Nairobi - Kisumu
28	Apollo Life Assurance Ltd.	1	2	1	80	2	3	8	30	62	1	58	LSHS Vehicle Body Builders	Nairobi - Kisumu
29	Fidelity Shield Ins. Co. Ltd.	1	3	1	85	1	7	17	44	51	0	51	Midland Vehicle Body Builders	Nairobi - Kisumu
30	Occidental Ins. Co. Ltd.	1	2	1	80	2	3	9	36	42	1	41	LSHS Vehicle Body Builders	Nairobi - Kisumu
31	Africa Merchant Assurance Co. Ltd.	2	2	0	80	2	3	11	46	62	1	60	Banbros Vehicle Body Builders	Nairobi - Kisumu
32	Invesco Assurance Co. Ltd.	1	2	2	90	2	9	14	28	62	0	63	Agro Vehicle Body Builders	Nairobi - Kisumu

33	Intra Africa Assurance Co. Ltd.	1	3	1	70	2	4	10	42	67	0	67	Dodi Vehicle Body Builders	Nairobi - Kisumu
34	Pacis Ins. Co. Ltd.	2	2	1	85	2	5	13	40	51	0	49	Dodi Vehicle Body Builders	Nairobi - Kisumu
35	Pan Africa Life Assurance Ltd.	2	3	1	70	2	5	12	44	62	0	62	Dodi Vehicle Body Builders	Nairobi - Kisumu
36	Directline Assurance Co. Ltd.	1	2	1	100	0	10	18	30	51	0	51	Sairaj Vehicle Body Builders	Nairobi - Kisumu
37	The Heritage Ins. Co. Ltd.	1	2	1	85	1	6	16	41	62	0	62	Autocare Vehicle Body Builders	Nairobi - Kisumu
38	Metropolitan Life Kenya Ltd.	1	2	1	100	2	10	15	25	62	0	61	Spur Engineering Vehicle Body Builders	Nairobi - Kisumu
39	Takaful Ins. of Africa	0	0	0	0	0	0	0	0	0	99	0	0	0
40	Tausi Assurance Co. Ltd.	0	0	0	0	0	0	0	0	0	99	0	0	0

KEY:	Gender	1: - Male, 2:- - Female
1	Age Bracket	1: - 18 - 24 years, 2: - 25 - 30 years, 3: - 31 -40 years, 4: - 41 & above years, 00: - missing
2	Experience Bracket	1: - 1 - 3 years, 2:- 4- 7 years, 3:- 8 & above years, 0:- missing
3	Speed of the Bus	Definite number; 00:- missing
4	Was the driver drunk?	1:- Yes, 2:- No, 0:- Missing
5	No. of very injured pass.	Definite number; 00:- missing
6	No. of moderately injured passengers	Definite number; 00:- missing
7	No. of mild injured pass.	Definite number; 00:- missing
8	Insured Capacity	Definite number; 00:- missing
9	Roll Bars	0:- No/Not Available, 1:- Yes/Available, 99:- Missing
10	No. of persons on board	Definite number; 00:- missing

Table 7: Summarized Data from bus body builders

No.	Name of Bus Body Builder	Gender	Age Bracket	Experience Bracket	Speed Governor Installation	Seat belt Installation	Alcohol Detector Gadget	ROPBs Installation	Average No. of Units built/Month
1	Agro Vehicle Body Builders	2	0	1	1	1	2	0	20
2	Autocare Vehicle Body Builders	1	3	1	2	1	2	0	30
3	Axel Vehicle Body Builders	1	2	2	2	1	2	0	30
4	Workhaus Vehicle Body Builders	1	3	2	1	1	2	0	25
5	LSHS Vehicle Body Builders	1	4	3	1	1	2	1	50
6	Dynacorp Vehicle Body Builders	1	3	2	1	1	2	0	30
7	Engineering Development Vehicle Body Builders	2	3	1	2	1	2	0	20
8	Kenya Coach Industries	1	3	2	1	1	2	0	50
9	Dodi Vehicle Body Builders	1	2	2	2	1	2	0	35
10	Midland Vehicle Body Builders	1	3	1	2	1	2	0	40
11	Sairaj Vehicle Body Builders	1	2	2	1	1	2	0	25
12	Spur Engineering Vehicle Body Builders	1	2	2	1	1	2	0	25
13	Banbros Vehicle Body Builders	1	2	2	1	1	2	1	30
14	General Motors East Africa	1	4	3	1	1	2	0	200

KEY:		
	Gender	1: - Male, 2:- - Female
	Age Bracket	1: - 18 - 24 years, 2: - 25 - 30 years, 3: - 31 -40 years, 4: - 41 & above years, 00: - missing
	Experience Bracket	1: - 1 - 3 years, 2:- 4- 7 years, 3:- 8 & above years, 0:- missing
	Speed Governor Installation	1:- Yes/Available, 2:- No/Not available, 0:- Missing
	Seat belt Installation	1:- Yes/Available, 2:- No/Not available, 0:- Missing
	Alcohol Detector Gadget	1:- Yes/Available, 2:- No/Not available, 0:- Missing
	Installation of ROPBs	0:- No/Not Available, 1:- Yes/Available, 99:- Missing
	Average No. of Units built/Month	Any numerical number; 0:- Missing

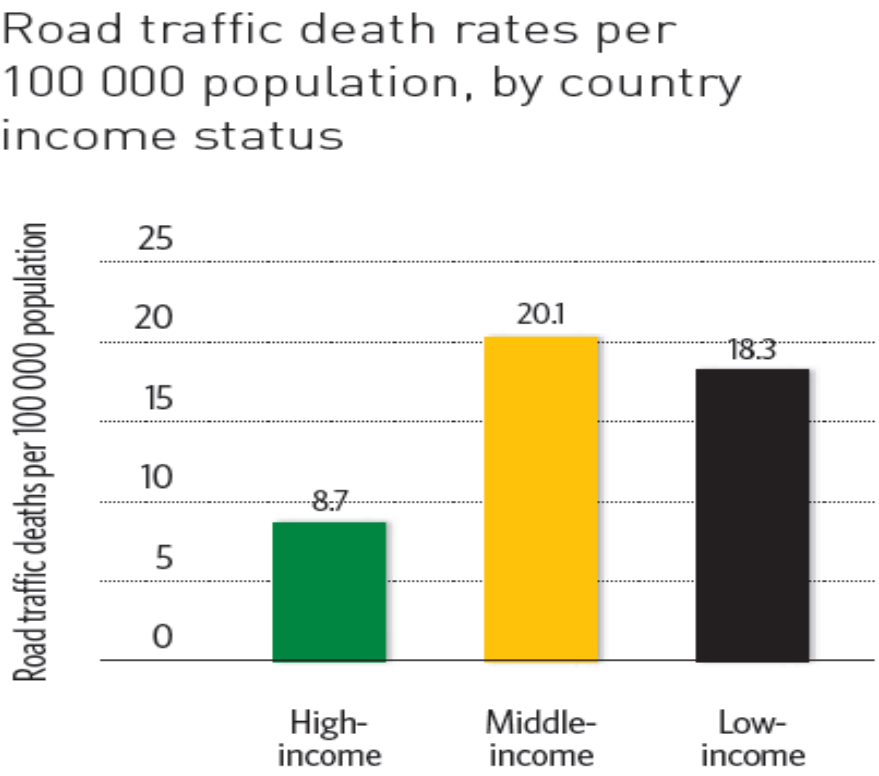


Figure 2: Road traffic death rates versus country income

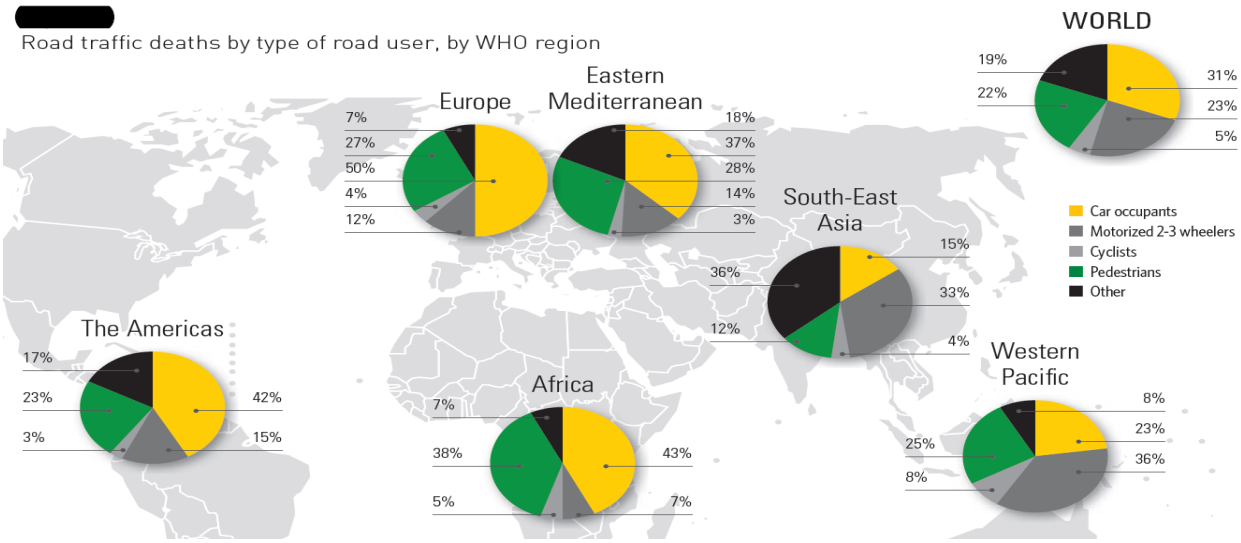


Figure 3: Road traffic deaths by type of road user

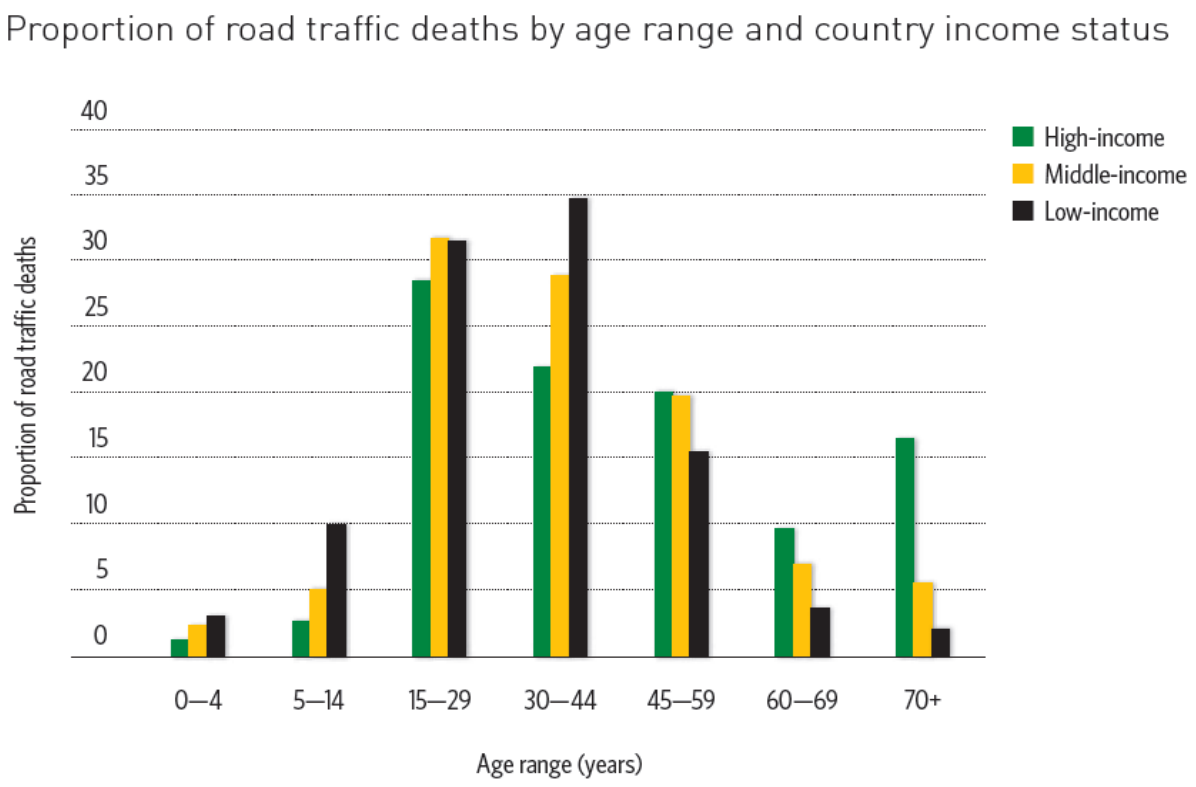


Figure 4: Road traffic deaths by age range and country income status

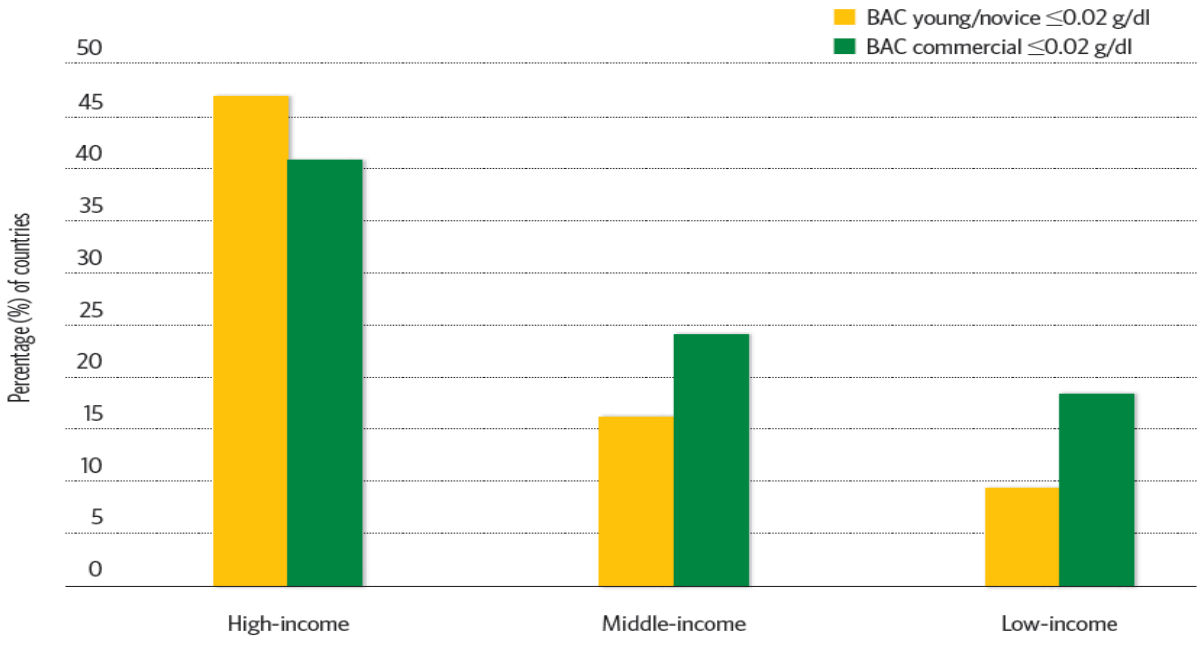


Figure 5: Percentage drunk-driving injuries vs. country level of income

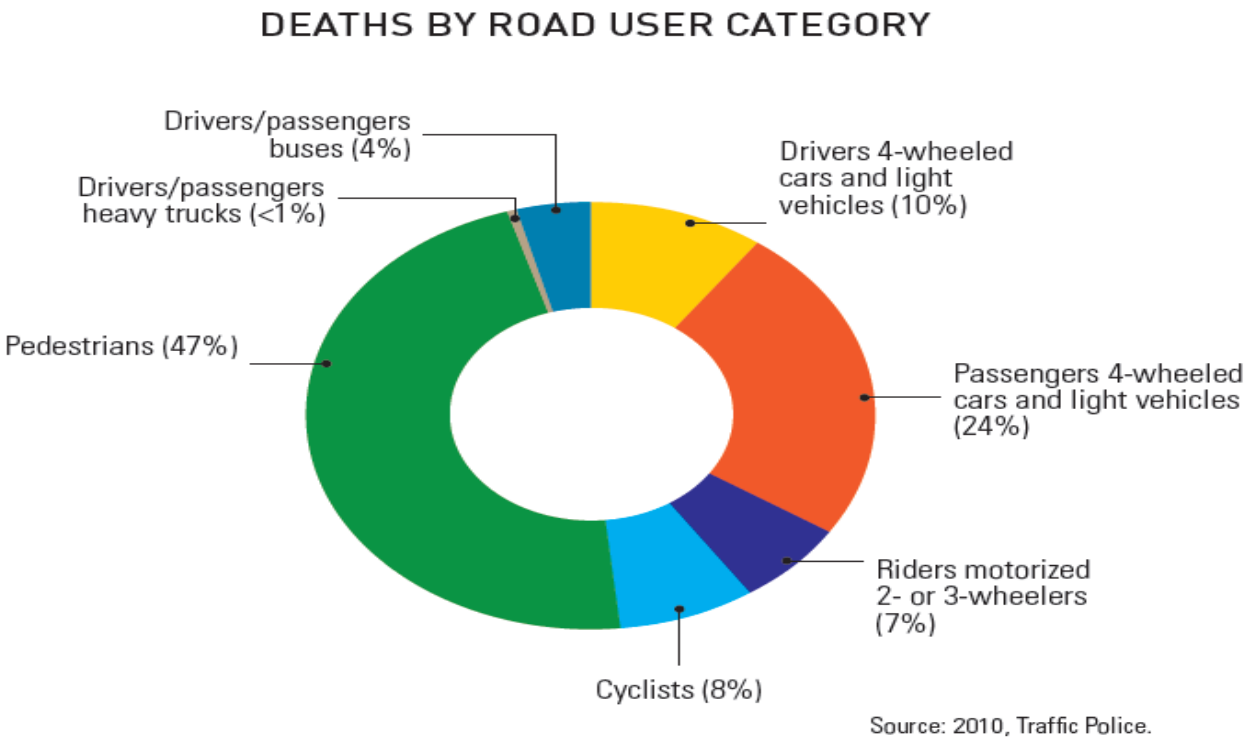


Figure 6: Deaths by road user category, WHO Kenya statistics

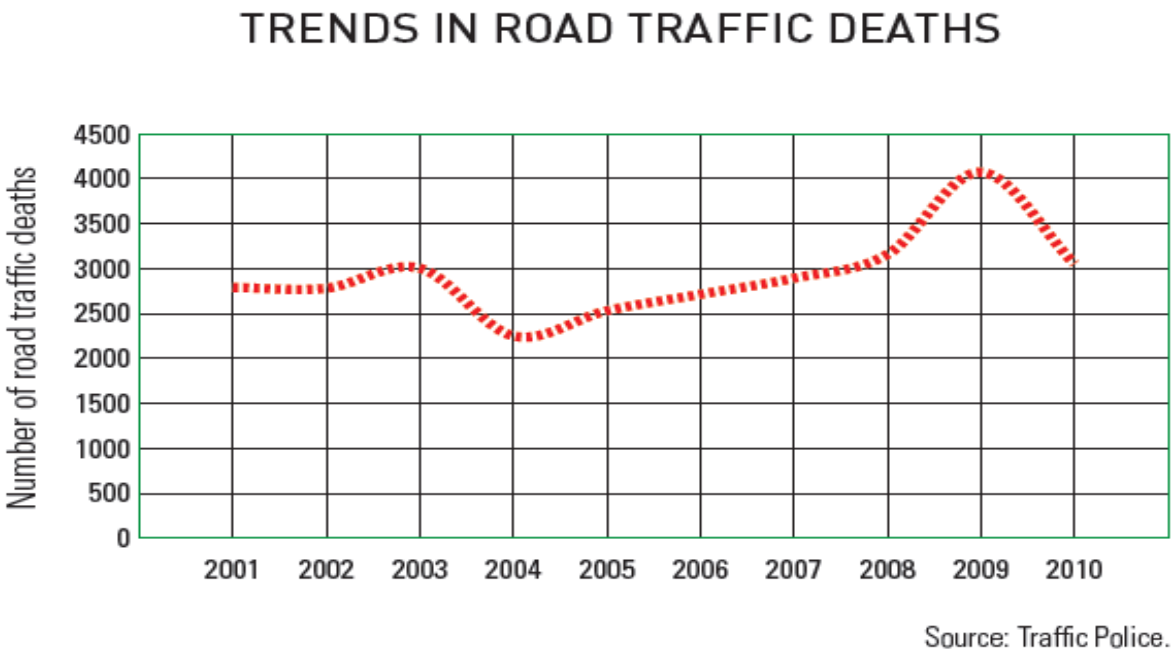


Figure 7: Kenyan trend in road traffic deaths

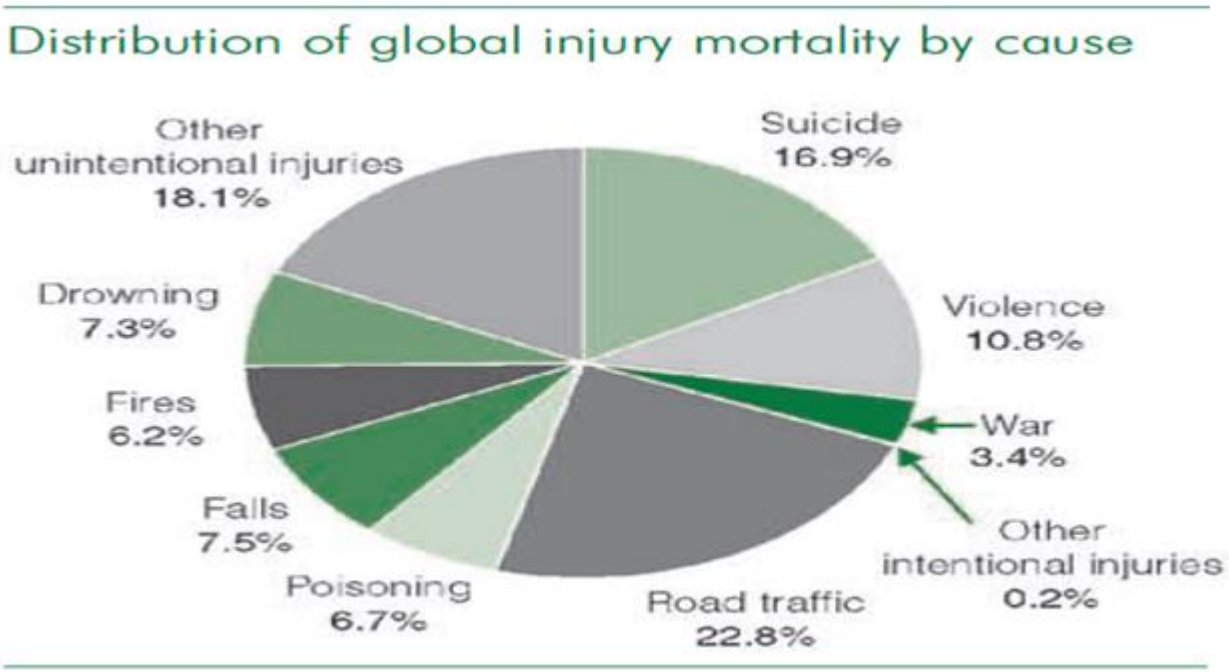


Figure 8: Distribution of global injury mortality by cause

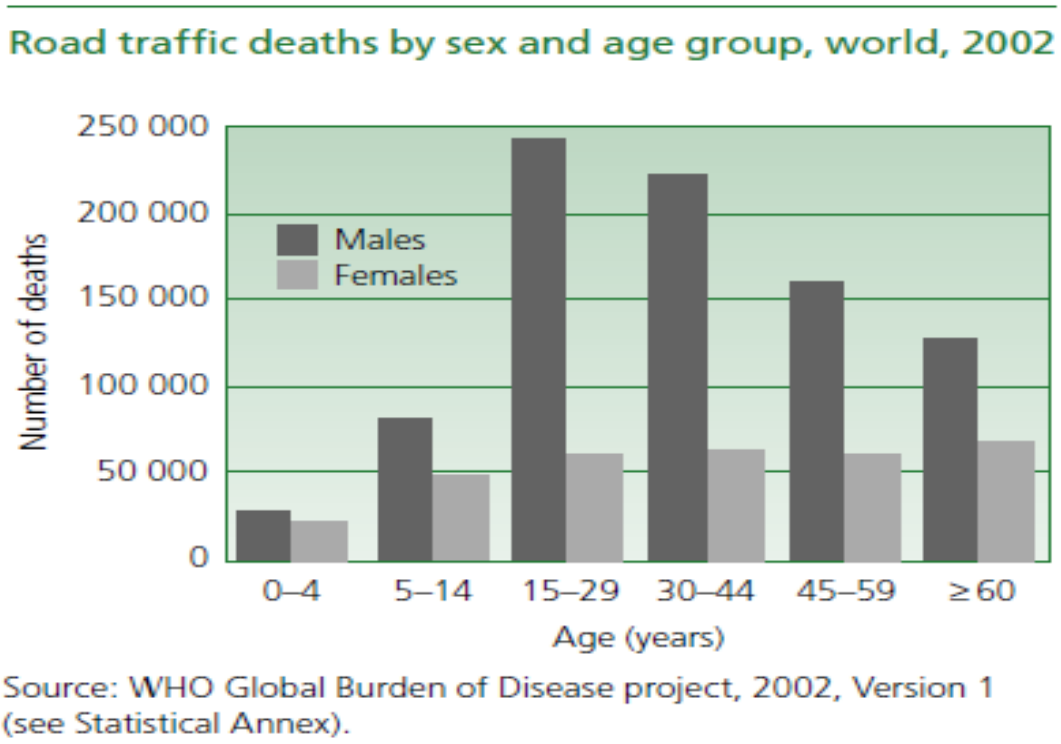
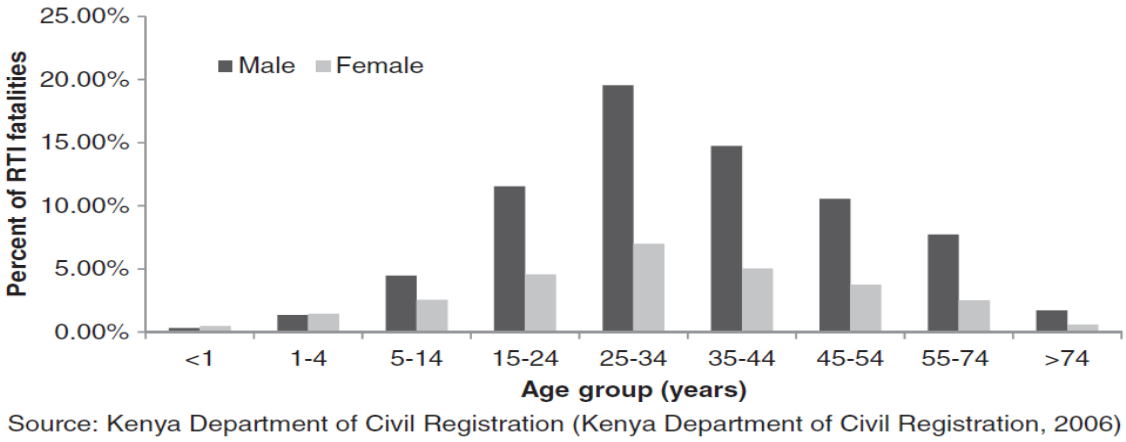


Figure 9: Road traffic deaths by sex and age group; WHO region



Source: Kenya Department of Civil Registration (Kenya Department of Civil Registration, 2006)

Figure 10: Road traffic deaths by sex and age group: Kenya

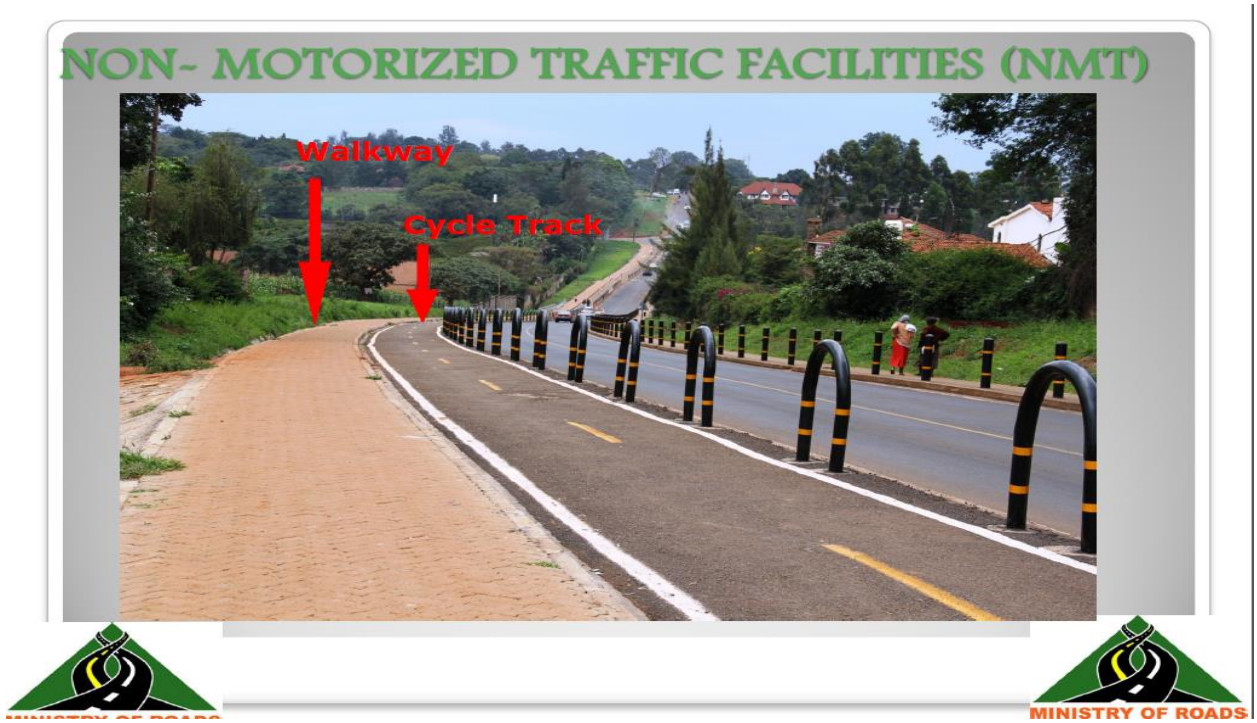


Figure 11: Non-motorized traffic facility

Picture: Example of non- motorized traffic facilities provided while designing roads (Decongestion of roads in Nairobi – presented on 7th August 2012 to UNEP by Eng. M. M. Njonge from Kenya Urban Roads Authority)

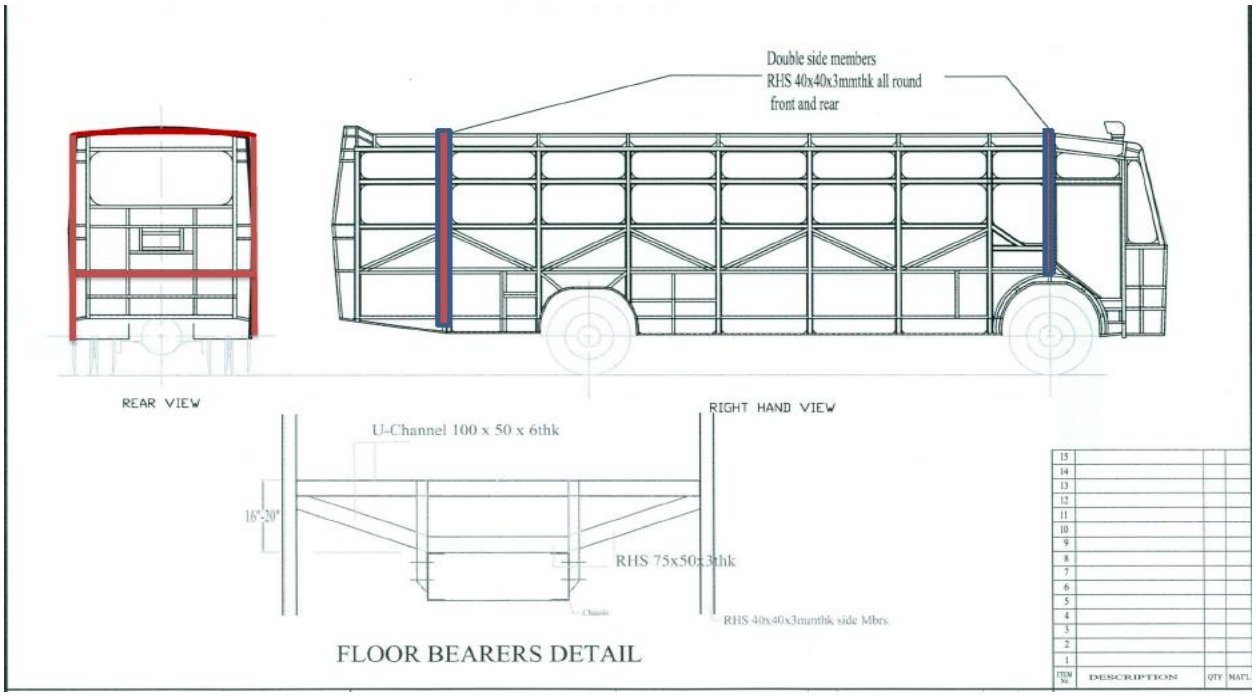


Figure 12: Vehicle design with incorporated roll over protection bars

Death toll in Mwingi bus accident rises to 34

The wreckage of the bus is seen near Mwingi town on the Thika-Garissa highway February 27, 2013. 34 people were killed 50 others were seriously injured in the dawn accident. STEPHEN MUDIARI

By KITAVI MUTUA kitavimutua@gmail.com
Posted Wednesday, February 27 2013 at 08:15

Figure 13: Picture of Mwingi – Garissa road accident

Horror crash claims 18 on school trip in Kisii County, Kenya

Updated Thursday, July 11th 2013 at 10:44 GMT +3

Horror crash claims 18 on school trip

Figure 14: Picture of Kisii road accident

By KENAN MIRUKA and ERIC ABUGA

KISII; KENYA: Twelve students, two teachers and a school bus driver perished in a grisly accident when the bus they were travelling in was overturned at a sharp bend along the Itumbe-Nyamache road in Kisii County on Wednesday evening. An unknown number of other students and teachers were seriously injured in the 6.30pm accident at Nyambunde in Sameta District. Unconfirmed reports indicate that the 54-seater bus was reportedly carrying about 60 students. According to an eye witnesses, the bus lost control, and rolled several times.