INFLUENCE OF ROAD INFRASTRUCTURE INTERVENTIONS ON IMPLEMENTATION OF PEDESTRIAN SAFETY RULES IN THE CITY OF KISUMU, KENYA

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DECLARATION

This research thesis is my original work and has not been presented for any award in any other University.

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DEDICATION

I dedicate this thesis to my parents Nelson and Ruth Ogombe for their support towards my education. I thank them for the motivation. To my late sister Christine and late uncle Ainea whose lives were prematurely cut short by road accidents. Their deaths inspired me to research on pedestrian safety.

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LIST OF ABBREVIATIONS AND ACRONYMNS

ANOVA	-	Analysis of Variance
ANZJPH	-	Australian and New Zealand Journal Public Health
APA	-	America Psychological Association
CBD	-	Central Business District
CCTV	-	Closed Circuit Television
CDS	-	City Development Strategies
EU	-	European Union
FHWA	-	Federal Highway Administration
FGD	-	Focus Group Discussion
IFP	-	International Federation of Pedestrians
iRAP	-	International Road Assessment Programme
ITRD	-	InternationalTransport Research Documentation
KIPPRA	-	Kenya Institute Public Policy Research and Analysis
KNH	-	Kenya National Highway
KURA	-	Kenya Urban Roads Authority
GIS	-	Geographical Information Systems
GOK	-	Government of Kenya
GDP	-	Gross Domestic Product
MUARC	-	Monash University Accident Research
NACOSTI	-	National Council for Science, Technology and Innovation
NCHRP	-	National Cooperative Highway Research Program
NHTSA	-	National Highway Transport Safety Authority
NJ DOT	-	New Jersey Department of Transport
NMT	-	Non- Motorist Transport
OECD	-	Organization for Economic Co-operation and Development
PCM	-	Project Cycle Management
PROJEX	-	Project Expenditure
PSV	-	Public Service Vehicle
RTI	-	Road Traffic Injury
SARTE	-	Social Attitude RoadTraffic Risk in Europe
SPSS	-	Statistical Package for Social Sciences
SSL	-	Smart Street Lighting

SUM	-	Sustainable Urban Mobility
TLB	-	Transport Licensing Board
TRACS	-	Transportation Routing and Control Systems
TRB	-	Transport Research Board
TRL	-	Transport Research Laboratory
UN-HABITAT	-	United Nations Habitat
VRU	-	Vulnerable Road Users
WHO	-	World Health Organization

ABSTRACT

Road infrastructure interventions exist yet implementation of pedestrian safety rules has remained a challenge globally, in Africa and Kenya.The purpose of this study was to establish the influence of road infrastructure interventions and attitude of pedestrians on implementation of pedestrian safety rules in the City of Kisumu, Kenya. The objectives were to establish the extent to which public education on road safety influences implementation of pedestrian safety rules, examine how road engineering designs influence implementation of pedestrian safety rules, assess the extent to which enforcement of traffic laws influence implementation of pedestrian safety rules, determine how pedestrian demographic factors influence implementation of pedestrian safety rules,establish the extent to which the combined road infrastructure interventions influence implementation of pedestrian safety rules and to examine the moderating influence of attitude of pedestrians on the relationship between road infrastructure interventions and implementation of pedestrian safety rules in the City of Kisumu. It was hypothesized that road infrastructure interventions and attitude of pedestrians influenced implementation of pedestrian safety rules at 0.05 level of significance. The study adopted the iRAP model on which the safe systems approach theory was anchored. The study applied mixed methods approach and pragmatism as the research philosophy and *Ex Post Facto* as the research design. The mixed methods approach applied quantitative and qualitative data complementarily. From a universe population of 409,928 residents of the City of Kisumu, a target population of pedestrians and drivers assumed to have used the sampled urban roads was drawn. A sample size of 384 was found ideal for this target population as per Fischer, Watson's formulae and Krejcie and Morgan's table of determining sample size. The sampling entailed both probability and non-probability procedures where simple random sampling, cluster random sampling, stratified random sampling and convenience and purposive sampling techniques were used.The data collection instruments for quantitative data included the questionnaires while the interview guide, observation checklist and document analysis captured qualitative data to complement the questionnaire and enable triangulation ofthe instruments.A pilot study was conducted on two urban roads randomly selected from the 110 urban roads.The reliability of the instruments was tested using Cronbach Alpha. Quantitative data analysis was done using descriptive and inferential statistics and qualitative data analysis using content analysis. Statistical Package for Social Sciences (SPSS) for Windows version 20 was used. Statistical tools of analysis for descriptive statistics captured measures of central tendency such as arithmetic mean, standard deviation presented in tables in frequencies and percentages.Inferential statistics both parametric and non-parametric, tested hypothesis through Pearson's Product Moment Correlation and Multiple Regression Analysis for relationship and association between two independent variables on a dependent variable as appropriate. The study found a statistically significant relationship between public education $p<0.013$, enforcement of traffic laws $p<0.000$, pedestrian demographic factors $p<0.000$ and attitude of pedestrians$<0.000$and combined interventions, enforcement of traffic laws and pedestrian demographic factors each statistically significant at $p=0.000$ thus the null hypothesis was rejected at ($p<0.05$). Road engineering designs $p=0.186$and combined regression found public education $p=0.313$ and road engineering design $p=0.102$ not statistically significant .Attitude of pedestrians moderated the relationship between enforcement of traffic laws and implementation at $p=0.019$.The study concludes that public education, enforcement of traffic laws, pedestrian demographic factors and attitude of pedestrians influence implementation of pedestrian safety rules.Effective implementation of pedestrian safety rules to ideally benefit policy makers , the government and all road users specifically pedestrians. The study recommends an integrated policy on road infrastructure interventions to enhance implementation of pedestrian safety rules based on safe system approach theory.Further research should focus on responsible sharing of the road space.

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

Road infrastructure is the pillar of road transport system on which road safety is founded. Road safety strategies combine behavioral and engineering interventions to influence road user behaviour. Road safety interventions for pedestrians have included Education, Engineering, Enforcement and demographic factors which existed globally but proved ineffective when used in isolation. Although studies on engineering, enforcement, education, demographic factors and attitude of pedestrians had been carried out in isolation with a focus on pedestrian safety, implementation of pedestrian safety rules was still not adequately addressed(Federal Highway Authority [FHWA], 2012;World Health Organization[WHO], 2013).

Globally, the National Highway Transport Safety Authority (2006) recommended the development and implementation of an inclusive road safety plan. It further recommended a pedestrian safety programme that promoted safe pedestrian practices, driver education to enable safe sharing of roads with other road users, and provision of safe pedestrian facilities through integration of engineering, policies, communication, enforcement, incentive, and education strategies. Given that the problem of road safety had a multidisciplinary nature, comprehensive implementation of pedestrian safety rules required coordination involving many state agencies.

The safe systems approach theory, (WHO, 2013) posited that a safe system ensured safe roads, vehicles, speeds and road users that embraced a multidisciplinary approach and since road accidents were system failures, a solution was expected to be found in another part of the same system (WHO, 2013). This is what this study sought to establish. The iRAP model which entailed the safe systems approach theory and star rating model gave hope towards finding a sustainable solution to the issue of implementing pedestrian safety rules. This, however, had not been effectively tested in the third world countries and is what this study sought to investigate.

Road infrastructure comprises the entire road network and includes all road facilities upon which the road transport system operates. This includes high traffic intra-urban roads

(WHO, 2013). Pedestrian fatalities, injuries and accessibility along and across the road continued to be a serious concern globally (WHO, 2013). Provision, proper utilization and adequacy of pedestrian facilities globally posed the greatest challenge and major barrier to accessing and providing safety to pedestrians who werevulnerable (WHO, 2015; WHO, 2013; Asingo and Mitullah, 2009). Pedestrians were vulnerable because of their large numbers, since they are the majority and single largest group of road users.

Despite the existence of road infrastructure interventions, including provision of pedestrian facilities, pedestrian accidents remain high. Road engineering designs should ideally cater for all road users whether motorists or non-motorists. In view of this, Zegeer (2006) advocated for a universal design that involved designing for people of all abilities both, the able bodied and the physically impaired that would address pedestrian safety issues. The road transport system has historically emphasized mobility for motor vehicles on the road and had therefore designed roads for motorists' use (FHWA, 2004). However, less attention had been paid to pedestrians and their safety (Campbell, Zageer, Hyang and Cynecki,2004) hence its historical neglect as well (Massoud, Riza and Amirruddin,2011). Universal design was therefore expected to address implementation of pedestrian safety rules.

Mead, Zegeer, and Bushnell (2013) report that universal design reduced barriers and improved facilities that met the need, accessibility standards and lessened the inequity between the impaired and the able bodied road users. Litman, (2012) and Mateo-Babiano, (2003) agreed designing a facility should accommodate a wide range of potential users, including physically challenged individuals (mobility & visually impaired) and the elderly on the use of the road**(**Mateo-Babiano,2003). These road users were pedestrians. Acknowledging road infrastructure as the road transport pillar and core foundation on which road safety was founded, Massoud et al.,(2011) added that engineering was critical to the determination of quality of the road transport system. However, engineering alone was inadequate without the influence of education, enforcement, demographic factors as well as moderation of attitude of pedestrians. This study adopted a proactive approach where integration of education, engineering, enforcement and positive attitude of pedestrians were expected to prevent or reduce fatalities and injuries of pedestrian road users.

The International Road Assessment Programmes (iRAP); (2012), cited 30 different road infrastructure designs, known to influence the likelihood of a crash and its severity and identified among others, cross-section of the road and road markings, road side hazards and sidewalks as having a possible influence on general road safety but did not specify its influence on pedestrian road users. WHO (2012) in yet another study, however, cited non provision and inadequate road infrastructure as the key risk factors for pedestrian injury. An iRAP baseline star ratings report in India showed that where 100% of roads were rated, 1 - or 2 - stars for pedestrians, the road infrastructure was not adequately provided for and therefore there was increased risk of pedestrian injury or fatality. The safety of pedestrians on urban roads was dependent on adequate provision and proper utilization of the road infrastructure and even where this was provided, the situation still prevailed. The question therefore was, where could the problem lie? Road infrastructure interventions under engineering provisions for pedestrians in this study singled out and focused only on sidewalks, zebra crossings and pavements as pedestrian facilities whose adequacy was under investigation.

Globally, research on road safety had tended to focus on other road users such as motorists and ignored pedestrians, yet more than one fifth of people killed on the world's roads each year were not travelling in a car, on a motorcycle or even on a bicycle, they were pedestrians (Ameratunga, Hijar and Norton,2006). Pedestrians accounted for 22% of road fatalities worldwide. In Africa, this proportion rose to 38% (WHO, 2012), with 46% in Kenya (Ogendi, Odero, Mitullah and Khayesi, 2013) and 45% in Kisumu (Opiyo, 2002). Few studies (WHO, 2013; iRAP, 2013; IFP, 2012) had been carried out on urban road infrastructure interventions as a possible cause of pedestrian safety. Road safety entails being vulnerable or not to injury incaseof a collision between man,vehicle and environment (Gwilliam, 2010). The terms accident, collision and crash were assumed to mean conflict between a pedestrian and a motor vehicle (Campbell et al., 2004) and adopted the same meaning in this current study.

Demographic factors, especially increase in demographic trends, were likely to influence pedestrian safety. The United Nations estimated that the world's population would exceed 9 billion by 2050, with 70% of these people residing in urban areas (Black, 2010). These people are likely to comprise pedestrians who would also be the majority in urban areas. A

sustainable road transport system aimed at reducing traffic related deaths and injuries and providing transport mobility by preventing needless fatalities and injuries is required. A sustainable road transport system was one in which the majority of the population remained automobile - dependent but killed fewer people. With the high global increase in population coupled with high motorization level, the likelihood of a crash or severe injury for pedestrians has increased due to high level of exposure to risk. Road transport, so far, was the only sector whose quality of service tended to decrease with an increase in income(Black, 2010). There was therefore a need to urgently handle pedestrian safety, to avoid pedestrian accidents as a negative effect of the transport sector and encourage walking to achieve a sustainable urban road transport system.

Cities attract a lot of activities to a wide cross section of the general population. People move to and from cities to work, shop, attend school, to recreate and socialize. Most of these people are pedestrians. Roads provide the necessary network to the cities and are a crucial part of the transport system. Since the population in most cities has grown and continues to grow, this daily increase exposed pedestrians to risk of exposure to accidents. Coupled with an increase in motorization level evident in cities, there was need to address a safe and sustainable transport system for all road users including pedestrians. Scheidegger (2009) confirmed that interpreting car ownership as a status symbol and development of high income groups, the African governments had focused much more on motor transport than walking. (Massoud, 2011; Mock, Amegashie,and Darte, 1999). They therefore neglected pedestrians yet African cities were pedestrian cities (De Langen and Tembele, 2001). Road crashes, accidents or collisions were system failures and a safer system on the road system was more comprehensive than the sum of its parts(Safer Journeys, 2012). The safe systems approach theory, if adopted, could hopefully form part of the solution to addressing the implementation of pedestrian safety rules.

In the United States, the total number of pedestrian deaths and injuries annually in road collisions was key to the National Highway Transportation System (NHTSA) whose estimation was at 5,300 pedestrians killed in the USA and a further 77,000 in non-fatal injuries(FHWA, 2004).Casualties of this magnitude were significant inview of national policy, encouraging more walking, for mobility and safety(FHWA, 2004).TheAustralian government is among pioneers of the safe systems approach theory, whoconducted

studies on road safety and found that road authorities focused more on the needs of motor vehicles than non-motorized transport. In South Australia, a 2006 - 2010 study reported that nearly 1 in every 8 road deaths involved a pedestrian(Road Crash Fact Sheet, 2006 - 2010).On average,besides fatalities, 106 pedestrians were seriously injured and 311 had slight or minor injuries each year on the roads in South Australia (Road Crash Fact Sheet, 2006 - 2010).

In Asia, reports from Vietnam and China on road safety, indicated that road safety was sidelined in favour of rapid road infrastructure development. In practice, the historical trend of increasing road deaths accompanying road development and motorization had not been simply due to greed or deliberate acts by one stakeholder group at the expense of others. Rather, it had been an outcome of general socio-economic trends with a pervading drive towards modernization and mobility (Mooren and Grzebieta, 2009). Therefore, historically, road safety was considered more of a mobility problem than a safety problem and, worse still, no consideration had captured the needs of pedestrian road users. Integrated road infrastructure interventions using the safe systems approach theory and moderated by attitude of pedestrians was likely to address implementation of pedestrian safety rules, hence its inclusion in this current study.

Road safety depended on man, vehicle and highway conditions that influenced it (Fluery, 2006; Tingrall and Haworth, 2006; Zheng, Wei Dai, Zhiqunsun and Yang Zhang, 2010) where man represented all road users including pedestrians and drivers, vehicle included all instruments on the road causing injury or death while highway conditions represent road infrastructure hence implementation of pedestrian safety rules needed to be tackled from the safe systems approach which advocated for safety of roads, vehicles, speeds and road users for a sustainable urban road transport. Harry (2010) attributed road engineering designs such as sidewalks, zebra crossings and pavements as having the potential to minimize accidents or incase of accidents prevent road users from severe injury or death. Although this is in place, implementation of pedestrian safety rules was still a problem.

African cities are considered pedestrian cities (De Langen, Opiyo, and Tembele, 2001) filled with pedestrians (Campbell and Campbell, 2007), and road transport is the most dominantmode of transport, yet travel conditions for pedestrians are very difficult because

of traffic safety issues caused by motorist transport (Pendakur, 2005) that discouraged walking. There is an intricate link between urban development and transport facilities (Massoud, 2011; Scheidegger, 2009; Mock, Amegashie,and Darte, 1999). According to Pendakur (2005) road traffic accident rates in Africa are very high; nearly 40 to 50 percent of those in the European Union (EU). African road transport is also not integrated hence insufficient. Pedestrians are among the largest group of traffic accident fatalities. Majority of the daily trips involve walking, half of which take more than 30 minutes. In large cities, walking is a negligible mode of transport and is classified under Non Motorized Transport(NMT) or personal transport. Walking as a mode of transport is so far inadequate and ineffective, both for mobility and safety (Pendakur, 2005; Shmidt and Kamuhanda, 2009). This is despite the fact that, virtually all journeys started and ended on foot (WHO, 2013).

A study by Gondo (2010) in Ethiopia reports that urban transportation and mobility issues are a major concern to urban transportation authority's of the third world countries resulting in a rapid and uncontrolled urbanization, confronting the roads with traffic volumes and mixes for which they were not designed. This situation has created inefficient and congested traffic and many accidents. Automobile dependency has increased roadway risk. Ethiopia faces challenges in relation to other countries of high accidents in the transportation sector and pedestrians are among the highest victims of traffic accidents in Ethiopian cities and towns, where roads were designed for motorists and their mobility and not that of pedestrians and their safety(Gondo, 2010).

In Dar-es-Salaam, a study by Nyoni, Masaoe and Estomihi (2011) cited the poor conditions of the road infrastructure as contributing to the high Vulnerable Road User (VRU) injuries and the belief among drivers that the road space belongs to them and not for pedestrians and therefore provided inadequate assistance to pedestrians crossing at main roads. Kenya in comparison to Dar-es-Salaam was ranked among the countries with the high risk of road death rate for every 10,000 vehicles registered. According to Shiundu, (2011) road safety discussions in Kenya have lately taken centre stage in addressing deaths from road traffic, raising serious concern in parliament and in the media as well (Ogendi and Odero, 2013).Macharia, Njeru, Muli, Nisiime and Nantulya(2009) confirms that pedestrians in Kenya are prone to accidents and need national road safety

targets to curb the situation (Macharia et al.,2009). The challenge of road transport planners was to treat road safety as a priority agenda that required urgent attention (Ogendi and Odero, 2013). Jean, Amekudzi and Vanegas, (2006), and Massoud et al.,(2011) both agreed that congestion on roads and pollution as factors that endanger the safety of pedestrians and city residents. Integration of road infrastructure interventions such as education, engineering and enforcement promise to provide a solution. However, attitude of pedestrians is also to be factored in hence its inclusion in this study.

In their study on trends in motor vehicle crashes and deaths in Kenya,Ogendi and Odero (2013) confirmed that between 1963 and 2008, there was a tremendous increase in population, increase in absolute number of registered vehicles and road traffic crashes over the period. Road deaths by category of road users in Kenya, between 2004 and 2006, showed that of all the roads users, pedestrians led at 46%, passengers were second at 29%, pedal cyclists 12%, drivers 11% and motor cyclists at 2%.

In Kenya, the neglect of the needs of NMT users by planners has been acknowledged (Republic of Kenya, 2004b) and according to Wasike, (2001) road safety policy exists but the non-motorized policy targeting pedestrians although now approved by Kenya's parliament was still far from implementation. Road development focuses more attention on roads for motorized transport (Ministry of Nairobi Metropolitan Development, 2008;Ogendi and Odero,2013). According to the Kenya National Road Safety Trust (2013), 85% of road accidents are caused by human error, 20% by sleep related causes and 65% of those involved are pedestrians. 3,000 people die from road accidents per year and it estimated that 5,400 people would be fatally or severely injured in road accidents by 2030. Between the year 1963 and 2008, Ogendi and Odero (2013) further assert that crashes involving motor vehicles in Kenya,the motorization level and number of vehicles registered increased which saw pedestrians take lead in the list of those killed in road crashes at 46%.Strategies aimed at controlling road deaths in all countries include: speed control, enforcement of rules on road safety, education measures targeting road safety and speed management as vital to safety of pedestrians. Road infrastructure interventions were apparently overlooked in the list of strategies hence the need to carry out this study but in an integrated manner moderated by attitude of pedestrians.

1.1.1 Concept of Road Infrastructure Interventions

Road infrastructure interventions in this study included both engineering measures and behaviour-change measures as a balanced approach to implementation of pedestrian safety rules (WHO, 2013). Pedestrian safety problems could only be effectively solved by combining interventions such as engineering, enforcement and education and not when used in isolation. It was the duty of engineers, educators, designers, planners, enforcement officers and citizens to identify and implement effective countermeasures to improve safety rules for pedestrians. In this study, Pedestrian safety interventions such as public education on road safety was indicated by road safety awareness, Traffic Act and Traffic parks. Road engineering designs was indicated by zebra crossings, pavements and sidewalks. Enforcement of traffic laws indicated by corruption, presence of traffic police and sanctions or fines. Pedestrian demographic factorswereindicated by age, gender and pedestrian level of education. They all formed the independent variables in this study.

1.1.2 Public Education on Road Safety

Road safety awareness is the ability to behave in a safe way while driving or walking on roads. It also means sensitizing road users on the need to share the road while minding about other road users. Road safety awareness is relayed by posters with information for drivers and pedestrians on safe use of the road. In this study, the level of road safety awareness was tested against implementation of pedestrian safety rules moderated by attitude of pedestrians.Road safety awareness was one of the indicators of Public Education on Road safety besides Children's Traffic Park and the Traffic Act .

The Traffic Act (Cap 403)which constitutes the laws that should be followed by the road users has given more emphasis to motorists at the expense of pedestrians. The traffic Amendment Bill of 2014 focused on road safety in general and only highlighted child pedestrians and speed limits in urban areas near schools hence there was need to establish the role of the Traffic Act in ensuring public education of pedestrians as taught in Childrens Traffic Parks. Children's Traffic Park as indicators of public education on road safety act as miniature versions of actual street networks,having lanes and streets with proportionate widths to accommodate smaller vehicles with traffic signals and police presence at peak hour times (Traffic Park, 2015).

Traffic parks are centres where children are taught how to use the roads found in urban areas. They improve awareness of traffic safety among children aged at least 10 years who are trained to ride bicycles or navigate cars which are pedal powered and operate according to traffic laws(Traffic Park,2013).Children gain experience in crossing streets as well as understanding challenges pedestrians face in a controlled environment away from real motor vehicles (Traffic Park, 2015). Jomo Kenyatta Sports Ground houses the Children's Traffic Park in the City of Kisumu hence its inclusion in this study.

1.1.3 Road Engineering Design as Adequacy of Pedestrian Facilities

Road engineering design was indicated by Zebra crossing which works to minimize fatal or serious crash by slowing down traffic and speed in areas where there is high pedestrian activity(Manyara, 2013). Ogendi and Odero (2013) cited zebra crossing as sustained implementation strategies that support pedestrian safety. Zebra crossing as a traffic calming measure addresses the influence of speed as a component of the safe systems approach theory and is a critical risk factor in a pedestrian-vehicle collision crash. Over - representation of pedestrians in fatal road accidents constituted 64% (Khayesi, 2003) and 71% (Ogendi and Odero, 2013) of cases reported in Nairobi respectively. This reflects the pedestrian inherent vulnerability, insufficient attention to the needs of pedestrians in safety policy making (Khayesi, 2003; Ogendi and Odero, 2013) and lack of safe speed on the roads. Pedestrian traffic had grown but did not match the corresponding provision for pedestrian facilities such as zebra crossing for these road users (Peden, Scurfield and Sleet, 2004) in developing countries.

Road engineering designs also include sidewalks which work to reduce the likelihood of serious or fatal crash along the road .Sidewalks work by excluding motor traffic from areas where there was high pedestrian activity (WHO, 2013).Revelations from road surveys assessment in developing countries show no provision of sidewalks for pedestrians yet roads had speeds of 40km per hour or higher speeds (iRAP, 2012). Road engineering designs for pedestrians were particularly poor with limited provision of sidewalks and only two pedestrian crossing facilities (Rogers, 2012) were provided. This reflected inadequacy of sidewalks for pedestrians hence its inclusion in this study.

Pavements form the road network or carriageway and include the road width, road space, road capacity and road maintenance that enable the pedestrians to use the road effectively and efficiently and to enhance their safety. Pavements also include road hazards and obstructions that hinder safe use by pedestrians. Research shows that, in urban areas, road widening occurs at the expense of pedestrian safety (Dumbaugh, 2005b; 2009; Gondo, 2010). Wide lanes have adverse effects on pedestrian safety by increasing their exposure to risk of death or severe injury. Narrow streets have an effect on driver behaviour as it forces them to drive cautiously on narrow streets (Dumbaugh and Ewing, 2009). It also enhances pedestrian safety.

1.1.4 Enforcement of Traffic Laws

Effective enforcement of traffic laws is a critical requirement for road safety. Even with this in place, if the laws are not effectively enforced; fatal accidents increase daily on our urban roads. Corruption poses a threat to enforcement of traffic laws and there is need to know what this corruption is and how to solve it (Traffic Focus, 2012,Kipsosgei,2011).

Corruption or bribery is to tender and accept a favour for performing a duty or abusing power entrusted on you for individual benefit. It is mainly concerned with official or non official actions done for some favour or gain (Davis, Lynn, Kaups and Parks,2002). Where corruption is high the levels of respect for the law is reduced. The consequences of being corrupt pose further risk in terms of unsafe conditions on the entire road transport system (Traffic Focus, 2012).Corruption manifests itself in various ways including when motorists drive vehicles that are unroadworthy or over speed yet are allowed to proceed on without penalty from traffic officers which is potentially disastrous to other road users.If the public loses trust in the integrity of its traffic officers, lawlessness of road users results. In the republic of South Africa, police officers and traffic officers are among those regarded as corrupt(Traffic Focus,2012).

In Johannesburg, as reported in the Traffic Focus (2012) on corruption ,when people fail to respect traffic rules, there is no safety on the roads. Road users have the responsibility of knowing how dangerous corruption is and of ensuring their conduct does not endorse it. However, corruption involved actions of both officials and receivers of bribes in equal measure (Traffic Focus, 2012). The same article further states that the two problems that

stood out to worry the government most were overall death rate and corrupt law enforcers. Regarding fraud and corruption, there would be zero tolerance approach on speed and safety of pedestrians if well planned(Traffic Focus,2012).

The presence of traffic police as a traffic management strategy influenced implementation of pedestrian safety rules (Gwilliam, 2010). Comparatively fewer accidents occurred in areas with traffic controls especially manned by traffic police yet areas without effective controls,free access to roads increased the possibility of risk of collisions (Gwilliam, 2010). The high collisions were partly due to the traffic mix on the roads as evidenced by high vulnerability and exposure to risk of road users between intersections where speed differences were great and police presence necessary(Gwilliam, 2010).In this study, presence of police was investigated under enforcement of traffic laws.

Sanctions and fines as enforcement of traffic laws was addressed in NCHRP (2008) which assisted states in selecting programmes, projects and activities that had the greatest potential for the reduction of highway death and injury. The objective was producing a manual on behavioural highway safety counter measures with a developed framework, guidance for estimating costs and benefits, emerging estimaton of newly tested,untied and proved behavioural highway safety counter measures.

The classification scheme used to estimate the effectiveness of these measures included voluntary action (counter measures that were designed to train, educate or request some behaviour), Law or regulation (require the behaviour), laws plus enhancements (high-visibility enforcement of the law) and sanctions and treatment of offendersNCHRP(2008). This study used sanctions and fines as indicators of enforcement of traffic laws and their possible influence on implementation of pedestrian safety rules moderated by attitude of pedestrians.

1.1.5 Pedestrian Demographic Factors

Pedestrian demographic factors referred to the characteristics or attributes of pedestrians. In this study, they were restricted to age, gender and pedestrian level of education as indicators of pedestrian demographic factors.

Statistics from Maryland State indicated that pedestrians from between 15-24 age bracket and older were especially vulnerable to injury with more than 30 percent of this age group of pedestrians injured(Maryland State Highway Administration, 2008) due to their high pedestrian activites which overexposes them to risk on the road. Older rather than younger pedestrians were prone to severe injuries due to their productive societal roles and adventure. Over the age of 35, pedestrian crashes were more likely to result in a fatality or serious injury than minor injuries (WHO, 2007) due to high levels of pedestrian activity and part of the body exposed to injury.

Studies on type of gender indicated that young male pedestrians were more at risk of collisions than female pedestrians (Martin, 2006; Department of Transport 2004). Over the period 2006 - 2010, more male pedestrians than females were involved in serious casualties on the road (Road Crash Fact Sheet, 2006 – 2010). Figures for male pedestrian fatality and serious injuries stood at 61% with males overrepresented in more serious crashes.Thus, of the casualties, more male pedestrians were represented.Over the 70 age group, more females took higher representation (Road Crash Fact Sheet, 2006 – 2010). This shows that males dominated the road space and were therefore more at risk as pedestrians.

Pedestrians do not need education to walk. However, the level of education of a pedestrian may determine their road user behaviour and choices made while using the road. Dupperex, Roberts and Bunn (2002) found a variation between pedestrian education and behaviour from various studies and outcomes and concluded that education on pedestrian safety could improve how pedestrians behaved while crossing the road, but as to whether this reduced pedestrian accident risk on the roads was unknown. There was, however, little evidence that safety education was effective on adult pedestrians, specifically targeting the elderly.Moreover,the trials excluded countries in the middle and low income bracket (Dupperex, Roberts and Bunn,2002) as discussed here.

1.1.6 Attitude of Pedestrians

In this study, attitude of pedestrians was measured by pedestrian behaviour across and along the road, their attitude towards other road users and implementation of pedestrian

safety rules. Attitude of pedestrians moderated the relationship between road infrastructure interventions and implementation pedestrian of safety rules.

The attitude of pedestrians had been negative and ignored so far by other road users and yet its effects led to fatal injury and even death which was irreversible. It also had serious cost elements of draining the economy of time spent on bed occupancy by the fatally injured and funeral expenses of those who had died (Tingrall and Hawarth, 2006). Adequate provision of pedestrian facilities in urban areas had been met with negative attitude by city government providers and had not been adequately addressed yet pedestrian traffic deaths were a major social problem closely linked to road infrastructure.

An understanding of the existing burden of pedestrian death in the population was necessary for developing effective interventions (Dumbaugh 2005; Dumbaugh and Ewing, 2009, Dumbaugh and Wenhai, 2011; Agarwal 2011; Haque 2011; Naci, Chisholm and Baker, 2009; Gwillian, 2002) not only for pedestrians but for all other road users. The location and provision of sidewalks, zebra crossing and pavements and possible black spots where fatal injury and deaths affected vulnerable pedestrians (Talen, 2011; Ozanne and Smith, 2004) was inappropriate yet implementation of pedestrian safety rules was a socially contextualized phenomenon operating beyond transport mobility to safety of pedestrians (Gondo, 2010; Aust and Engstrom 2011; Eleonora, Yannis and Golias, 2012) and was therefore studied with attitude of pedestrians in this study.

1.1.7 Implementation of Pedestrian Safety Rules in the City of Kisumu

Although studies have been done on pedestrian safety, specific literature on implementation of pedestrian safety rules needed to be researched on, both in developed and developing countries. Ogendi et al. (2013) and Manyara (2013) report that there was a high rate of RTA with pedestrians dying instantly on average.By 2013,a mean total of 3,000 deaths on Kenyan roads were recorded annually (Kenya Police,2010;ROK,2013, Manyara, 2013) between 1963-2008 the number of registered cars was at 966% raising the motorization level by 152% at the same time span (Ogendi and Odero, 2013). With the increase in Kisumu's population to 409,928 residents (RoK Census, 2009), the number of registered vehicles had also increased due to the high population growth and as a status symbol. The implementation of pedestrian safety rules had meanwhile stagnated,

deteriorated and remained unplanned increasingly threatening the safety of vulnerable pedestrians. The pedestrian fatality rate for the City of Kisumu stood at 45% and according to Kenya police reports held at the Kisumu Central Police Headquarters between 2013-2015, a total of 59 pedestrians had lost their lives or had been severely injured as follows in 2013, 10 pedestrian fatalities and 10 serious injuries, in 2014 there were 15 pedestrian fatalities and 15 serious injuries, and in 2015, 9 pedestrian fatalities (Kisumu Traffic Police Records, 2015 unpublished). This life threatening phenomenon had to be addressed if lives were to be saved both from fatal death and severe injury. The road network was poor, with inadequate provision of zebra crossing, sidewalks, and pavements, leading to traffic congestion and traffic mix (Ogendi et al., 2013). The new road constructions that were ongoing in the City of Kisumu on Nairobi-Kisumu road and Kondele overpass on Kisumu-Kakamega road had not made the pedestrian situation any better, as pedestrian facilities were ignored. The safe systems approach theory was therefore suitable for anchoring this study, if implementation of pedestrian safety rules was to be realized. The central question this study sought to answer was how to implement pedestrian safety rules in the City of Kisumu. Effective implementation of pedestrian safety rules in the City of Kisumu was therefore the contextual dimension of this study and was to be adequately addressed here.

1.2 Statement of the Problem

Pedestrian safety interventions existed in the City of Kisumu yet implementation of pedestrian safety rules remained a challenge to road users especially pedestrians. Public education on road safety for pedestrians had done very little to ease the pedestrian safety situation as the road safety campaigns needed to be repeated at regular intervals and target a particular road user group(Martin, 2006). Old pedestrians were not very receptive to new advice and for them education seemed to only reach 20% who fell in this age bracket (Martin, 2006). Low level of awareness by pedestrians and policy makers on the existence of interventions as cited by Otsyeno (2011) was seen where the road department concentrated on black spots and dangerous locations but ignored the road pavement critical for pedestrians' safety concluding that all was well if a road user arrived safely at his destination.Engineers and planners were held responsible or expected to take the blame for not ensuring that the design was safe for pedestrians. Moreover, the Traffic Act was poorly implemented and poor enforcement hindered success (Kipsosgei, 2011).

Pedestrians no longer felt safe walking along or across the roads as the speed limits of 30km/hr meant for motorists and 10km/hr for pedestrians seemed ignored (Opiyo, 2005). Traffic volumes were high, drivers careless and negligent of pedestrians (Pukose, 2007). Roads were wide, number of directions of conflicting traffic and type of crossing posed problems to pedestrians who failed to comply (Devito, 2006). All these points of discussion as far as the City of Kisumu was dominated by pedestrians seemed to have little influence (Yitambe, 2004; Opiyo, 2002) or attract serious attention on pedestrian safety at the design planning and implementation level. Pedestrian safety was increasingly threatened by road fatalities and severe injuries due to inadequacy of sidewalks, zebra crossing and pavements (Ogendi and Odero, 2012).

The pavements in City of Kisumu were reported to be in poor condition with unplanned tracks, eroded and potholed roads which were dangerous since they did not allow a conducive road environment for walking (Odero, Khayesi and Heda, 2014). Some roads allowed for a traffic mix.This caused congestion of vehicles and people in the Central Business District (CBD) where there were no dedicated pedestrian facilities. The inter-city roads were narrow generally less than 7 metres wide while the standard width is 3.5metres per road on a two way road carriage (Opiyo, 2005) and inadequate for pedestrian use. Sidewalks along Jomo Kenyatta Highway were infringed upon by informal settlements leading to walking and street trading competing for the same space (Onyango and Olima, 2012). The new road constructions ongoing in the City of Kisumu made road diversions for motorists, but did not seem to have similar provision for pedestrians. In addition, the road capacity was constrained and the sidewalks invaded with impunity thereby compromising safety of pedestrians (Mitullah and Makajuma, 2009).Existence of street furniture and trucks for both loading and unloading further inconvenienced and endangered pedestrians (FHWA, 2004).

The neglect of pedestrians in road space design as reported by Opiyo (2002) had indicated pedestrians as great casualities of road accidents.Pedestrians were also recorded as great causers of accidents when motorists oversped making roads difficult to cross (Opiyo, 2002). Aligula et al., (2005) confirmed that the burden of physical harm borne by the pedestrian was worsened by poorly designed pavements. Fear for risk of accidents deterred pedestrians from walking yet few old or new road infrastructure interventions

addressed pedestrian safety as their primary objective (Aligula and Abiero, 2011; Wasike, 2007). Pedestrians died or were severely injured daily on urban roads yet pedestrian safety rules were hardly implemented. The situation in the City of Kisumu was comparable to what was reported in the media as happening on Thika Highway, Nairobi where pedestrians lost their lives daily due to high speed of vehicles, inappropriate road user education and negative attitude towards engineering designs such as use of footbridges(NTSA,2015).

Statistical evidence revealed that pedestrians as road users occupied a leading position in terms of road crash victims at 46% in Kenya (Ogendi and Odero, 2013).This was followed by the City of Kisumu at 45% (Opiyo, 2005) which was above the regional and global figures at 38% and 22% respectively. However, often lost in these road safety statistics was the fact that a large number of auto related deaths and injuries every year were not of drivers and passengers but pedestrians (iRAP, 2009 Kenya results) yet in the City of Kisumu, pedestrian accidents caused one fifth of injury related hospital admissions (Ogendi et al., 2013).The pedestrian fatality rate for the City of Kisumu stood at 45% and according to Kenya Police Report held at the Central Police Headquarters in the City of Kisumu between 2013-2015, a total of 59 pedestrians had lost their lives or had been severely injured as follows: In 2013, a total of 10 pedestrian fatalities and 10 serious injuries were reported. In 2014, there were 15 pedestrian fatalities and 15 serious injuries reported and in 2015, a total of 9 pedestrian fatalities were reported (Kisumu Traffic Police Records, 2015).The state of implementation of pedestrian safety rules in the City of Kisumu was a cause for considerable concern (Opiyo, 2005). Being hit by a vehicle while walking was rated highly as a cause of pedestrian deaths in the City of Kisumu with pedestrians aged 5-12 being the most affected. Parents who believed there was heavy traffic in the area or whose children needed to cross several roads were reluctant to let their school going children walk(Timperio, Crawford and Telford, 2004; Weir, Etelson and Brand, 2006). Compared with other cities in Kenya such as Nairobi and Mombasa, pedestrians in the City of Kisumu were highly vulnerable in the road safety situation and constituted victims of 80% of the fatalities(NTSA,2015).

Pedestrians were over represented in the road traffic injuries and deaths yet often ignored in the road infrastructure intervention planning process. Pedestrians accounted for 45% of

road traffic fatalities but received very little of the road safety funding. The funding allocated for road infrastructure development existed but few projects were pedestrian oriented. The national and county government had not only failed to allocate adequate funding to address pedestrian safety issues but were beginning to remove the road infrastructure interventions due to the belief that they provided pedestrians with a false sense of safety. Sometimes, pedestrians were not even seen as legitimate users of the road and were often blamed in case of a road crash while the integrated non-motorized policy meant for pedestrians is far from implementation (Wasike, 2007).

The City of Kisumu was reported to have a high population of 409,938 residents and densely populated areas in excess of 350 persons per kilometer square (RoK Census, 2009) and 48% of the urban population living below the absolute poverty bracket yet, the city's population continued to increase, annually at 2.8% (UN-HABITAT City of Kisumu Development Strategies (CDS), 2004 - 2009). Majority of pedestrians of all age groups resided in the city and its environs and entered and left the city each day to work, shop and attend school there by crowding the sidewalks and overlapping to the pavement(FHWA, 2004). The high pedestrian activity and traffic mix that resulted led to 55% of pedestrian collisions that occurred within the City of Kisumu. Consequently,the cities had become the most dangerous places for pedestrians due to high death rates due to aggressive driving (Mitullah and Makajuma, 2007; Pukose, 2007; Opiyo, 2005). This was due to an increase in traffic, prevalence of sub urban development, lack of institutional regulation of the problem and the overall decline in amount of pedestrian activity in the street and neighbourhood through the city. This had resulted in an unfortunate safety paradox in the form of disappearance of safe and livable cities for people to walk and overall increase in pedestrian fatalities and injuries.

The attitude of other road users towards pedestrians appeared negative and the plight of pedestrians was ignored and neglected (Munalo and Maina, 2010). Pedestrians' educational level of safety in particular and on what affected their lives as road users seemed minimal and the pedestrians themselves were not involved in the safe use of the road (Opiyo, 2005). Pedestrian behaviour across or while walking along the road was contrary to safe road use.Attitude of pedestrians took the behavioural component of attitude which was observed as they walked along or across the road.With an increase in

motorized vehicles in recent years in the City of Kisumu, road traffic injuries had emerged as one of the main reasons for mortality, morbidity and disability with trucks, buses, matatus and cars being the major contributors of 80% of pedestrian accident deaths and fatalities in the city (Ogendi and Odero, 2013). Pedestrian deaths and injuries were tragic, but often predictable and potentially preventable regardless of how and where it occurred (Sokin, Edwards, Roberts and Green,2006). Addressing implementation of pedestrian safety rules was therefore vital in reducing the statistics of crash cases due to unsafe roads. However,even with intervention in place and effective implementation of pedestrian safety rules if the attitude of pedestrians towards the road safety issue was not addressed then severe injury, fatal death, loss of income, reduction in Gross Domestic Product (GDP), increase in amount of time spent on hospitalization and funeral expenses would result and negatively influence the safety of pedestrians.There was therefore need to moderate the relationship between road infrastructure interventions and implementation of pedestrian safety rules with attitude of pedestrians.If a positive attitude of pedestrians was integrated into a road safety system using a proactive approach and involving responsible sharing of road space, this study was expected to encourage more people to walk for both safety and mobility. This study therefore sought to establish the influence of road infrastructure interventions moderated by attitude of pedestrians on implementation of pedestrian safety rules in the City of Kisumu.

1.3 Purpose of the Study

The purpose of this study was to establish the influence of road infrastructure interventions and attitude of pedestrians on implementation of pedestrian safety rules on selected roads in the city of Kisumu, Kenya.

1.4 Objectives of the Study

The study was guided by the following objectives:-

1. To establish the extent to which public education on road safety influence implementation of pedestrian safety rules in the City of Kisumu.
2. To examine how road engineering designs influence implementation of pedestrian safety rules in the City of Kisumu.
3. To assess the extent to which enforcement of traffic laws influence implementation of pedestrian safety rules in the City of Kisumu.

4. To determine how pedestrian demographic factors influence implementation of pedestrian safety rules in the City of Kisumu.
5. To establish the extent to which the combined road infrastructure interventions influence implementation of pedestrian safety rules in the City of Kisumu.
6. To assess the moderating influence of attitude of pedestrians on the relationship between road infrastructure interventions and implementation of pedestrian safety rules in the City of Kisumu.

1.5 Research Questions

The study sought to answer the following research questions: -

1. To what extent does public education on road safety influence implementation of pedestrian safety rules in the City of Kisumu?
2. How do road engineering designs influence implementation of pedestrian safety rules in the City of Kisumu?
3. To what extent does enforcement of traffic laws influence implementation of pedestrian safety rules in the City of Kisumu?
4. How do pedestrian demographic factors influence implementation of pedestrian safety rules in the City of Kisumu?
5. To what extent do combined road infrastructure interventions influence implementation of pedestrian safety rules in the City of Kisumu?
6. In what way does attitude of pedestrians moderate the relationship between road infrastructure interventions and implementation of pedestrian safety rules in the City of Kisumu?

1.6 Research Hypotheses

The study tested the following alternate hypotheses

Hypothesis 1:

There is a significant relationship between public education on road safety and implementation of pedestrian safety rules in the City of Kisumu.

Hypothesis 2:

There is a significant relationship between road engineering designs and implementation of pedestrian safety rules in the City of Kisumu.

Hypothesis 3:

There is a significant relationship between enforcement of traffic laws and implementation of pedestrian safety rules in the City of Kisumu.

Hypothesis 4:

There is a significant relationship between pedestrian demographic factors and implementation of pedestrian safety rules in the City of Kisumu.

Hypothesis 5:

There is a significant relationship between the combined road infrastructure interventions and implementation of pedestrian safety rules in the City of Kisumu.

Hypothesis6:

There is a significant relationship between road infrastructure interventions and implementation of pedestrian safety rules moderated by attitude of pedestrians in the City of Kisumu.

1.7 Significance of the Study

The findings of this study are expected to assist the Kenya Government contribute to policy and practice, research and theory that would assist in policy making to reinforce their responsibility for providing high quality road infrastructure interventions for pedestrians. The practitioners in the Ministry of Roads and transport authorities such as Kenya Urban Road Authority (KURA) to not only develop policy measures but also strategies to attain acceptable levels of implementation of pedestrian safety rules in the City of Kisumu and other cities all over Kenya. To policy makers, the study hoped to unravel the weak and strong links between public education, engineering, enforcement, demographic factors forming a basis for improving implementation of pedestrian safety rules in the City of Kisumu, Kenya, Africa and to beef up what key international institutions like the World Bank and UN-HABITAT had initiated on road safety rules in generaland implementation of pedestrian safety rules in particular(Stackey, 2012). The research would then be useful to transportation researchers, engineers, planners, educators, law enforcement officers and safety professionals involved in implementation of pedestrian safety rules.

It was also hoped that the study would fill the gap left by researchers in previous studies which had concentrated more on road transport as a mobility problem and not the

influence of road infrastructure on pedestrian safety. The study would hopefully add to existing research on pedestrian safety. It would further a new insight into the transport sector from a project planning and management perspective on proper use of the road by pedestrians, complying with road traffic rules and being mindful of their safety and that of other road users. It is expected that the study may provide useful information to pedestrians in the City of Kisumu, who were vulnerable road users and whose time was spent in hospitals as in-patients due to accidents or injuries. The findings would also be useful to the Kenya Government whose Gross Domestic Product (GDP) would be spent on health bills and loss of productive human resource in case of death or severe injury to the citizens.

A new contribution to the body of knowledge on pedestrian safety may have persuaded political leaders to develop, implement and support pedestrian safety measures, with their political good will (WHO, 2013). The study results are further expected to provide useful reference material to researchers and scholars enabling information obtained to be used to make decisions on facts from research findings and not based on decisions from mere tradition or authority. It was expected to serve as a starting point for further studies on responsible sharing of space, proactive approach to addressing pedestrian safety issues, and adapting the safe systems approach to studying the influence of attitude of pedestrians on the relationship between road infrastructure interventions on implementation of pedestrian safety rules in the City of Kisumu.

1.8 Delimitations of the Study

The study was carried out on selected roads to target pedestrians in the City of Kisumu. The study confined itself to the concepts under investigation such as public education, engineering designs, enforcement, demographic factors as independent variables and attitude of pedestrians as moderating variables on implementation of pedestrian safety rules in the City of Kisumu which was the dependent variable. The total number of roads within the City of Kisumu was 110 and 10 were sampled to meet the representative threshold of this study. The ten selected roads fell within the intra-urban transport in the City of Kisumu(Opiyo,2005). The sampled roads were chosen based on the criteria of road design, traffic volume, land use, population density and level of pedestrian activity. The time spent by pedestrians on the road depended on individual activity, choice of mode or

travel pattern. Virtually, all journeys started and ended on foot making everyone a pedestrian. The study therefore targeted pedestrians engaged in individual activities on the sampled roads assuming they had either walked along or across the sampled roads.

The regular pedestrians' level of road user education was presumably high and therefore the level of awareness and knowledge higher than that of the majority of the general population who were not regular pedestrians on these sampled roads. The study was carried out during the day specifically during normal working hours and during peak hours when there was high pedestrian activity and thus conflict between man, vehicle and environment was experienced most at these times. Observations during the night were not possible due to ethical and security considerations. The ten urban roads within the city sampled for the study, were accessible and enabled the researcher to conduct the study. The study period was between August 2012 and August, 2015.The study was confined to Kisumu because, compared to the national figure of pedestrian accidents at 46%,the pedestrian fatality rate for the City of Kisumu alone stood at 45%.Further to this, 55% of pedestrian collisions occurred within the City of Kisumu. This figure was a cause for considerable concern.

1.9 Limitations of the Study

The City of Kisumu on which the study was based covered a wide geographical area and a high population of 409,928 residents of the City of Kisumu (GoK, 2009; Statistical Abstract, 2012). For a more conclusive result, the universe population would have been studied. The study however sampled pedestrians on selected urban roads to generalize on the entire universe population. The researcher was not able to control the respondents' attributes such as feelings, level of education, age and gender, social interaction level and failure to respond to certain items in the questionnaire which would give limited information, the researcher therefore triangulated the data collection instruments by including interview guide and observation checklist, document analysis to minimize weakness in one instrument and beef up the questionnaire. This study adopted mixed method approach, pragmatism and *ex post facto* design to manage the limitations. The study only covered the opinion, attitudes, actions and words of pedestrians chosen within the City of Kisumu within limited time, resources and logistics. For these reasons, the

outcome was expected to be judiciously applied to the whole of the City of Kisumu and other urban centres in Kenya.

1.10 Basic Assumptions of the Study

The study assumed that all the respondents were conversant with the variables under study and would therefore cooperate and provide data required to address the research problem. All the pedestrians in the sample had a common socio-economic background since they belonged to developing countries. Road infrastructure interventions were assumed toplay a major role in the improvement and enhancement of implementation of pedestrian safety rules. Improved implementation of pedestrian safety rules was moderated by attitude of pedestrians towards road infrastructure interventions. Effective implementation of pedestrian safety rules helped save on money that would have been used in payment of bills during hospitalization or funeral expenses in case of death. Pedestrian accidents had negative social and psychological effects which were underlying issues. Road safety projects provide employment and livelihood for road users including pedestrians.Finally, it was assumed that star rating of roads was an objective and standard measure of validly measuring the injury and fatality level of pedestrians.

1.11 Definition of Significant Terms as used in the Study

The following terms were defined in the context of this study:-

Adequacy of Pedestrian Facilities- Refers to zebra crossings, sidewalks and pavements that enhance pedestrian safety in this study.

Attitude of Pedestrians - Attitude refers to a complex mental state consisting of beliefs, feelings, values and the urge to act in a certain way. In this study, attitude of pedestrians refers to pedestrian behaviour along or across the road.

Pedestrian Demographic Factors - Refers to pedestrian characteristics or attributes of age, gender and level of pedestrian education. Age of pedestrian refers to a particular period in a person's life such as young, old or, elderly as appropriate and gender refers to social and cultural differences with reference to male and female pedestrians.

Enforcement of Traffic Laws - Refers to ensuring road users obey traffic laws and rules on urban roads. In this study it applies towhat traffic police, pedestrians and drivers do to

ensure laws and rules are obeyed and pedestrian safety rules are complied with. Corruption means dishonest or illegal behaviour by those in authority to use their power in return for money or on enforcement of traffic laws. Presence of police meant the physical presence of police on the road to enhance rules,regulations,compliance and implementation of traffic laws. Sanctions mean making people obey the law or behave in a particular way and a fine, paying money as an official punishment for breaking traffic laws or breaching safety regulations on the road.

Engineering Designs - Comprise the entire road network upon which road transport operates including high traffic urban roads and pedestrian facilities whose adequacy is investigated in relation to pedestrian safety. Zebra crossing means formal crossing for pedestrians with legal priority to cross with no traffic signal controls.Zebra crossing was marked on the road with alternate white and black stripes. Pavement means the flat hard surface or paved structure on the road where pedestrians walk and sidewalks, the side of the road that allowed people to walk along a road.

Implementation of Pedestrian Safety Rules-Refers to the process ofcarrying out or ensuring obedience to traffic laws, rules and regulations relating to pedestrian road users and their safety.

Public Education - Refers to improved knowledge and skill development on implementation of pedestrian safety rules for the public. In this study it entailed road safety awareness as the ability to behave in a safe way while driving or walking on roads.It sensitizes road users on the need to share the road while minding about other road users. It also refers to the Traffic Act which contained laws governing road users such as pedestrians and drivers and Children's Traffic Park, a small scale and controlled environment where children are taught road rules and regulation by experts in road transport.

Pedestrian Safety - Pedestrian safety is defined as having facilities for pedestrians which are comprehensive and accessible and enhance their safety as a priority. It also entails alert and compliant road users.

Pedestrian -Refers to any person travelling on foot for at least part of his or her journey or a person walking on the pavement.

Road Traffic Crash - A collision or accident that involves a moving vehicle on a public road leading to at least one injury or death of a pedestrian. It includes collision between road vehicles and pedestrians.

Road Infrastructure Interventions - Road infrastructure interventions comprise both behaviour change and engineering interventions for pedestrian safety. It consists of public education on road safety which is indicated by level of road safety awareness, knowledge of the Traffic Act and availability of Children's Park. Road engineering designs are indicated by adequacy of zebra crossing, pavements and sidewalks. Enforcement of traffic laws is indicated by level of corruption, presence of traffic police, sanctions and fines and pedestrian demographic factors are indicated by age of pedestrians, type of gender and pedestrian level of education, on the entire road network upon which road transport system operates; including high traffic intra-urban roads and intercity roads.

Safe Roads - Safe roads are designed to prevent and reduce road crashes. These roads showed road users where they were meant to be and how to use the road safely. Clear road layouts took into account the road user's ability to process information and make decisions.

1.12 Organization of the Study

The study is organized into five chapters. Chapter one describes the introduction which includes background of the study, statement of the problem, purpose of the study,research objectives, research questions, significance of the study, scope of the study, basic assumptions of the study, limitation of the study, delimitations of the study and definition of significant terms as used in the study and organization of the study. Chapter two presents a review of related literature starting with an introduction, road infrastructure interventions are discussed as public education on road safety, road engineering design, enforcement of traffic laws, pedestrian demographic factors and attitude of pedestrians on implementation of pedestrian safety rules, theoretical perspectives and conceptual framework, knowledge gaps and summary of literature.

Chapter three describes the research paradigm, research design, target population, sample procedures and sample size, data collection instruments, pilot testing of research instrument, validity and reliability of instruments, data collection procedure, data analysis techniques and ethical considerations. Chapter four entails data presentation, analysis, and interpretation starting from the introduction, questionnaire return rate, and demographic characteristics of respondents, study objectives and hypotheses testing. Finally, Chapter five contains introduction, summary of the findings, discussions, conclusions and recommendations for policy action, suggestions for further research and contribution to the body of knowledge.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of literature organized into different sections. This includes the concept of road infrastructure interventions discussed as public education on road safety,road engineering designs,enforcement of traffic laws, pedestrian demographic factors, and attitude of pedestrians on implementation of pedestrian safety rules with knowledge gaps from objectives, concepts, methods, findings from the variables discussed in this review.This is then followed by the theoretical framework, conceptual framework and matrix table showing summary of literature review with scientific investigations highlighted as discussed in this review.

2.2 Concept of Road Infrastructure Interventions and Implementation of Pedestrian Safety Rules

The World Health Organization (WHO, 2013, iRAP, 2013) defines road infrastructure as the entire road network comprising road facilities and high traffic intra-urban roads upon which the road transport systems operate. Road infrastructure is the pillar of road transport on which road safety is founded (Mitullah and Asingo, 2007). Road infrastructure interventions comprise both behaviour change and engineering interventions. Everybody has a role to identify and implement effectivecounter measures to improve pedestrian safety which includes officers enforcing laws, engineers, educators and planners (WHO, 2013;Zegeer,2004). A combination of measures is more effectivethan implementing a single strategy. In this study, the road infrastructure interventions consisted of public education, engineering, enforcement and pedestrian demographic factors since problems with pedestrian safety could not be adequately addressed by use of enforcement, engineering and education in isolation but as integrated interventions.

Thomas,Rive,Garvitch,Fritch,Charlton and Barker, (2012) in New Zealand and the Highway Safety Programs Guideline (2006) cited the combined approach as an effective solution in reducing crashes.Institutions involved with and people engaged in implementation of pedestrian safety rules, depending on their expertise or training, preffered either engineering measures or behavior – change measures as sustainable

solution required balancing of both perspectives (Loreno, Clinton and Sleet 2006,WHO, 2013) and essential to a balanced Safe System Approach.

A Safe Systems Approach preventeda risky environment on the road solely on interventions on the built environments to reduce the risk (WHO, 2013). Decision-makers, engineersand planners therefore routinely consider building pedestrian safety in the major road transport as a system of design and planning. Road crashes are system failures and strategies that benefitted pedestrian safety were expected to benefit other road users using the safe systems approach theory that this study adopted.

Implementation of pedestrian safety rules was viewed as a shared responsibility where all road users played a role in protecting pedestrians betterand making the world safe for walking. Pedestrians themselves were not left out in this. The International Federation of Pedestrians (IFP) argued that walking had to be planned, and a pedestrian-friendly infrastructure had to be implemented.In doing this, pedestrian safety had to be kept in mind (IFP, 2012). Implementing pedestrian safety rules required the design and planning of roads to include safe facilities that prioritize pedestrian needs which includes all of us, as indeed we all are and everybody was a pedestrian depending on individual activity, modal choice and travel pattern (WHO, 2013;Agarwal, 2011). The governments, in partnership with others, were in a better position to draw attention to the pedestrian's specific needs. enforce laws, legislate and set standards to protect and design built environments in such a way that prevented pedestrian deaths and injuries (WHO, 2013) as pedestrian movements were made increasingly restricted and unsafe (International Monorail Association, 2010) to increase the level of implementation of pedestrian safety rules both through behavioural and engineering interventions. Mitulla and Makajuma (2009), viewed pedestrian safety in Kenya as a holistic concept that covers aspects of pedestrian safety in line with the safe systems approach of safe roads, vehicles, speed and road users for sustainability.

Attitude means a generalized mental and neutral state of readiness to respond positively or negatively to certain objects, events and conditions in the environment. Nyaga, (1997) observed that attitudes had cognitive, affective and behavioural components. Attitude of pedestrians was therefore inferred from what a pedestrian said about an attitude object,

from the way they behaved along and across the road and what they thought they should do, that is, social norms, their habits, and expected consequences of the behaviour (Liaw,Huan and Dong,2007). In this study, the behaviour component was taken into account in the preparation of the attitude scale used to measure attitude of pedestrians. In this study, attitude of pedestrians moderated the relationship between the independent variables (concepts) and implementation of pedestrian safety rules, the dependent variable (concept) and would possibly contribute to new knowledge in theCity of Kisumu, Kenya proactively.

2.3 Public Education and Implementation of Pedestrian Safety Rules

Public education in the road safety context is a "soft" approach to promote desirable road use or behaviour change which relied on persuading pedestrians to adopt appropriate behaviour while walking along or crossing the road (Martin, 2006).Road safety awareness involving motorists as well as pedestrians was a key stake in developing efficient educational road safety campaigns (NJTPA, 2011; Pedestrian Safety Management, 2007). In this study, public education on road safety was discussed under road safety awareness, the Traffic Act and the children's Traffic Park in the City of Kisumu.

2.3.1 Road Safety Awareness and Implementation of Pedestrian SafetyRules

Road safety awareness entails the ability to behave in a safe way while driving or walking on roads and sensitizing road users on the need to share the road while minding about other road users. The Pedestrian Safety Management (2007) whose objective was to address the current policy and organizational framework on pedestrian safety identified twelve categories of crashes and corresponding road infrastructure interventions used by traffic engineers indicating that although road infrastructure interventions improved pedestrian accessibility and safety, it was important to understand the motivation behind behaviour of both motorists and pedestrians. Their ability to adopt new behaviour was critical to developing effective educational road safety campaigns(NJTPA,2011).

Studies on applied research and policy recommend public education on both road andsafety of pedestrians. Holland and Hill (2007); Knezek (2007) agreed, that there was limited research on effective education strategies targeting adults. The education efforts targeting the old tended to stress passive changes unlike the decisions people made

concerning crossing the road.Holland and Hill (2007) further stated that the process of behavior change involved decision making of motorists and pedestrians which was necessary to effect educational outreach. Enforcement which was also viewed as an educational process itself, increased the mass media safety campaigns effectiveness (NJTPA, 2011).

On motorists' fault as a pedestrian crash factor, (Kim,Made and Yamashita,2008) Knezek (2007) and NJDOT(2005) recommended education of drivers that emphasized knowledge on safety and crossing laws of pedestrians as well as education, liability, drivers responsibility on behavior of pedestrian which were hazardous (Jeng and Fallat, 2003; Knezek, 2007). New Jersey Department ofTransport (NJDOT) (2005) further echoed an education for drivers which emphasized their responsibility to pedestrians incorporated in the States's driver education, driver licensing and registration and renewal processes(NJTPA, 2011).

Education programs according to Federal Highway Authority (FHWA) (2008) were to be tailored to populations at risk and the messages developed in group members through partnership.However, New Jersey Department of Transport (2005) warned that limitations in language and barrier on literacy could interfere with how educational strategies in the states'cities were effectively received. NJDOT (2005) discovered a need requirement by adult non-readers for specific educational materials in Essex and Hudson affected by limited literacy and low proficiency in English literary that had been documented. Campaigns were effective when audiences were divided into subgroups on the basis of risk, demographics, geography, values and attitudes(NJTPA, 2011).

Successful campaigns occurred when data collection instruments such as interviews, focus groups, questionnaires were piloted for modification before actual implementation was done(NJTPA, 2011). Road safety advertising needed close alignment to the source of communication through radio / outdoor adverts, variable messages and signboards (Vaa and Phillips, 2009; Wundersitz,Hutchinson and Wolley, 2010).Three advertising exposures were ideal. However, if ten advertising exposures were done then it was likely to lead to wear out and fifteen advert exposures would result to negative reactions (Woolley, 2001; Wunderstitz, Hutchinson and Wolley, 2010). Jacobsen and Goston,

(2010) on why injuries occurred showed the importance of behavioural approaches to injury prevention.

Road safety campaigns by Wundersizt, Hutchinson and Wolley (2010) showed theories of behavioural change relevant to campaigns on the basis of models that predicted behaviour such as reasoned action theory which assumed people's decisions were consistent and logical and held the belief that attitude together with social normative were due to intentions. The theory focused on both intent and intentions which translated into actual behaviour. Wundersitz, Hutchinson and Wolley (2010) in the Health Belief Model concluded that there was need for realistic campaigns on road safety which were more effective in conveying messages, change in belief and attitude rather than altering the behaviour of drivers directly(NJTPA, 2011).This current study integrated the conceptual and methodological gaps such as knowledge of the Traffic Act, Children's Traffic Park besides engineering, enforcement, demographic factors moderated by attitude of pedestrians. The methods had left a gap in mixed methods,a pragmatic correlational analysis and multiple regression analysis which this study hoped to fill.

Martin (2006) in London whose aim was identification of factors underlying pedestrian behaviour on the streets with visions on pedestrian safety, how the factors identified influenced pedestrians' behaviour, at what locations this behaviour (its factors and underlying factors) affected the safety of all road users including pedestrians on the streets. Using videos to make observation, surveys for self reports, focus groups and qualitative interviews to collect data, the study found that,with respect to pedestrian road user behaviour, increase in risk of road traffic collision was due to choice of crossing place, non-compliance at designated crossings, crossing speed and failure to attend to traffic (Martin, 2014).

The study used literature searchers such as TRL, TRACS, ITRD and PROJEX as databases to source material on pedestrian safety.Road safety education in the form of information and persuasive messages for promotion of safe use of the road,adverts on television,newspapers,radio,magazines,publicity campaigns,formal training in the classroom or on the road were education measures used to influence road user behaviour.These measures raised the level of awareness of road users on road safety and

the knowledge of both Highway Code and safe and unsafe behaviour aimed at promoting desirable safe behaviour. It also made road users aware of how unsafe their behaviour was in promoting desirable attitudes, providing or teaching people strategies to minimize risk of being involved in road traffic collisions and increase the awareness of other road users' needs (Thomas et al., 2012).Although the empirical study by Martin (2014) discussed public education, it left a gap in engineering, enforcement, demographic factors and did not highlight attitude of pedestrians as a moderator variable nor safe systems theory, *expost facto design* and pragmatism which this study hoped to fill.

Road safety campaigns and age of pedestrians as discussed by Martin (2014) further showed that the child pedestrians were more influenced by road safety campaigns than adolescents (Conlon, 2013). Education on pedestrian safety could raise children's knowledge on road safety and their observed behaviour while crossing the road repeatedly at regular intervals. Only 20% of the elderly pedestrians were reached by education and were reluctant to accept advice.Studies showed a statistically significant reduction in pedestrian accidents after implementation of road safety education programmes (Martin, 2014).

In case of drivers, road safety education in turn could promote desirable attitudes and behaviours (Martin, 2006; Miller, 2000).Improvements in driver behaviour were likely to have desirable impact on pedestrians since "better" driving behaviour reduced the conflict between vehicles and pedestrian. To increase pedestrian's safety, programmes should have been put in place for education of drivers especially young ones who were less likely to take pedestrians into consideration when driving (Martin, 2014).

The study by Miller (2000) further indicated that few education interventions targeted adult pedestrian behaviour and fewer evaluations of those interventions. Research suggested that education of road users promoted desirable attitudes and behaviour in child pedestrians but no studies were documented on education of adult pedestrians in this review.Earlier reviews had showed that many adults and children were prone to pedestrian collisions who also carried out many potentially unsafe pedestrian behaviour. Globally, road safety campaigns promoted desirable pedestrian behaviour that targeted all road users especially children (Martin, 2014).

2.3.2 The Traffic Act and Implementation of Pedestrian Safety Rules

The Traffic Act is a legal document passed into law by parliament to enhance traffic laws. Globally, traffic laws state that it is a must for pedestrians to follow traffic signs, control signals and pavement markings when crossing a road (Lee, 2011). At the same time, pedestrians are not allowed on the busy roadways. Pedestrian "rules of the road"specified by some developed countries was that pedestrians were expected to follow certain rules on the road such as using sidewalks whenever they were safely available.

Pedestrians were required towalk when facing traffic where sidewalks were not provided for. Pedestrians ought to obey traffic officers or signals. At pedestrian crossing with no traffic control signals or officers, pedestrians had express right to cross. Pedestrians were expected to yield the right of way to vehicles in the absence of signs and signals and zebra crossing.Even where pedestrian had the right to cross, the driver was legally required to take care at all cost to avoid hitting pedestrians.

In a review of the Highway Traffic Act of Toronto, Canada, Devito (2006) on pedestrian and driver liability, found that many pedestrians, at their peril, believed they had an absolute right of way when they sought to cross or in some other way, engaged upon a roadway.When pedestrians who did not observe their safety and that of other road users, the courts foundthem either completely or partially responsible for the resulting injuries and collisions.The basis of this premise was that a duty of care was owed by drivers to pedestrians and pedestrians were also obliged to exercise due carefor their own safety and the safety of others. The Highway Traffic Act imposed a reverse onus on a driver who impacted a pedestrian on a public roadway (Devito, 2006). The study assumed that pedestrians acted rationally and reasonably, and maintained proper look out on the road. It also cited location of pedestrians and simple rules of the road to be considered when assessing pedestrian collisions.

Devito (2006) in conclusion states that pedestrians legally crossing at designated crosswalks, had much higher rights and higher legal protection than pedestrians crossing elsewhere.The study by Devito,2006 further recommended that given the reverse onus, it was extremely important that accidents involving pedestrians be investigated early on. Photographs of the accident scenes were taken right away so that the location specifics were preserved. A statement could be taken from the driver to refresh their memory later, from the pedestrian immediately (if possible) before they had a chance to "revise" their

version of events.Independent witnesses were alsoto be located and statements obtained from them. The investigating officer was interviewed so that his or her conclusions and any measurements were obtained. While all these seem somewhat onerous, an early investigation was essential in order to allow one to properly assess liability (Devito, 2006). TheTraffic Act addressed pedestrian safety issues but not the moderating influence of attitude of pedestrians' on the relationship between the variables under investigation.The author used photographs, observation and interview but not questionnaires. This study hoped to fill this methodological gap.

Pedestrian planning policies were drawn from Traffic Acts and were important for enhancing the implementation of pedestrian safety rules. A guide to best practices on pedestrian planning Litman,Blair,Demoplaus,Eddy,Fritzel,Laidlaw,Maddox and Forster (2014) in Canada covered pedestrian planning comprehensively. The study, targetting policy makers, planners and advocates sourced new information on how to make communities walkable.

Litman et al., (2014) provided basic information on planning, design and implementation. It described non-motorized practices on how to measure, predict travel, evaluate, prioritizeand implement various programmes that supported non-motorized transportation. It covered planning for paths, sidewalks, street improvements, road and path maintenance, road safety, personal security, universal access,non-motorized traffic law, enforcement, education and encouragement programme and integration with a community's strategic plans and various other programmes. The benefits of walking for community included, among others, removal of barriers to mobility, increase in safety and comfort of pedestrians, broadening of travel options for non-drivers, reduction of conflicts between motorists and other road users, reduction of automobile traffic and the problems it creates, increased recreational activity and exercise, better accommodation of people with disability and creation of more livable communities, improved pedestrian conditions that could benefit everybody in the community regardless of how much they used non-motorized travel modes (Litman, et al, 2016). Most of the concepts and methods addressed in the guide were relevant to the variables addressed in this study.

The Traffic Act (Cap 403) of 2013 in Kenya asan Act of Parliament was meant to consolidate the law relating to traffic on the roads. The Act indicated traffic laws for road users but gave more emphasis to motorists at the expense of pedestrians. The Act

highlights traffic offences, their penalties and regulation of traffic. The Traffic Act was meant to provide the public with education that would improve the level of compliance with traffic rules. This was, however, not the case as the level of knowledge of the Traffic Act was equally low. Pedestrians besides other road users had a negative attitude towards the Traffic Act hence implementation of pedestrian safety rules remained low. The culture of impunity played a role in this hence its inclusion as a variable in this study to improve the level of knowledge of the Traffic Act on pedestrian safety, a gap this study tried to fill (Survey Data, 2016).

The Traffic Act Amendment Bill of 2014 was enacted to ensure safety of children on the road especially around schools or when using school transport and for enhancing speed limit enforcement measures.As an amendment of the Traffic Act, Cap 403 on road safety measures, the Bill was aimed at protecting school children and enhancing enforcement mechanisms for speed limit and connected purposes. The amendment sought to protect child pedestrians through speed regulations around schools while crossing the road to and from school. The clause obligated the roads authority to ensure there were traffic calming controls near schools. The clause was intended to significantly reducethe road crashes involving children around schools where they were most vulnerable due to high concentrated child population around schools. It alsoset speed control regulations and proposed maximum penalties depending on the level at which one exceeded the speed limit. It spelt the intention of improving efficiency in enforcement of offences related to speed and reduce corruption, which emanated from offenders who sought to avoid spending lengthy time in court(RoK, 2014).

The strengths of the Amendment Bill which made it relevant in this study was that it specified speed limits in certain areas.This was a critical factor in enhancing implementation of pedestrian safety rules in line with the safe systems approach. It also spelt out the behaviour expected of drivers in enhancing pedestrian safety especially school age pedestrians. The Amendment Bill also stated the speed limit of 30 km/hr as the speed limit allowed at pedestrian crossings and urban areas with specific traffic signs indicating to drivers entering and leaving the road where the 30 km/hr speed began or ended. It specified that traffic routes around schools or access to schools should be planned, designed, equipped and maintained with safety features (Traffic Amendment Bill, 2014). These included wide pavements, sidewalks (footpaths) and zebra crossings with

appropriate signs and markings. As a source of public education for road users, the amendment catered for the needs of pedestrians and was reviewed for integration in this study(Survey data, 2016).

Enforcement of the Traffic Act on vehicles and pedestrian fatalities was cited by Pukose (2007) who used descriptive prospective study to determine the presentation and severity of public service vehicle related injuries at Kenyatta National Hospital and found that a total of 161 patients satisfied the inclusion criteria and were recruited into the study. There were 112 males (70%) and 49 females (30%) giving a ratio of 2:3:1. 10(6%) were below the age of 18 while 151(94%) were above the age of 18 years. 36(22%) were seriously injured while 83(52%) sustained moderately severe injuries and 42(26%) mild injuries (Pukose, 2007).

The most common injuries were lower limb injuries in 41(25%) of the patients. The study period, 2003/2004 and 2006/2007 registered a decline in number of fractures, severe injuries and accident occurrence. Observations for incidences in 2003/2004 was rated at 2.24 for every 10000 within 4 months while 2006/2007 had incidences of 0.55 per 10000 which was a decrease of 71.3% recorded PSV accidents at KNH.

It was noted that careless drivers and negligent pedestrians were the main causes of both passenger and pedestrian accidents affected in road accidents suffering injuries that resulted in morbidity and time loss due to hospitalization. Many injuries reported at Kenyatta National Hospital were road accidents caused by public service vehicles. A review of head related injuries admitted at the National facility at Kenyatta in 1979 between July and December accounted for 46.3% of the head injuries reviewed (Pukose, 2007).

Although the study was based on the Traffic Act and its enforcement, it did not address road safety awareness, Children's Traffic Park, corruption on traffic enforcement and influence of attitude as a moderating variable. It used frequencies and percentages but did not test hypotheses using correlation and multiple regressions which this study focused on.

2.3.3 Role of Children's Traffic Parks and Implementation of Pedestrian Safety Rules

Traffic parks are a miniature of real streets, scaled down to proportional lanes and street widths appropriate for smaller vehicles and controlled by traffic signals and traffic policeTraffic Park,2015). They are also known as Children's Traffic Park, in other localities the name traffic garden, safety village and transportation park are used.In urban areas the traffic park is where children are taught or learn rules governing safe use of the road. Children's traffic parks exist in different parts of the world including Africa but in the City of Kisumu; it is located within Jomo Kenyatta Sports Ground under Kenya Urban Roads Authority (KURA). The purpose of a children's traffic park is creation of road safety awareness to school children of 10 years old and above. The children were trained using pedal powered cars and bicycles to obey traffic laws and safe use of roads.The traffic parks make children learn through experience on how to cross streets and safety challenges in a controlled environment without actual motor vehicles.

Parents' perceptions of the children's traffic park was reported by Veitch,Bagleys,Ball and Salmon (2006) in a qualitative study that questioned where children usually played and also highlighted the influence on children's active free-play. The 78 parents from different socio-economic areas in Melbourne, Australia were studied for their perceptions on why and where children played. Ecological models were used to interview parents, which identified safety and social factors as critical social themes, environmental themes in the physical environment included pedestrian facilities at parks and playgrounds(Veitch et al., 2006). The level of children's active participation in free-play depended on their attitude and independence which crucially influenced their active free-play at a personal level. The results are relevant for both children's chances for active free-play and urban planning in the future (Veitch et al., 2006). Although this review was relevant to the study in public education, it did not focus on integration of other variables such as enforcement, engineering, demographic factors moderated by attitude of pedestrians on implementation of pedestrian safety rules.

Perceptions of parents on neighbourhood safety and children's physical activity children was studied by Weir, Etelson and Brand (2006) whose objectives were that children from poor minority groups were disproportionately affected by obesity epidemic and negative

perceptions about neighbourhood safety affected overweight children's' physical activity (Active Living Research (ALR), 2013). The study investigated the degree to which parents in a poor inner city versus a middle-class suburban community limited their children's outdoor activity because of neighborhood safety concerns, the study used parents of 5 – 10 year old children family practice from poor residents in an inner city and those from pediatric practice in the suburban areasin a middle-class community to complete a questionnaire with 20 items. The amount of child's activity and level of anxiety was then estimated by parents based on personal and traffic safety in the neighbourhood.

The study found that in comparison children from the inner city (n = 204) engaged less in physical activity than children in the suburban children (N = 103) ($P<0.001$) (ALR, 2013). Intercity Parents expressed a much greater anxiety about safety in the neighbourhood than parents in the suburban parents ($P<0.0001$). The population indicated that the physical level of children was negatively correlated with anxiety of parental about neighbourhood safety ($r = -0.18$, $P< 0.05$) (ALR, 2013).

While these concerns may not entirely explain the discrepancy in activity levels between inner city and suburban children, a safe environment was crucial to increasing opportunities for physical activity (ALR, 2013). The study cited inadequacy of pedestrian facilities for children leading to the health issue of obesity. It, however, left out enforcement, the pedestrian demographic aspect of gender and attitude of pedestrians which the current study addressed.

Children's traffic park as cited byTimperio,Crawford, Telford, (2004) in Australia, examined what the local neighbourhood was perceived to be and its association with walking among children, whose ages ranged between 5-6years, (n = 291) and 10-12 years (n = 919) recruited from 19 Australian primary schools. Parents reported the child's regular walking to local destinations in relation to their perceptions of the local neighbourhood. Those whose ages were between 10-12 years were asked their views on road safety and what their views on these issues were(Coulson, Fox, Lawlor, & Trayers,2011).

The study results showed that 5-6 year-old boys whose parents perceived the neighbourhood to have heavy traffic were 2.8 times more likely (95% CI = 1.1-6.8), and girls 5 - 116-year-old whose parents owned more than one car were 70% less likely (95% CI = 0.1-0.8), and whose parents believed that public transport was inadequate in their area were 60% unlikely (95% CI = 0.2 - 0.9) than other children to walk at least thrice a week. Parents who believed there were no lights or crossings was associated with walking or cycling among 10 to 12 year-old boys (OR = 0.4, 95%CI = 0.2-0.7). Among older girls, parents' belief that their child needed to cross several roads to reach play areas (OR = 0.4, 95% CI = 0.2-0.8) and that there was limited public transport in their area (OR = 0.7, 95%CI = 0.4-0.97), and the child's conviction that no sports ground or park around their home (OR = 0.5, 95%CI = 0.3-0.8) did less walking (Coulson, Fox, Lawlor, & Trayers, 2011; Timperio et al.,2004). The study concluded that perceptions of the local neighborhood may have influenced the physical activity of children. This study used methods such as odds ratio, and confidence interval in data analysis but did not use multiple regression analysis, mixed method approach and variables such as enforcement, attitude of pedestrians and the current study has tried to address this gap.

Access to children's traffic parks was cited by Roemmich et al.(2006) who, associated access to parks and recreational facilities with the physical activity of young children whose objectives was to determine associations of the neighbourhood and home television environments with physical activity of young children (ALR, 2013).Using 32 boys and 27 girls aged 4 to 7 years wearing accelerometers for 3 weekdays and 1 weekend day, both the number of televisions and watching by child was monitored with the aid of a TV allowance units for a period of 53 weeks. The geographic information system was used to measure the neighbourhood environment variables (ALR, 2013).

The results showed that controlling for age, sex, adiposity and socioeconomic status and child television watching hierarchical regression analysis was used to predict physical activity in step 1 (ALR, 2013). In step 2, the increase in amount of variability in prediction of physical activity was not significant. In step 3, comparing housing density and its interaction by sex led to an increase of 12% ($p<0.05$) of the variance. In step 4 percentage park plus recreation area was due to the park plus recreation for a further 10% ($p<0.05$) variability. The high housing density predicted increased the boys' physical activity, but

not girls(Roemmich et al., 2006).The study concluded that neighbourhoods with increased proximity between places close to home and large proportion of park area had more physical activity of youth. This study was relevant to this study since public education was indicated by children's traffic park but was limited in enforcement, engineering and attitude of pedestrians for proper implementation of pedestrian safety rules (Misigah,Kinyanjui, & Ohaya, 2013).This is the gap this study has tried to fill.

A conceptual model by Bediemo-Rung, Mowe and Cohen (2005) on identified Park-based physical activity as a promising means of satisfying current physical activity requirements. However, research was limited on policy and environmental characteristics to improve levels of physical activity. The study proposed a conceptual model to guide thinking and suggested hypotheses. The framework described the relationships between park benefits, park use, and physical activity, and the antecedents/correlates of park use. In the classification scheme, the discussion focused on park environmental characteristics that could be related to physical activity, including park features, condition, access, aesthetics, safety, and policies(Coulson, Fox, Lawlor, & Trayers, 2011). It further reported that, from activity areas, the overall park, supporting areas and surrounding neighbourhood as specific geographical locations in and outside parks data could be collected. Future research suggests operationalization of specific measures, data collection methodologies and measurement of relations between levels of individual physical activity and particular characteristics of the park(Coulson et al., 2011; Bediemo-Rung, Mowe and Cohen 2005). There was also need for various disciplines to form collaborations. The study did not, however, test a hypothesis as was required by ex post facto design in this study.

2.4 Road Engineering Designs and Implementation of Pedestrian Safety Rules

Road infrastructure provides road safety in urban environments. Road engineering designs as a variable in this study were discussed under three indicators adequacy of sidewalks, zebra crossings and pavements.Influence of road infrastructure on pedestrian fatalities and injuries as reviewed byReynolds,Harris,Teschke,Cripton and Winter (2009) indicated that walking had the potential to improve fitness, thereby diminishing obesity associated with non-travel. However, the study reported that pedestrians required more hospitalization from these high risk injuries than passengers in vehicles. Therefore, an understanding of how to make pedestrian transport safer was important to improving pedestrians' health.

Acknowledging the continued growth in research, transportation infrastructure examination and injury risk to pedestrians, the authors used review on studies on results based road infrastructure on pedestrian safety as a method of data collection (Mueller, Rivara and Bergman, 1987).

The results were presented in tables at intersections (such as roundabouts, traffic lights) or between intersections on "straightways" (such as sidewalks) to assess road safety. Studies reviewed included outcomes on accidents from crashes, injuries and their level of severity; and crashes (Mueller, et al., 1987). The findings were that, road infrastructure literature and safety of pedestrians to date was experiencing challenges in facilities whose range was incomplete and control for risky exposure difficult (Reynolds et al., 2009). Results obtained by reviewing 23 articles, out of which (eight examined intersections and 15 straight-aways), suggested that road infrastructure influenced the risk of both crash and injury. Roundabouts formed the main focus of intersection studies. The findings revealed that roundabouts with multiple lanes greatly increased pedestrian risk only if a separate road was part of the design and studies of straight-aways, group facilities could be merged and reduced into single category based on different potential risk which they posed. Findings suggested thatsidewalks and multi-use trails posed the greatest, with major roads having comparatively more hazards than minor ones and pedestrian facilities linked to lowest risk (Reynolds et al., 2009; Chadda and Schonfled, 2008; Chitere 2006; Carreno, Willis and Stradling, 2002; Mueller, et al., 1987).

Pedestrian traffic was overwhelmingly present and of great social-economic importance in all African cities and should have been provided for where vehicles were separated from pedestrians on the roadway which was cost effective (Bech-Padrosa, 2010). This considerably increased the safety and efficiency of vehicle and pedestrian traffic. Making the pedestrians invisible in the road safety issue did not yield good results (Eleonora, Yannis and Golias, 2012; Bech-Padrosa, 2010; De Langen, Tembele and Opiyo, 2001). When land use diversification led to disappearance of informal shortcut routes, pedestrians were forced to use main pavements which became too narrow for pedestrian traffic and became unsafe and inefficient. De Langen, Tembele and Opiyo (2001) stated that proper road infrastructure interventions could restore urban traffic safety but did not however mean that all accidents could be eliminated. Irresponsible traffic behaviours, drunk driving

and walking persisted and grave errors continued to occur. African cities were pedestrian cities and the most dangerous places to walk on foot.

On pedestrian facilities,a study in Texas by Dumbaugh and Wenhao Li (2011) argued that purpose-built pedestrian-specific facilities such as sidewalks, zebra crossings reduced pedestrian accidents, providing a basis for starting engineering guidelines to solve pedestrian safety. Other factors that promised to solve the issue of safety of pedestrians included lights in the streets and pavements. There was need for more research in the future to examine a diversity of road engineering designs, development of detailed guidelinesas recommended (Mueller, et al., 1987). In a study conducted in Nairobi, Asingo and Mitullah (2007) found that road infrastructure was one of the pillars of road transport on which road safety was founded. They further found that road infrastructure posed the greatest challenge and major barrier to accessing and providing safety to pedestrians, a fact that had been ignored in attempts to find a solution to road safety issues in the transport sector. Issues of accessibility of road infrastructure to pedestrians (Opiyo, 2002; 2005) still posed a challenge to pedestrians in the City of Kisumu and needed to be addressed though engineering alone was not sufficient needed and it to be integrated with other concepts such as education, enforcements, demographic factors and moderated by attitude of pedestrians for effective implementation of pedestrian safety rules in this study.

2.4.1 Zebra Crossing and Implementation of Pedestrian Safety Rules

Zebra crossings provide formal crossings to pedestrians with legal access over motor vehicles without using traffic signal controls (Martin, 2014).Compared with signaled controlled crossings, they offer relatively low cost options. Zebra crossings as a typical instrument of traffic calming are a special group of traffic management instruments whose aim is traffic safety, specifically reduction of urban traffic accident and their severity. Pedestrians were regarded as non-motorized traffic in this study. Zebra crossings are engineering interventions in the environment meant for use by pedestrians.

Pedestrian crash severity are influenced by environmental factors. Holland and Lin (2007) cited the influence of environmental factors in a study whose objective was on how severe injuries and fatalities of pedestrian - vehicle collisions were on state routes in King County, Washington (NJTPA, 2011). The study used concepts such as, characteristics of

road, data variables, uses of land at or next sites of collision, traffic conditions and models like binary and ordinal logistics as methods. Findings showed that collisions that led to fatal and severe injuries were both strongly and significantly related to pedestrian crossing at intersections without signals (compared to crossing in any other locations or walking along the road) and vehicles moving directly ahead on the road (compared to an inclusive action of all types of vehicle). The study recommended better taking of reports, information on vehicle speed during collision and vehicle type to inform safety programmes, policies and standards effectively.

In questioning engineers and planners responsibility on adequacy of pedestrian facilities, Otsyeno (2011) reporting from a health perspective on Kenyan road safety, cited inappropriate dedicated infrastructural road designs as the cause of poor results for those involved in road crashes in sub Saharan Africa. Otsyeno (2011) cited pedestrians, the public and policy makers unawareness on interventions that existed arguing that the road department only prepared work plans for specific blackspots and dangerous locations on public roads to enhance road safety after accidents had occurred (Kenya Roads Board) but ignored the other sections of the road pavement critical for pedestrian safety. Stating that inland transport was dominated by road transport in Africa, the study concluded that a safe road ensured a road user safe arrival at destination, when this did not happen engineers and planners should have ensured that road engineering design enhanced pedestrian safety. Although the study by Otsyeno (2011) approached the issue of pedestrian safety from a health context, this study incorporated a multidisciplinary perspective of combining both behavioural and engineering interventions to the implementation of pedestrian safety rules. It also used mixed methods approach and pragmatism to address the pedestrian fatality and injury problem as cited by Otsyeno (2011) in this review.

Zebra crossings as cited in Elvik (2009) in the city of Oslo, using negative binomial regression identified that the number of accidents increased when traffic volume increased together with evidence of a safety in numbers effect with reference to volume of pedestrian traffic. The frequency of accidents increased in complex traffic environments and the speed of approaching motor vehicles increased. Although the study reviewed zebra crossing, it did not address public education on road safety, enforcement of traffic laws, pedestrian demographic factors and attitude of pedestrians or apply the safe systems

approach which the current study incorporated to implement pedestrian safety rules effectively.

Excessive high speed is the main cause of severe urban traffic accidents. Speed has a strong influence on urban road safety and measures to calm traffic were specifically designed to control vehicle speeds which were the single most critical cause of pedestrian fatality and injury on urban roads (NJTPA, 2011). Due to theclose link between speeds of travel and injury severity, measures to calm traffic were key counter measures in accident prone sites. De Langen, Opiyo and Tembele (2001) on conflict and common interests between pedestrian and other traffic, in particular, public transit (bus) and car traffic,the ten zebra crossings which were constructed in pilot projects in Temeke ward in Dar-es-Salaam and one in Morogoro all in Tanzania were a better alternative to humps (De Langen, Opiyo and Tembele,2001).

Bech-Padrosa,(2010) in Sierra Leone in a study whose aim was to apply the findings to other projects motivated by the same conditions as in those roads. One of the conditions included a large number of pedestrians crossing these roads. Pedestrians crossed everywhere because of side streets and dispersed activities. Minibuses popularly known as *dala dala* stopped randomly on the road shoulder to load and unload passengers. This caused problems such as danger in crossing for pedestrians due to high speed of motor vehicles combined with unwillingness of most drivers to slow down to let pedestrians cross. The high speed of vehicles increased the risk of vehicle/vehicle collisions which, when they occurred, created a lot of damage and significant traffic delay (traffic jam).

The study, whose objective was to create crossing points with low vehicle speed, where vulnerable pedestrians (elderly, children) could be sure to always cross without danger (create green spots) found effects very positive for pedestrian traffic accidents on road sections where raised zebra crossings were constructed, as pedestrian accidents were almost eliminated. Safe crossing became possible and improved significantly. For motor vehicle traffic, the pedestrian waiting times at raised zebra crossings were not reduced but, on the contrary, increased(Bech-Padrosa, 2010)

Road users' perception of safety revealed that most people were safer and at ease after the traffic calming interventions. Although the visibility of the raised zebra crossing was very important, the painted white and black stripes gave little improvement due to sand and dust accumulating on the road surface and to quick wear and tear. The legally required traffic signs also did not help much to improve the visibility of raised zebra crossings. For vulnerable pedestrians, the raised zebra crossings were necessary to create green spots where they could cross.

In their study on road infrastructure interventions and road safety, De Langen, Opiyo and Tembele (2001) argued that there was a false sense of safety feeling from zebra painting from a pilot study they carried out in Nairobi. The painted zebra crossing without accompanying speed curbing measures showed that such crossings did not increase accident hazards by making naïve pedestrians under-estimate the risks. The study recommended that continued use of painted only zebra crossing must be discouraged. The false sense of safety from pedestrian crossing led to failure to implement pedestrian safety rules for both drivers and pedestrians. This study reviewed road engineering designs, zebra crossing and attitude of pedestrians but no other variables such as children's traffic park, corruption on traffic enforcement laws, police presence and other relevant variables for effectively addressing implementation of pedestrian safety rules which this study hoped to address in a pragmatic style of what worked. Zebra crossings were viewed negatively by some road users including residents, traffic engineers and media group as barriers to effective use of the road (WHO, 2013; De Langen, Opiyo and Tembele, 2001). Such measures ought not to have increased crash rates but just do the opposite by slowing traffic.

A study by De Langen, Rwebangira, Kitandu and Mburu (1999) aimed at drawing conclusions on how valuable and effective road engineering design interventions 4 - 7 years old were(Bech-Padrosa, 2010;De Langen et al.,1999).The study found that in three years, maintenance requirements could now be judged properly. Using observation of traffic, direct site location, advice from Municipal experts as methods cited in Mburu (2002) MSC thesis, they further found thatchoices of proper designs were ideal for improving the performance of urban traffic and safety of pedestrians who were the majority but vulnerable on African roads (Otsyeno, 2011; Bech-Padrosa, 2010).

The findings further identified Raised Zebra Crossings (RZC) as a traffic calming measure under road engineering design that ensured pedestrian safety. Raised Zebra crossing created a strong sense of improvement on road safety of pedestrian's in particular safe crossing, vehicles with two wheels for safe driving and motor vehicles for less collisions), at the same time it positively influenced the fluid flow of traffic through reduction of high speed(Bech-Padrosa, 2010). As a result, RZC increased road capacity (De Langen, Opiyo and Tembele, 2001).This study seemed to provide a good solution to the problem of pedestrian fatalities and injury as an ideal situation in an African context. However, when applied to the City of Kisumu where speeding vehicles were common and the pedestrian fatalities stood as high as 45%,there was need to balance the interventions approach through public education, enforcement, consider demographic factors and address the issue of attitude of pedestrians using the pragmatic approach that seemed more sustainable hence its inclusion in this study.

An integration of road infrastructure interventions and attitude of pedestrians to enhance implementation of pedestrian safety rules that were expected to reduce pedestrian fatalities and injuries was the idea behind the use of Raised zebra crossing for pedestrian safety.Raised Zebra crossing adjusts the shape to influence driver behaviour (speed) thereby restoring traffic safety for local residents and school children. The law regarding zebra crossing stated that in the absence of traffic control signal, drivers ought to yield to pedestrians especially on a zebra crossing or the pedestrian was potentially at risk. In addition, every driver approaching a zebra crossing yielded the right of way to a pedestrian whether accompanied by guide dog or cane (Lee, 2011). Contrary to this, if there was no zebra crossing, a pedestrian was expected to give way to vehicles on the road.

2.4.2 Pavement and Implementation of Pedestrian Safety Rules

Pavement means the road or carriageway meant for providing safety and mobility on the road. On the need to integrate the road to accommodate all road users, a study by Jacobsen, Racioppi and Rutter (2011) whose objective was an examination of how traffic influenced walking from diverse sources using literature review from traffic engineering, medical, public health, city planning and public administration as a method of research, and found that pedestrians were discouraged from walking for fear of real or imagined danger as well as discomfort the traffic imposed (Jacobsen, Racioppi and Rutter, 2011).

Pedestrians judged injury risk and responded accordingly based on whether the danger was real or perceived. Although it could have been hard for these effects to be measured, observed behaviour revealed a strong association between traffic volumes and speed on 45 levels of walking. The road in this review meant pavement. Although the study focused on safe sharing of road space by pedestrians; it did not incorporate road infrastructure interventions and attitude of pedestrians which this study tried to fill. Concerning methods that the study used, literature indicates that if it did not address mixed method approach, ex post facto design, correlation analysis and multiple regression analysis as used in this study.

In a study, Chen (2009) indicated that African countries faced challenges from road traffic crashes and injuries on health, economics, and development. Out of 4 per cent motor vehicles globally, African road fatalities exceeded 10 per cent. This figure was likely to be higher with further motorization. Carnage on the road had a negative impact on development especially socio-economic and human development. The objective was toupgrade the trends, causes, status, existent countermeasures, and road safety issues, challenging African countries. It was further hoped that the findings could stir discussion and lead policy makers to formulate road safety policy (Chen, 2009).

The method used included a review of published articles in scientific journals; government and institutions internal reports, and web-based published articles (Chen, 2009).Key search engines and journal specific investigations were used in the search. The reviewed journals were sourced from a diversity of disciplines including traffic safety, injury prevention, public health, medicine, economics, general social science and local journals from Africa, bearing in mind multi- disciplinary nature of road safety and its special local issues potentially unique to Africa. The identified relevant articles though limited in number of published studies were assessed for relevance and validity. Traffic safety was revealed to be facing serious challenges in Africa. For example, in Tanzania and Ghana, statistics recently showed over 100 people per 10,000 vehicles died in road crashes, compared to 1.7 fatalities per 10,000 vehicles in the US. This deaths would however double between 2000 and 2020 if no action was taken. Factors similar to those in motorized countries were identified in the review as contributing to road accidents. The police reported that human behaviour and vulnerability of a group accounted for over 85%

of the factors reviewed. Unlike in industrialized countries, vulnerable users of the road were the principal cause of traffic casualties in Africa. Over 40% of all road deaths in Africa were pedestrians alone. Literature reported on interventions was limited (Chen, 2009). Mixed ways of evaluating programmes and research methods were of questionable validity. African countries had challenges in improving road safety. These included, among other things lacking data, limited research, lead agencies and organizations, in a culture prone to fatalities in stagnant economies (Chen, 2009).

The study concluded that African countries human, social, and economic development was threatened by road deaths and injuries. There was need to slow and/or reverse this trend. The United Nations recent recognition and initiatives had become handy by building alliances and momentum. The African pedestrians held the future to their safety on the roads with help from global village which also inhabit (Chen, 2009). The study was relevant to pavement but from an African context, the current study adopted the findings in a city context. Although the pavement was from an engineering context, this study combined behavioural interventions such as education and enforcement together with moderation from attitude of pedestrians to give it a balanced approach.

The role of pavements on pedestrians was cited by De Langen, Opiyo and Tembele (2001) in a study whose purpose was to establish a detailed and well tested set of traffic planning and road design methods and recommendations for urban pedestrian and bicycle traffic in Africa. Using household survey, monitoring, planning design and implementation, observation, participation and pilot projects as methods of data collection, which documented the first set of tested findings on all urban infrastructure planning and design situations in Africa that involved pedestrian and bicycle traffic and concluded that the study was yet to cover all urban road infrastructure planning and design situations in Africa. The study recommended more fields testing in more countries and cities in Africa and more experts vital to arrive at broader collection of proven planning methods, interventions menusand road designs. On policy formulation, the study reported that pro-walking policy could not be created from the outside if there were no pedestrians to walk. Ownership was a key concept in pedestrian safety and a strong focus on walking could help solve transport problems in African cities.

The study further reported that pedestrian pavement was only important if pedestrians were there to use them. Pavement allowed low walking speed recommended for spot improvements. For pedestrians walking on the carriageway, it was important to provide good pavements. Where pedestrians were making long detours, the guideline recommended improvement of pavement at bad spots. Bad pavement quality consisted of loose sandy soils mud, micro detours, resulted in absence of walkways, unsafe walking, pedestrian congestion (insufficient capacity, streets trader, parked vehicles and waste) and waiting time involved in road crossing (sometimes for the old or children or disabled, made the possibility to use a route fully disappears).

Pavements are further discussed by De Langen, Opiyo and Tembele (2001) in a pilot study in Morogoro in Tanzania and Eldoret, Kenya which revealed conditions of the pavement specific to each location such as loose sandy soil, black cotton soil, slopes, lack of vegetation cover of adjacent soil which resulted in damage to walkways and pavements by motor vehicles. The situation was further worsened by erosion by storm, insufficient water runoff or self-draining soil properties, lack of availability of low-cost paving blocks and construction skills and lack of arrangement for regular maintenance. The study, whose objective was to facilitate selection of the most appropriate pavement type, in a specific location/conditions case, used methods like counting observations, photographs, video films, random sampling of respondents' and case studies and found various pavement alternatives. The first alternative consisted of compacted earth whereby almost all walking routes in Tanzania and Kenya had an earth pavement compacted by daily pedestrian use. Where drainage conditions were good, local soil properties reasonably good and use was by pedestrians only, a compacted earth track usually had a fair to good quality, suitable for walking. The second pavement was cement stabilized soil in which, if the existing soil was sandy enough, cement could be used to stabilize it. It was better during rains as clay soils could be stabilized with lime. Compacted murram as a third alternative on walkways could be paved with compacted soil. Surface dressing on compact gravel base, concrete slabs with side restraint made a good and durable pedestrian walkway pavement. It also gave pedestrians convenience and speedy walking. Large concrete slabs without side restraint were laid well otherwise it was hard for pedestrians to use and almost became impassable (De Langen et al., 2001).

The pavementfunctions as a walking route for pedestrians. The shape of a road meant the actual physical form product of its pavement design, how much road space was available and of what quality. Pavement maintenance in the City of Kisumu had however been neglected hence the need to implement pavement improvement programmes to enhance implementation of pedestrian safety rules. Theshape or condition of the pavement was observed and measured through lane width, type of pavements and pavement defects and use of a road could be observed and measured through traffic volumes, speeds, driver behaviour, accidents, walking times for pedestrians crossing, waiting times for left and right variations and changes in use patterns, sudden or temporary observation was made with care. The study gave a detailed account of the function, shape and use of a pavement from an engineering intervention context but did not incorporate behavioural interventions such as education, enforcement which was incorporated under public education, enforcement, demographic factors and attitude of pedestrians as a moderator variable was not used to test hypotheses between variables under investigation. Pedestrian facilities as cited in Odero, Khayesi and Heda (2014) were sporadic, uncoordinated and ineffective. Using descriptive analysis to analyze secondary data sourced from varied reports from published or not published literature, the study revealed that over 3,000 people died annually on the roads of Kenya and a fourfold road fatalities increased for the past 30 years. Three quarters of the causalities on the road were young adults in an economically productive group with vulnerable pedestrians and passengers; accounting for 80% deaths. Vehicles specifically, buses and matatus were singled out as principal cause of these fatal accidents(Odero, Khayesi and Heda, 2014; Oladapo, 2013).

Although matatus in Kenya played a key role in public transport sub-sector, they violated traffic rules with impunity. Variation in crash characteristics existed in urban and rural settings with pedestrians at higher risk of being killed in urban areas, and majority passengers among those killed on intercity road highways common in rural settings. The impact of road infrastructure interventions had not reduced the rates, the numbers, and results of road crashes. Though these crashes have increased markedly, efforts to develop effective interventions in Kenya have been minimal. Despite the major increase in road crashes in Kenya, development and implementation of interventions was ineffective (Gray, 2013). What has stood in the way of injury study, however, left gaps in attitude of pedestrians as a moderator variable which the current study integrated.

2.4.3 Sidewalks and Implementation of Pedestrian Safety Rules

Provision for pedestrians entailed sidewalks which were adequately designed and planned for to accommodate safe travel (Monsere, Dill, McNeil, 2016).The World Health Organization's, (WHO;2013) whose 64/255 resolution adopted by the National General Assembly by 2010 proclaimed a decade for action, set out to look into road safety generally and pedestrian safety in particular. Their 2011-2020 goal was to control and reduce the growth road transport fatalities thereby saving approximately 5 million lives within that period. Countries were guided by a global action planin achieving this goal(WHO, 2013). This practical tool was based on five pillars of safer roads and mobility road safety management, safer vehicles, post-crash responses and safer road users. There was a call for regular monitoring of global progress to meet targets set in 2009 to provide and disseminate information from the 2010 baseline data to monitor progress made in 100 years of action(WHO, 2013).

The objective of the study was to use a standard method and assess changes made on the burden posed by road traffic injuries and how effective interventions can be implemented in all member states since the report of 2009(WHO, 2013). It further indicated road safety gaps, across institutional management, policies and legislative domains, and collection of data for stimulation and prioritization of road safety activities and to set both national and international level baseline surveys to monitor activities for 100 years (WHO,2013). Self-administered questionnaires with information on key variables, iRAP model, star rating for roads and pedestrians were the methods used. The study covered 98.6% of the global population with about 6.8 billion people from 182 areas or countries ,95% of the African population contributed to the response rate. WHO, (2013) from the 2011, legislative and policy related data was drawn while the 2010 data was fatality related. Statistics showed that 22% of the vulnerable road users risking fatalities globally were pedestrians (OECD, 2015).In low and middle income countries, a greater part of the road users were pedestrians. In Africa, walking was an important form of mobility for the majority of people. In Africa, 38% of all road traffic deaths occurred among pedestrians. Almost 60% of road traffic deaths fell between the age brackets of 15-44 year olds with men constituting over three quarters (77%) in high income countries' proportion of deaths (Manyara, 2013). The study found that safer roads reduced the likelihood of a crash and severity and that engineering road design, construction and maintenance could be

underpinned by a safe systems approach where allowance was made to compensate human error, roads and road sides were made safer, speed made safer through traffic calming(WHO, 2013).Public transport could enhance safety of movement and reduced congestion.Action was needed to make vehicles safer for non-car road users such as pedestrians.

The study concluded that road traffic injuries remained a critical health concern. Moreover, where politics had led to multi-sectoral action, based on evidence, road traffic injuries had reduced. It recommended that, although the pace of legislative change was too slow, continual process of legislative review to further strengthen laws should be beefed up to address risk factors such as speed and drink - driving. Enforcement of strong road safety laws was essential for successful implementation of pedestrian safety rules. Sufficient resources would enable support of enforcement laws on road safety leading to realization of full benefits. Currently, however risk related laws were poorly enforced. The use of strong social marketing campaign was therefore needed for public understanding of and support for legislative measures (WHO, 2013).

Reducing road traffic deaths required more consideration of the needs of pedestrians. There was strong evidence based on what intervention worked and the government was key to this implementation (WHO, 2013). Best practice road safety audits included an assessment of safety for all road users including pedestrians. Crash risks for all vulnerable users such as pedestrians could be reflected in road safety audit and assessment results. For example, the International Road Assessment Programme (iRAP, 2013) safety assessments used their road inspection data to provide star ratings for roads, with five star roads indicating the highest performance and one star road the lowest risk for injury.

Star rating was provided for pedestrians. Data from countries with moderate to low incomes showed half the roads assessed rated in the highest risk categories 1-2 stars due to the fact that 84% of the roads were assessed where pedestrians had no sidewalks and footpaths (Dupperex, Roberts and Bunns, 2002). It emerged that action was needed to make vehicles safer for non-car road users. Vehicle safety standards were one means of protecting those outside the vehicle. However, until recently, most emphasis on vehicle safety had been on protecting those within the vehicles. Since the 1970s, crash engineers

had known that, in addition to reducing vehicle speeds, changing the shape and stiffness of vehicle front would significantly reduce the severity of injuries sustained by pedestrians. Now, there was a global standard for pedestrian safety and innovative technologies e.g. crash avoidance systems such as autonomous emergency breaking that offered the prospect of improved safety for vulnerable road users. This study reviewed addressed the pedestrian safety issue from a global perspective and highlighted various concepts similar to the variables addressed in the study. The report, however, did not apply the mixed methods approach, *ex post facto* design, and multiple regressions. It did not also address public education on road safety and pedestrian demographic factors as variables as addressed in this study. Adequacy of sidewalks in relation to age of pedestrian was cited by Kirsten and Lawson (2006) who reviewed literature on the relationship between attributes in the physical environment and children's physical activity and found the youth physically inactive (Gray,Keller,Martin and Shepard, 2015). The purpose was to investigate how the built environment influenced childrens' physical activity (Hardy et al., 2007). To achieve its objective the study used 33 quantitative studies to assess attributes of the physical environment and physical activity of children between the ages 3-18 years. The study used descriptive survey design and correlation design and categorized data into 3 dimensions of infrastructure namely transport, recreation and local conditions (ALR, 2013).

Results showed a positive association between children's participation in physical activity and provision of public road infrastructure specifically presence of sidewalks. Road infrastructure was in terms of how many roads to cross, density of traffic, speed of vehicle and road environment were found to have a negative association with the physical activity participation of children. The study concluded that there was a link between the two variables under investigation (physical environment and physical activity of children). The study recommended a trans-disciplinary intervention. Two variables, the moderator and mediator were assessed and found necessary to appropriately inform policy efforts (ALR, 2013). Although the study reviewed literature from the context of the developed world, the current study applied it in the context of the developing world. The two variables namely sidewalks and age of pedestrians addressed in this study, may not have been adequate if used in isolation and the current study hoped to enhance it by integrating public education, road safety awareness, the Traffic Act and knowledge of the children's traffic park. Issues

not addressed such as enforcement of traffic laws in terms of corruption, presence of police, sanctions, fines, pedestrian gender and attitude of pedestrians were resolved in the current study.

Patterns of pedestrian injuries and its implications on urban safety planning in relation to adequacy of sidewalks was cited by Ogendi et al., (2013) in the city of Nairobi where pedestrians were indicated to form a major part of road fatalities and injuries yet there was limited research done to understand the characteristics of pedestrian injuries better (Mueller, Rivara and Bergman, 1987). Data used was obtained from Kenyatta National Hospital (KNH) on road injury admissions for over 3 months beginning 1st day of June and August 31st, 2011. 176 persons admitted at KNH in Nairobi with traffic injuries were studied (Ogendi et al., 2013).The findings indicated that pedestrians had the highest proportion of admissions at 59.1%, followed by admissions from motor vehicles and passengers at 24.0% with matatu transport next at (35.5%). Most pedestrians occurred while crossing the road with (70%) being hit while crossing, 10.8% while standing and 8.1% while walking. Most pedestrian accidents were registered on Saturdays at 25.5% and Sundays at 16.7% with injuries commonly (67.7%) affecting the limbs (Ogendi et al., 2013).

The authors argued that the pedestrians safety be accorded priority in addressing road safety matters in the City of Nairobi.Planners of urban road safety should have adopted already existing cost effective interventions to improve the safety of pedestrians(Ogendi et al., 2013).These include extensive calming of traffic to limit the speed to 30km/hr permitted in towns for motor vehicles, provide pedestrians with sidewalks, calming of traffic in residential areas, pedestrian oriented and not car oriented designs, education and enforcement of road traffic regulations. Although Ogendi et al., (2013) addressed many concepts such as road infrastructure interventions which this study proposed to adopt as variables, they, left a gap in attitude of pedestrians towards implementation of pedestrian safety rules. In line with the methods used, they also used data collected from a health facility which gave the study a social context. The current study hoped to fill the gap left by integrating the interventions from a multidisciplinary context applying mixed mode approach. Sidewalks was discussed in Mitullah and Makajuma (2009) along Jogoo Road in a study whose aim was to detail the operating pedestrian safety conditions and purpose

to evaluate NMT corridor experience in a holistic manner. The study used manual counting techniques, survey on attitudes, sites pre-selected along Jogoo road and typical NMT operating environment captured at peak hours to establish the level of service for NMT along Jogoo road (Mitullah and Makajuma, 2009).

The study found a constrained road capacity and invasion of sidewalks by matatus which compromised pedestrian safety. Motorists over-speeding during off peak hours made it difficult for pedestrians to cross roads. Motorists using sidewalks during traffic congestion had further posed risk of accidents to pedestrians. Operating conditions for NMT on Jogoo road corridor were therefore not safe for road users inappropriate design and infrastructure was documented as causing the problems cited herein (Mitullah and Makajuma, 2009). The alternative methods tested to evaluate how NMT infrastructure performed had been proven and attitudinal survey results gave indications of consistent performance on some aspects(Mitullah and Makajuma, 2009). NMT therefore represented least-cost methods appropriate for transport planning practice in poor cities. Mitullah and Makajuma (2009) concentrated on the inadequacy of sidewalk in Nairobi but did not address other issues such as road safety awareness, knowledge and compliance to the traffic Act, education of children in the traffic parks. They also did not address enforcement of traffic laws by avoiding corruption by road users, avoiding sanctions and fines, behaving well on the road with or without police presence, considering the pedestrian age and gender besides attitude of pedestrians which this study has to addressed.

Emery, Crump, Bors (2003) study on how reliable and valid two instruments were, set to test how suitable sidewalks were for walkingin which professionals from public health hypothesized the suitability of walking conditions on the community environments and subsequent increase in activity level of community members. Evaluation for suitability was measured using indicators and instruments for assessment. The two instruments were found reliable and valid to assess sidewalks as suitable for walking (Sallis and Cuter,2003; Emery, Crump, and Bors, 2003). The methods used included two data collectors on 31 road segments using instruments for assessing suitability for walking and an additional, three transportation experts using a 7-point Likert response system on the same segment for subjective evaluation of the same. Reliability of the assessment instrument and that of the Likert response system was determined by Intra-class correlations. Pearson

correlations determined the criterion-related validity of the suitability measures for research staff with expert assessment. The results indicated that for the intra-class, correlations of r =.79 and .90, respectively were recorded for the walking assessment instruments. For the Intercoder reliability, Likert response system was r =.73 for the walking form an r =.77, while Pearson correlations for criterion-related validity was r= .58. for the walking assessment instruments. The study concluded that to systematically assess the physical environment, instruments for assessing suitability for walking were ideal for professionals and community members though some variables had low reliability and validity than expected(Sallis and Cutter,2003; Emery, Crump, and Bors, 2003). The current study needed to fill the gap by domesticating the findings in the Kenyan context and public education, enforcement, implement pedestrian safety rules to reduce fatalities and injuries affecting pedestrians.

In the City of Kisumu, Onyango, Olima and Onyango, (2012) conducted a study on infringement of sidewalks by street vendors in urban spaces meant for other uses. However, there was still little research on how street vending could be integrated in urban plans to avoid their infringing on sidewalks. The dynamics of street vending as a phenomenon in Kisumu Municipality was assessed. The objective was to examine the nature and patterns of street vending activities. Street vendors formed the target population in the Central Business District and the customers buying from street vendors and administrators within Kisumu municipality. Kisumu Municipality was purposively sampled. The owner of the street vending enterprise was selected using multistage procedure of sampling to participate in the study. The street vendors introduced their customers to participate and respond to the researcher's questionnaire. Content analysis was based on qualitative information collected from focus group discussions and interviews through creating themes, categories and patterns (Gray, et al., 2015). Quantitative data was analyzed using percentages, multinomial logistic regression and Pearson Chi square ($\chi 2$). Street vendors were found to station themselves at different locations including on pavements, near banks and business premises, hospitals, parks and any open space with high pedestrian activity conducive for selling different products. The locations were conducive based on accessibility, attractiveness, number of customers, competitors, allocation by municipality and original site where the vendor started off.

The study concluded that street vendors identified the locations where they vend on their own without any guideline. The sites occupied at random by vendors formed a haphazard pattern on the urban built environment which gave a disorganized impression of the streets. The study recommended that there was need to guide planning of street vending to integrate them in urban land use. The study was relevant to the current study because it addressed the infringement of sidewalks as a pedestrian facility for commercial purposes making it inadequate for pedestrian use, one of the concepts this study set out to address. The study is relevant to this study as pedestrians who are the customers of the street vendors form the target population in this current study. However, public education, enforcement of traffic laws, pedestrian age and gender, were not addressed, a gap this current study hoped to fill.

2.5 Enforcement of Traffic Laws and Implementation of Pedestrian Safety Rules

Enforcement of traffic laws entail ensuring that road users obey traffic laws and rules on urban roads as well as ensuring compliance with pedestrian rules. Corruption or bribery is to tender or accept an advantage to perform a duty (Traffic Focus, 2012). It also means abuse of power entrusted on an official for self-gain or failure to perform a duty when there appears to be no gain. Where there is low respect for the law, the level of corruption is high. Corruption results in increased risk and the entire roads transport system is unsafe (Traffic Act, 2012).

Corruption manifests itself with the action of officials who corruptly allow motorists to over speed or drive vehicles that are unroadworthy to continue driving with impunity, without care of the potential risk to other road users. When the integrity of the traffic officers are in question, the rate of lawlessness of road users increases. For instance, traffic and police officers in South Africa lacked integrity and were therefore corrupt (Arrive Alive, 2014). If road users failed to respect rules that govern road use, the roads remained unsafe. All road users, pedestrians included, should be aware that corruption is dangerous and not embrace corrupt behaviour. Corruption, however is not only realized in officials who, receive or benefit from but also from those who offer bribes as well (Traffic Focus, 2012).

Federal Highway Administration (2004) recommended promotion of pedestrian safety by reduction of aimless walking, over-speeding by motorists, ignoring road signals and rights of pedestrians as part of law enforcement (NJTPA,2011). Law enforcement relating to use of sidewalks specified that, a driver of a vehicle approaching or leaving a road, driveway or building was expected to give a pedestrian priority to use the sidewalk. Provision of sidewalks enhanced pedestrian safety while non provision required them to walk on the left side of the road facing traffic (Cornell, 2003). In this study, enforcement has been indicated by corruption, presence of police, sanctions and fines.

2.5.1 Corruption and Implementation of Pedestrian Safety Rules

Corruption, as cited by Davis,Lynn,Kaups and Parks, (2002) identified specific issues, such as educational campaigns that targeted population restraint use. Ethnicity had been reported by previous studies as the cause of disparities in restraint use. The aim of the study was to ascertain if ethnicity caused a restraint in motor vehicle use and if the said changed the presence of a primary or secondary restraint law (Davis, et al., 2002). The study used information from motor crash victims admitted to two level 1 trauma centers between 1997-1998 one from a primary restraint enforcement (motorist penalized for violating restraint) and secondary restraint law (enforcement of restraint violation) for subsequent violations. Data was obtained at the time of hospitalization and computerized in a registry database for trauma (Davis, et al., 2002).

The findings were that there was a significant difference between restraint use by victims of motor crash from both primary and secondary enforcement states (58% vs. 37%, $p<0.001$). In addition, the use of restraint use varied markedly by ethnicity in the secondary enforcement states (Caucasian, 42%; vs. African-American, 21%, and Hispanic, 26%, $p<0.02$, $\chi 2$). Comparing use of restraint between these two types of enforcement states (primary and secondary) revealed that all ethnic groups increased restraint use significantly ($p<0.01$) (Davis, et al., 2002). The study concluded that, in states that had secondary law enforcements, use of restraint differed by ethnicity but use of restraint increased markedly by primary enforcement law. Improved restraint use in motor vehicles through educational campaigns, enforcement and implementation of primary restrain laws was essential to target specific populations using mixed method approach, *ex post*

*facto*design, pragmatism, document analysis, multiple regression analysis which the current study has used(Davis, et al., 2002).

In the Kenyan context, Kipsosgei (2011) conducted a study to assess how operations in the passenger service were affected by 'new' regulations on road safety in Nairobi which also sought to establish the implementation and enforcement opportunities and challenges posed by the new regulations(Kipkosgei, 2011). The study design was cross sectional, descriptive and comparative with PSV operators sampled to take part in the study. Structured and unstructured questionnaire for owners of PSV, commuters, drivers and their conductors and traffic police, TLB, Ministry of Transport, Local Authority and Matatu Welfare Association as key informers were used as data collection instruments (Kipkosgei, 2011). The sample size included 120 PSV operators and data as processed and analyzed using SPSS. Descriptive statistics was used to analyze data and student test for hypothesis testing and presentation done using graphs, means, graphs and text in simple table comparisons. The study found significant changes in input and PSV output of [p=0.05], few changes were noted on the PSV drivers and conductors working conditions, transport service quality with improvement of implemented regulations and key regulation enforcers faced regulation enforcement challenges and two hypothesis stated in the null [Ho] rejected at P=0.05(Kipkosgei, 2011).The study concluded that the recently set regulations were good, but poorly implemented and enforced hence hindering success. For sustainability on regulations, the study recommended strict and consistent implementation and enforcement as necessary. Although this study discussed the vulnerability of passengers and how the new regulations affected them (Litman and Fitzryon, 2016) it did not address the pedestrian safety regulations, safe road users, safe vehicles, safe roads and safe speed coupled with public education, engineering, pedestrian demographic factors and mixed method approach gaps that this study has filled.

Although the traffic enforcement measures targeting drivers was also applicable to pedestrians the review did not specifically focus on them. However, driver enforcement effects were likely to benefit pedestrians as well (Martin, 2014). Concerning corruption, although enforcement allowed the performance of random tests in some countries, it was abused and amounted to corruption (Gwilliam, 2010).The outcome and not the procedure of drivers' daily inspection (reduced drunken driving) should therefore be the subject of

control .More importantly, the real issue has been how to protect pedestrians from motor vehicles and provide adequate zebra crossings and sidewalks(Gwilliam, 2010).However,this study finds that although providing facilities for pedestrians offered great protection potential, if not coupled with public education, enforcement it may not be the most ideal measure. No consideration is given for pedestrian demographic factors hence the need to integrate the moderating influence of attitude of pedestrians in the current study.

2.5.2 Presence of Traffic Police and Implementation of Pedestrian Safety Rules

Presence of police may influence implementation of pedestrian safety positively or negatively. Traffic police presence may be low in large parts of the city and alarmingly, finding witnesses after an accident may not be easy. The person that caused the accident may disappear quickly before the police appear , in which case the presence of police or the victim concerned may not be handy. In particular, this happens in case of an accident between motor vehicle and pedestrians. It is also common for a guilty driver to reach a settlement in atraffic injury where there is noserious damage to the vehicle. In this case the victim is paid some money and the the parties agree not to involve the police.

Presence of police as cited by Asingo&Mitullah (2014), on compliance with road safety measures report pedestrians often crossed the roads carelessly and that presence of police would improve observance of most basic traffic rules and giving way to motorists.Role of traffic police by Dumbaugh and Ewing, (2009) is likened to the presence of T-blocks and bollards as “sleeping policeman” in which they state that there is a high rate of vehicles damaged when they hit T-blocks and bollards and the number of drivers who do not manage to keep their vehicles on the road. They therefore argue that if the road furniture can prevent 10% of the damage to vehicles or prevent mishaps then the road furniture was a better intervention (Bech-Padrosa, 2010). The argument further states that incase the damage caused is related to failed brakes, negligent drivers or unroadworthy vehicles driven when drunk or on an unlit night then blocks and bollards served the purpose of a “sleeping police man” which contributed to enforcing the desired driver behaviour. This analogy by De Langen, (2005) describe engineering designs as sleeping policeman and silent teachers. To enhance traffic safety, the combined need for engineering, education and enforcement in African cities was a must. This means that engineering (implement

decisive traffic calming interventions) silent teachers (concrete, but very eloquent) and sleeping policemen (always there and fair) was necessary.

Accidents rarely occurred where police mounted traffic controls yet where development control was ineffective, unrestricted access to main roads unrestricted, the risk of collision increased (Gwilliam, 2002). This was due to the traffic mix by all road users motorized or non-motorized on road intersections where they were vulnerable to high speed differences. (Gwilliam, 2002). Traffic Management spells out that fatalities and injuries are majorly caused by over speeding, drunk driving and lack of protection of persons during accidents. There should be enforcement of systematic policies dealing with each at the national level and rigorous policies enforced at local level.

Accident severity would be effectively reduced by speed limits and controls. Physical traffic calming measures for speed control are road narrowing (pavement and raised zebra crossing), control of speed limits by traffic policeusing static or mobile camera, enforcement by radar guns and tracking vehicles (Gwilliam, 2002). Traffic speeds are reduced through calming of traffic whereby on main roads, road markings (zebra) emphasize speed limits, with colour and texture of the road applied on approaches to critical areas on the pedestrian crossings. Some calming measures on local roads may however aggravate accidents if introduced on main roads (Gwilliam, 2002).

2.5.3 Sanctions/Fines and Implementation of Pedestrian Safety Rules

Sanctions and fines as enforcement of traffic laws means making people obey the law or behave in a particular way. In a study, National Cooperative Highway Research Program (NCHRP) (2008) on effectiveness of Behavioural Highway Safety Counter Measures whose purpose was to assist states in selecting programmes, projects and activities that had the greatest potential for the reduction of highway death and injury. The objective of the study was to produce an application manual for behavioural counter measures, framework development and cost-benefit estimation guidance on emergent, untied, experimental and not yet proven behavioural road safety counter measures (TRB, 2013). The study used 104 practical counter measures as a guide to highway safety counter measurer's for state offices (NCHRP, 2008). Of these, 34 had been 'proven' effective and the countermeasures recommended to be implemented whenever feasible, practical and

politically acceptable. Many involved little direct costs either because the primary effort involved passage of a law.

Some proven counter measures when rated,involved direct costs for their implementation. Benefits cost calculations indicated that most countermeasures would produce a positive benefit cost ration for most states. Estimated effectiveness for 54 of the 104 counter measures was rated as unlikely, uncertain or unknown. Three countermeasures actually had been shown to have negative consequences. The study concluded that the countermeasures be avoided until full evidence was realized. In between the proven countermeasures and the unknown, uncertain, unlikely, there were 13 counter measures believed to work but for whichevaluation evidence was not yet available. Emerging and developing countermeasures were not yet fully implemented, yet all were evaluated. The classification scheme used to estimate the effectiveness of these measures included voluntary action (countermeasures that were designed to train, educate or request some behaviour), law or regulation (require the behaviour), law enforcement with high-visibility, sanctions and treatment of offenders.

The Traffic Act Cap 403 of 2013 and the Traffic Amendment Bill of 2014 spells the sanctions and fines for different offences committed by road users including pedestrians and motor vehicle drivers in Kenya. Among the sanctions and fines was that a person who contravened and committed a traffic offence would be liable to a fine or attend court in person or pay money in an approved money payment system. For driving on the pedestrian pavement or sidewalk, a penalty for a first offence is an imprisonment for less than three months, or pay a fine<30,000 and for 2ndoffence <6 months. For exceeding the speed limit, the Act specifies the range as follows 5 to 10kph as 10,000; 11-20 kph attracts a fine of 15,000, 21-30kph an amount of 20,000 and between 31 or more 25,000. These acts also provided for statutory penalties. The information stated in these legal documents were necessary for improving the level of knowledge of their content to road users, especially pedestrian road users and should be beefed up with other behavioural and engineering interventions to enhance pedestrian safety.

2.6 Demographic Factors and Implementation of Pedestrian Safety Rules

Pedestrian characteristics of age and gender are reviewed in this study including their influence on walking. Statter,Schuble,Todd,Harris-Rosado,Liu,Donald and Kyran, (2011) in their study, indicate that young pedestrians were major casualities of death, disability and hospitalization. To prevent and iron out this, it was necessary to identify that at- risk children and racial disparities as a cause of injury and fatality among children. Children from poor families residing in crowded urban areas were at more risk of injury as pedestrians(Statter et al., 2011). Prevention insights from the Geographic Information Systems (GIS) analysis cited child population density as well as median income as community factors of choice. Children younger than 16 years were identified, with the aid of a trauma registry e-code for pedestrian-vehicle collisions then specialized care during hospitalization at the University of Chicago Medical Center, a Level I pediatric trauma center, after motor vehicle accident covering the 2002 - 2009 period(Statter et al., 2011).

Demographic data and crash site details were collected using run sheets for retrospective chart and Emergency Medical Services review, using a block by block basis, crash sites were aggregated (Statter et al., 2011).An analysis of hot spots was then performed to localize clusters of injury events. Spatial clusters of varying confidence intervals using fixed hands of 400m distance were identified Gi* use of statistical method (~¼ mile). Maps generated from the census data of 2000 through GIS detailed evaluation of race, employment, income, how dense both private and public schools, and the number of children residing in the vicinity of the medical center labeled as crash sites was identified(Statter et al., 2011). Crash locations that were statistically significant were then identified using spatial correlation. The results showed that between 2002 to 2009, 3,521 admissions were registered for traumatic injuries at the University of Chicago Medical Center (Statter et al., 2011). Children who were injured in the pedestrian motor vehicle accidents accounted for 27.7% (974) of the total admission. 106 traumatic deaths were recorded, with about 29 (27.4%) causing accidents to pedestrians. Most accidents sites involving child pedestrians occurred in the poor dominated by, Afro-American neighborhoods (Statter et al., 2011).

Non-African-American high income neighborhoods' registered low observed prevalence of these crash sites. The study concluded that using GIS for spatial analysis associations in

crash sites involving child pedestrian motor collisions served by the child trauma centre were identified. The crash sites were more common in African-American neighborhoods'. The difference in prevalence rate was attributable to fewer children from the rich dominated, non-African-American neighborhoods, inclusive of people living in the immediate environs of the hospital(Statter et al., 2011). The volume patterns of traffic, as a cause of these events of injury, were not studied. This study addressed the road engineering aspect of inadequacy of sidewalks by children in a low income community; the current study proposes to integrate education, and enforcement, pedestrian demographic factors and attitude of pedestrians to implement pedestrian safety rules. Mixed method approach and pragmatism was expected to enable a proactive approach to the pedestrian problem.

In a pilot study, in the city of Glen Eira using the star rating system for pedestrian walking routes, Liu,Corben,Lorgan,Oxley,Corben and Gay, (2010) reported that child obesity was a public health issue of significant community concern and physical activity a key factor in arresting obesity levels. In the past few years, the frequency of children walking to school and back had markedly reduced while parental concern regarding the overall safety of their children had increased (Liu et al., 2010). The pilot study, in conjunction with Monash University Accident Research Centre (MUARC), had aimed overally at enhancing pedestrian safety among primary school-aged children, while also promoting more active travel. Four local primary schools within the city of Glen Eira were engaged in the trial with 97 ratings conducted by different rater types from the community (Liu et al., 2010).

The pilot study was aimed at enhancing pedestrian safety of young children in primary schools and to pilot the previously designed star-rating tool within realistic settings in the community (Gray, et al., 2015; Liu et al., 2010). The purpose was to design a star rating model and develop an assessment tool to provide a measure of safety at varying crossing locations. The objectives of the study were to engage four local primary schools in trial application of the star rating system, evaluate the functional performance of the star rating tool in determining the safety levels of selected crossings/subjection safety ratings by various rater types, identify variables at different crossing locations in practice that contribute to unacceptable lower safety levels, to assess the usability of the star-rating tool

and further identify opportunities for its application and to strengthen the current partnership between Caulfield Community Health. The star rating system was a practical simple tool to use that aims to produce objective information that can direct attention to pedestrian safety priorities and promote safe walking throughout communities.

The methodology included a star rating model designed to take into account five main factors, speed limit, average number of vehicles, width of road, number of directions whether formal crossing facility was provided for crossing maneuvers e.g. zebra crossing (Corben, Logan and Oxyley, 2008). The factors proved to be the main determinants of pedestrian safety as the link between them and accident risk was self-evident. They had the advantage of measures being collected by use of the rating system either during a site visit, or from relevant information provided by road authorities (Corben, Logan and Oxyley, 2008).

The design used was participant recruitment and study design with children / parents - general community as objective and professional opinions, subjective ratings. There were 24 crossing locations - six rating crossings x 4 schools. The data were collected from each school between the times 3.30pm until 4.00 pm. SPSS was used and objective star rating with both integers, continuous objective and star rating with potential for negative ratings to occur as 0, 1, 2, 3, 4, 5… 1.4, 0.88, 2.45, and 4.62. The star rating tool is, however,still in its initial pulling stages. The accuracy and sensitization of the model may require adjustment using two different conceptualizations of the objective star-rating accounts for the limitation but may contribute the best method for accurate interpretation(Corben,Logan and Oxyley,2008). Results showed functional performance of the star rating tool and correlation analysis performed to investigate the strength of the relationship between various combinations of objective and subjective star ratings. Means and standard deviations for objective and subjective star-ratings were computed and results further revealed that the mean integer-objective star rating was slightly lower than the mean continuous-objective star rating which suggested that the integer objective star rating may be a more conservative estimate of crossing safety levels overall. Past subjective star rating were slightly lower than the pre-subjective star rating which indicated a reduced estimate of safety after being introduced to the fewer crossing risk factors(Corben, Logan and Oxyley, 2008).

The correlation analysis by Corben, Logan and Oxyley, (2008) revealed a significantly large correlation between the pre-subjective rating and post-subjective star rating r = 0.88, p<0.01, two tailed, where 78% of the variance in the star ratings could be explained by raters being introduced to the five variables. A significant difference was realized using paired samples t-test between the star ratings if the pre-subjective star-rating group (M = 3.36, sd =1.34) compared to the past subjective star rating group (M = 3.10, sd = 1.35, t = (93) = 3.51, p<0.01, two-tailed (Corben, Logan and Oxyley, 2008). This study used concepts and methods proposed in this study but did not include pragmatism, *ex post facto* design, multiple regression analysis a gap filled by this study. Behaviour change factors affect implementation of pedestrian safety rules.

Walker (2004) reviewed the psychological factors that affect the safety of vulnerable road users and established that pedestrians cause of accidents were diverse but the two psychological factors were that drivers only expected to find motor vehicles at junctions and not pedestrians, developed a conditioned attention strategies of not paying attention to those parts of the road where vulnerable road users such as pedestrians tended to be present (Walker, 2004). Secondly, the vulnerable road users were not even aware of their own vulnerability and did not therefore care to protect themselves appropriately (Walker, 2004). The study found limited information on pedestrian demographic factors that wereaimed at improving their road safety. The study concluded that more research was needed on accidents involving pedestrians, bicyclist, and motor cyclists. VRUs included in this study were only pedestrians.

The method used included literature review, questionnaires and data analysis. Pedestrians are vulnerable as recipients' of injury rather than inflictors' of injury. In the European Union 17,000 of VRUs are killed each year at rates of 7000 pedestrians. VRUscontribute to a third of deaths on the road(Walker, 2004). The purpose was to review literature on the safety of VRUs whose objective was to to create road safety awareness to drivers, VRUs and traffic management professionals and remedy issues of concern effectively. Walker (2004) indicated that all psychological issues uniquely related to VRUs and their exclusion criteria to involve other factors such as excessive speed, alcohol and aggression not included. The reason of exclusion was that they were not psychologically oriented or

affected all road users' generally and not specific type of road user (Walker, 2004). The data analysis consisted of descriptive, epidemiological and correlations.

Human factors inbehavioural assessment of pedestrian vehicle accident was reviewed by Thomas et al., (2012) in pedestrian vehicle accidents were investigated in the Wellington Central Business District which focused on four areas namely crash analysis study, observational study, intervention phase and evaluation phase. The report whose objective was to explore how a number of explanatory factors affect performance factors to identify the correlation between safe and unsafe behaviour of pedestrians as well as implementation of interventions and countermeasures to effectively reduce unsafe pedestrian behaviour and injury (Thomas, et al., 2012). The method used naturalistic observation techniques, explanatory factors for demographic and individual differences, pedestrian activity and clothing, performance factors - gaps acceptance and conflict and looking and crossing behaviour. The study reviewed pedestrian-vehicle safety studies internationally using observational studies to inform the methodology and examine performance measures in relation to pedestrian distraction and vehicle visibility. Previously what was important in avoiding collisions in pedestrian maneuvers and decisions to cross was vehicle detection, motion detection and concurrent self-motion (Thomas et al., 2012).

In relation to pavement or road surfaces, the study found that the accuracy of motion detection of vehicles was affected by varied road surfaces(Thomas et al., 2012). Vehicle motion detection was more impaired in the situation of bitumen pavement with chromatic bands, a pavement with high optical flow densitycompared to other road surfaces such as bitumen or concrete without chromatic bands. The authors concluded that over-signalized road had motion detection risk implications, with careful considerations given to how many and what type of signals a road needed to create a safe environment(Thomas et al., 2012). There were individual differences in motion detections whereby, advanced detection skills was registered among females. The time required to detect vehicles accurately ,however, increased with age. Comparatively, males required less time to detect vehicles but the error rate also increased with age. Tom and Granie (2011) found further gender differences for gaze target when pedestrians crossed the road. The study found that whereas females focused their gaze on pedestrians, males focused their gaze on traffic.

Such differences between male and female pedestrians had implications for the accuracy of motion detection of vehicles (Thomas et al., 2012).

The methodology used was observational. It involved watching, exploratory footage and fixed site observations, video and CCTV observation method with observation measures and age divided broadly into three categories as follows the young of up to 25, average range of 25-65 and the old with 65 years and above, with gender divisions into females and males(Thomas et al., 2012). Site characteristics included engendering factors such as 3 width of the road, lane separation of lanes, heights of kerb, colour, street furniture, street furniture road environment. Alteration in behaviour recently may have been due to changes on speed zones, signage, use of colour, care taken when changing lanes from one to two ways as well as crossing, looking and compliance behaviour crossing characteristics (Thomas et al., 2012). For observational reliability, an inter-rater reliability on small sample of observations was done to check for consistent and accurate coding. Kappa statistics was used to measure reliability and presentations done in frequencies and percentages.

Exploratory and Chi square, discussion and recommendations on individual interventions, and typically safe crossings(Thomas et al., 2012). The 1386 crossings across four sites completed without a crash, 3.8% (n=53) of crossings had potential conflict, where both vehicle and pedestrian occupied the same space within 2-3 seconds of pedestrian leaving. The potential conflict rate increased by 2.8% (3.8% to 6.6%) (n=92) when following definition inclusive of conflict avoidance behavior (Thomas et al., 2012). The recommendations were that the relation between desired pedestrian behaviour versus social marketing safety campaign outcomes should be emphasized (Thomas et al., 2012). On social marketing/education intervention, negative attitudes towards crossing occurred when pedestrians potentially risked crossing the road regularly without injury. This promotes the advantages of high-effort, active looking and behaviour of waiting before crossing(Thomas et al., 2012).

2.6.1 Type of Gender as a Pedestrian Demographic Factor

Gender as a demographic factor may influence the safety of pedestrian as discussed by Holland and Hill (2007) on age, gender and driver status to investigate their influence on

pedestrian behaviour when crossing risky roads using questionnaires and which indicated that intention to cross decreased with age. Younger adults, with men having positive attitude than women were more careful when crossing risky roads. The study confirmed thatthe aged were keen on safe crossing than younger people though the limitation of the study had stated that intending to cross and actually crossing are different behaviour (NJTPA, 2011). The study reviewed suggested that interventions should target groups and what the groups identify as most effective ways of communicating written and multimedia road safety messages (NJTPA, 2011).

The study by Ozanne-Smith (2004) indicated heightening attention paid to Road Traffic Injury (RTI) by Australian and New Zealand Journal of Public Health (ANZJPH) which investigated the relevance of age and behaviour to less developed world where the highest percentage (90%) of Road traffic deaths occurred (Plumert, Kearney, Cremer, 2004). The review involved ANZJPH articles published over 5 years (1999-2004), which met WHO definition of RTI. From the eight selected studies a variety of research and evaluation methods were used to focus on young drivers, alcohol use and indigenous Australians. Risk factors identified revealed widespread driving behaviour by the young and alcohol consuption involvement. Intervention success legislative change with regard to utility passengers, updated certificates of effects related to the New Zealand's 1992 Transport Act (Scot, 2010). The study, however, targeted only demographic factors affecting drivers as the main cause of accidents and did not address demographic factors of age and gender affecting pedestrians on urban roads hence the gap this study has filled.

The conclusion was a drastic and continuous reduction in Australians road toll- based on scientific research (Ozanne-Smith, 2004). Road Traffic Injury (RTI) was based on Australian public health agenda, aimed at World Health Organization's five-year strategy worth emulating by less developed areas (Plumert, Kearney, Cremer, 2004). The implications were that developed countries such as Australia and New Zealand had knowledge, expertise and the responsibility to assist poor countries to curb the growth of RTI that came alongside rapid motorization(Ozanne-Smith, 2004). This study proposes to incorporate the success of this best practice for implementation of pedestrian safety rules in the City of Kisumu.

Muller and Riener, (2011) cited conventional street lighting systems as being wasted in areas with low pedestrian activity. The efficiency of flexible lighting technology made lighting in streets became a reality.The study aimed at describing the Smart Street Lighting (SSL) system, as a fulfillment of the flexible public lighting systems. In the methodology, the SSL system was presented on pedestrians 'locations and desired safety zones as ideal for a dynamic switching of street lamps(Muller and Riener, 2011).Using a Smartphone, each pedestrian was localized and the information sent to an SSL server. To control the street lamp, each lamp post had a Zig Bee-based radio device and multi-hop routing that received control information from the SSL server.

The findings confirmed the proposed SSL system when applied had a high probability of improving street lighting, especially in peri-urban areas with low pedestrian activity (Müllner, and Riener, 2011). Broad use of the SSL was important in reducing the emission of CO_2 when lampposts were switched off when not in use(Muller and Riener, 2011).Research implications and limitations was that it discussed implementation of SSL in details and presented the outcome of the application on a small scale. Experiments revealinterruption of wireless communication by trees in between lampposts. The detection of an inaccurately positioned global system would result in unexpected lighting effects(Muller and Riener, 2011).The originality and value of the study is its introduction as an SSL framework, with a system of street lamp switching which is reliable, fast and saves energy saving depending on location of pedestrian and safety needs. A standard smart phone capability was used to define safety zone and estimate location and recommendations for solving pertinent issues discussed(Muller and Riener, 2011).

2.6.2 PedestrianEducation Level as a demographic factor

Pedestrian education level as a demographic factor determined how a pedestrian used the road. Pedestrians were a group of road users who only needed their feet rather than education to walk. However, pedestrian education levels could determine their use of the road or road crossing behaviour. Safety education for pedestrian injury prevention was cited by Dupperex, Roberts and Bunn, (2002) whose objective was on how effective pedestrian'sfrom diverse age groups were used in randomized controlled trials to systematically review safety education programmes. The study identified how pedestrian safety education was affected by behaviour, attitude injuries, knowledge andmotor-vehicle

collisions(Dupperex, Roberts and Bunn, 2002). The quality of trials included methods of randomization and numbers lost during follow up as the main outcome measures (Reading, 2002). 14 out of 15 randomized controlled trials based on safety education focused on child pedestrianswhile one trial focused on institutionalized adults (Reading, 2002).

Although six trials discussed how safety education affected behavior, none of the studies focused on its occurrence on pedestrianinjury, there was however variation in studies and outcomes(Dupperex, Roberts and Bunn, 2002).The study concluded that educating pedestrians could alter their observed crossing behaviour, as to how sustainable this would eventually be contribute in reducing the risk of pedestrian injury during a road traffic crash was unknown (Kipkosgei, 2011). There was no indication that safety education for adults was effective. The trials were, however not done in countries with average and below average incomes (Dupperex, Roberts and Bunn, 2002). Although the study was carried out in a developed world context in relation to age and engineering, it left a gap on elderly pedestrians and did not integrate enforcement, public education and attitude of pedestrians as done by the current study.

2.6.3 Attitude of Pedestrians on Road Infrastructure Interventions and Implementation of Pedestrian Safety Rules

Attitude of pedestrians is indicated by behaviour of pedestrians towards the use of the road. Attitude as a term has numerous definitions depending on the author. To some, it referred to a varying trait that predisposed them to display certain behaviour with respect to the attitude object (Gakuu, 2006).Attitude means a mental state of readiness, organized through experiences compelling an individual to respond in a particular way to a related object or situation. Attitude is also a person's favourable and unfavourable evaluation; feelings and tendencies towards an object or idea. Attitude as an enduring disposition requires one to consistently respond to various aspects of the world in a given way (Gakuu, 2006). It was difficult to change attitude since it varied with the frame of mind from liking to disliking of things, moving towards or away from things. A person's attitude fitted into a pattern hence was difficult to change.

Attitude has three components, cognitive, affective and behavioural. The third component, the behavioural component was identified byLiaw,Huan and Chen (2007) as a predisposition to action, such as using or buying the object of attitude. Attitudes therefore involved what people thought about, felt and how they chose to behave towards an object (Liaw,Huan and Chen,2007). They were inferred from what a person said about an attitude object, from the way they behaved. It was, however, important to note that, sometimes, behaviour was not only determined by what people liked to do, but also what they thought they should do, that was, the social norms, their habits, and by the expected consequences of the behaviour (Liaw,Huan and Chen,2007). Of the three components of attitude, the behavioural component which referred to the intentions and behavioural expectations was taken into account in the preparation of the attitude scale to measure attitude of pedestrians along and across the road. Attitudes were, however, complex and difficult to measure, because people changed their minds. In this study, what was important was how attitude could be represented and measured. Measuring attitude and their relationships in this study was complex and delicate. This study was concerned with measurement of attitude of pedestrians as a moderating variable between road infrastructure interventions and implementation of pedestrian safety rules.

Attitude could be measured through questionnaires based on thoughts, feelings and actions towards the attitude and quantitative techniques where opinions were represented by numerical scores. A particular test item or other behaviour indicated an attitude had the same meaning for all respondents so that a given response was scored identically for everyone who made it. It could also be measured as a typical questionnaire where respondents were asked to indicate whether they agreed or disagreed with each of a series of belief statements about an attitude object (Timperio, 2004). Finally, those attitudes were arranged along an evaluative continuum ranging from favourable to unfavourable. This study used a Likert scale which was quantitative, continuous and interval scaled to measure the moderating influence of attitude of pedestrians on the relationship between road infrastructure interventions on implementation of pedestrian safety rules. With the Likert scale, the respondents placed themselves on an attitude continuum. A person's score could be summed up and the resulting total used as an index of that person's attitude. A researcher could tell a good item (i.e. one that measured an underlying attitude) from a bad one (one that did not) by correlating each item with the total. Attitude of pedestrians

as behaviour of pedestrian along or across the road was cited by Rosenbloom, (2009) in Tel Aviv in a study on effect of subject Norms/Group pressure in pedestrian crossing behaviour whose objective was to investigate pedestrian behaviour in crosswalks at traffic lights, which found that age was not considered as a factor when male pedestrians tended to cross faster at red light signal than female pedestrians (NJTPA, 2011).Power of groups and cultural norms positively influenced pedestrian behaviour.

The study recommended that other pedestrians present and waiting to cross at red light signal suggested power of groups and cultural norms thus subjective norms were relevant to behaviour change process and effect of social norms (factors) to be explored further) (NJTPA, 2011). Although the study addressed concepts such as gender and attitude of pedestrians measured by their road crossing behaviour, it did not capture the variables education, engineering and enforcement which the current study integrated. Besides, other methods other than observation to collect information were not addressed and attitude of pedestrians was not treated as a moderator variable, a gap that this study filled.

Kim,Made and Yamashita (2008) study on characteristics of pedestrian and driver at fault behaviour 1 in Hawai, an accident crash database recorded between 2002 to 2005 was used with predictor model to describe pedestrian-motorist faults in accidents to analyse and compare their behaviours at fault and singled out factors that result in death and injuries. It emerged that drivers were 126 times more likely to be at fault than pedestrians. Likewise, more male drivers (66%) than female drivers and more male pedestrians (69.5%) than female were at - fault in accidents.

The study found inattentionas a main human causal factor and men were 1.2 times more vulnerable to serious injuries than women (NJTPA, 2011). The driver fault model addressed specifically men, morning hours, intersections and business districts as being strongly correlated with at-fault motorist.The study concluded that there was need to focus on identifying and and changing driver behaviour since drivers were more often to blame in crashes than pedestrians. Enforcement on jaywalking was important as it reinforced safe pedestrian behavior.It was recommended that a more valuable address to the issue of motorist at fault would determine where to focus enforcement and education

efforts. This study,however, did not address the variables such as education, and method such as multiple regression analysis as addressed in this study.

The use of an automatic pedestrian crossing detection device and smart lighting system was highlighted by Nambisan,Shashi,Srinivas,Pulugurtha,Vasuderan,Dangeti and Virupaksha (2009) whose objective was toevaluate the effectiveness of the automatic pedestrian detection device and smart lighting system in improving pedestrian safety at a midblock crossing on an arterial in the Las Vegas Metropolitan area. The methodology entailed field observations conducted before and after, first with no crosswalk, then after installation of a crosswalk which did not improve pedestrian behaviour and safety on its own. The findings revealed that, after installing the automatic detection system for presence of pedestrian and subsequently brighten the crosswalk with high intensity lights, the observed number of pedestrians crossing at the improved site increased from 44-84 thus few pedestrians jay walked hence improved use of the facility.There was a reduction in the number of pedestrians trapped in the crosswalk and motorist yielding increased from from 22 to 35% (Nambisan,2009). The study combined engineering, enforcement and attitude of pedestrians but did not address public education on implementation of pedestrian safety rules. It neither tested hypotheses nor used *expost facto* design which the current study adopted.

On pedestrian crossing behaviour, Jeng and Fallat, (2003) in a study on how crosswalks on affected transit users road using behaviour with the objective of investigating solutions to pedestrian accessibility around bus stops on route 9 in two Counties, Mommouth and Middlesex, NewJersey. The study used methods such as literature review, field observations, on site survey, lab study (videos and photographs) to assess drivers' view of unexpected risk at a pedestrian crossings and research hypotheses which posited that crosswalks influenced the level of comfort of pedestrians therefore they dared to cross at marked crosswalks. The conclusions, from field observations, were that pedestrian education on a variety ofsigns and safety designs was important since many pedestrians did not know what the flash-do-not-walk interval meant. This was thus negative attitude to implementation of pedestrian safety rules.

The study found that majority of bus transit riders would cross one direction of route 9, wait and walk in the median and then wait for a gap to cross other direction of the highway. Fewer pedestrians used the nearby sign to cross but even those who did avoided the push button or followed indications of the pedestrian signal. The study showed how behaviour could be used to measure attitude of pedestrians while crossing the road.In comparison, the current study hoped to use attitude of pedestrians as a moderating variable on the relationship between road infrastructure interventions, the independent variables, and the implementation of pedestrian safety rules, the dependent variables.

Crosswalk use, behaviour change and pedestrian safety campaigns, was discussed by Boyce and Geller (2000) in a study on community-wide intervention to improve pedestrian safety which gave guidelines for institutionalizing large-scale change in behaviour. They used a long term A-B-A reversal design follow-up to evaluate the programs commitment and incentive across the community for pedestrian safety improvement (Boyce and Geller, 2000). In the campaign, signing of promise cards wasencouraged for college community residents who crossed campus roads and yielded to pedestrians on crosswalkswhen driving.

Use of crosswalk increased during a 6-week intervention period to 68% (n = 1,718) from a baseline mean of 58%(n= 2,038). The driver-yielding behaviour significantly increased throughout the study, from a baseline mean of 23% (n = 979) to amean of 44% (n = 272) for 2 weeks after the removal of intervention materials and termination of publicity. Observations on use of crosswalk and yielding behaviour 1 year after intervention was initiated which revealed a crosswalk use return to near baseline levels of (61%, n = 1,954),while driver-yielding behavior remained high at(53%, n = 602),thus being substantially above the baseline. The study recommended institutionalizing pedestriansafety campaigns (Boyce and Geller, 2000). The concepts crosswalks, change of behaviour and pedestrian safety campaigns were similar to pedestrian facilities, attitude and road safety awareness addressed in this study. The study,however, did not include enforcement of traffic laws and pedestrian demographic factors which therefore created a conceptual gap in this study.

Boyce and Geller (2000) also used baseline survey to do a pre and post 6 week intervention, observation as data collection tools. Data was presented in frequencies and percentages. The current study hoped to use questionnaire, interview schedule, and document analysis besides observation methods. The study therefore created gaps for methodological issues not addressed in this study such as pragmatism, e*x post facto* design and multiple regression analysis.

Easter Seals Project Action (2006) designed a toolkit for the assessment of bus stop accessibility and safety whose objective was to target transit agencies and public works/engineering departments who design and place bus stop design and placement, promotion of partnerships and coordinate bus drivers and planners and to implement universal design best practices in bus transit systems. The methodology included a bus stop checklist containing issues related to pedestrian access, safety, security features, and guidelines for creating safe and accessible bus stops (NJTPA, 2011). The study, however, did not address enforcement of traffic laws and did not use document analysis, questionnaire and interview guide which this study included in a safe systems approach.

Attitudes of pedestrian towards the use of the road was cited in the Republic of South Africa (2008) Draft National Non-Motorized Transport policy, which stated that walking was such a simple human activity but had been frequently ignored in a bid to provide advanced transportation systems (Republic of South Africa, 2008).The policy stated further that pedestrians now wanted a change that would lead to living in asafe, enjoyable and welcoming place. Thepolicy further elaborated that the pedestrian wanted livable areas where they could walk, recreate, and socialize. Therefore, a positive or negative attitude while using the road could influence implementation of pedestrian safety rules.

Walking had provided environmental benefits such as: breathing fresh air, using non fossil fuels, health benefits and used less land space over other modes of transport. The benefits of walking were realized through construction of pedestrian facilities that was in line with environmental sustainability and protection. This presented a positive attitude towards proper use of the road. The draft further explained that walking was considered the cheapest least space consuming and the most economical means of transport for short distances. Factors that discouraged walking included:geographic conditions such as

freeways, roads with high volume and restricting the movement of road users especially where safe crossing points are limited. This was a negative attitude towards road use.However, the draft policy had not been legally enforced, hence the need to incorporate enforcement of traffic laws in the City of Kisumu as one of its variables.

In aiming to understand drivers'views of three drawn from different categories namely private car drivers, Public Service Vehicle (PSV) drivers and truck drivers on fatigue and its management on Kenyan roads, Munala and Maina (2010) reported that their opinions were an indicator of how serious the problem was and the need to put immediate management measures in place. Using empirical and exploratory field survey design, the target population comprised passengers and drivers as the primary consumers of road transport with the justification that drivers were active road users as part of its methodology.

The study also used convenience/accidental choice based sampling under non-probability sampling design. At each location, convenience sampling of interviewees was done on the basis of ease of location and availability (Munala and Maina, 2010). Purposive sampling/judgment sampling was further used to get strategic informants with detailed information of central significance to the study. From this sample size, 100 respondents were private car drivers, 115 PSV drivers and 100 truck drivers who were administered with questionnaires (Munala and Maina, 2010).Out of these, 87 respondents were private car owners, 110 PSV drivers and 85 truck drivers;a response rate of 89% was realized (Munala and Maina, 2010). Data collection instruments used included self-administered questionnaires, participant observation, semi-structuredand unstructured interviews.

The data collection procedure justified the choice of Mombasa road which was a class A road (A109) as ideal. The total distance of the road was 467km. Mombasa road was among the busiest roads which connected Kenya's seaport to the capital city of Nairobi. It was a transport artery and principal access sea port to the hinterland of the East African, Southern Sudan and Northern Tanzania regions and countries (Munala and Maina, 2010). The data were collected between October 2008 and January 2009 on Mombasa road, Voi and Mombasa from 6 am to 6pm on 26th at each location for three consecutive days. For security reasons night time was avoided (Munala and Maina, 2010).Data analysis included

descriptive andcross tabulation statistics developed to draw initial insights and later translate into various graphs for display.

The study found that fatigue of drivers was responsible for fatalities and injuries to other road users including pedestrians (Munala and Maina 2010). This study was reviewed to understand why drivers caused fatalities and injuries to other road users especially pedestrians. The concepts and detailed methodology used in the study were replicated in line with the safe systems approach theory adopted by this study. The study, however, only focused on opinions of drivers and the need to manage road safety from a driver's perspective. The study did not capture concepts such as public education, enforcement, demographic factors and attitude of pedestrians and methods such as mixed methods research, *expost facto* design, and multiple regression analysis as captured in this study.

In the same vein, De Langen, Opiyo and Tembele (2001) on attitude of pedestrians indicated that the main price to be paid for safe urban roads was a change in attitude and the preparedness to give priority to another road user. Drivers' attitude to safe urban roads was negative. They drove at their own discretion outside the road or parking areas and speeded as they liked. This led to poor traffic behaviour and enforcement and faulty traffic rules.

Attitude of pedestrians was also critical to the successful implementation of pedestrian safety rules. Attitude depended on level of motivation or demotivation of pedestrians, level of familiarity with urban roads, experience while using the road, familiarity with specific pedestrian safety interventions at hand or how it was implemented and its logistics and level of pedestrian involvement. There may have been a positive link in attitude of pedestrians and implementation of pedestrian safety rules. However, pedestrian concerns and needs about implementation of pedestrian safety rules were found to be universal, irrespective of age, gender, education, type of road and geographical location. A pedestrian may thus have held either a positive or negative attitude towards implementation of pedestrian safety rules in this study.

2.7 Theoretical Framework

This study was anchored on three theories namely theSafe systems approach theory, risk homeostatic theory and Grey theory as explained in the following subsequent sub-themes.

2.7.1 The Safe Systems Approach Theory

The dependent variable in this study was implementation of pedestrian safety rules. The safe systems theory was therefore examined since road crashes were manifestations of systemic failures and safety on the road worked well as a system. The proponents of the safe systems approach theory included Wegman and Elsenaar (1997) in the Netherlands, Tingvall and Haworth (1999, 2003) in Sweden and the Australian Transport Council (2004). The safe systems theory which aimed at eliminating death and serious injury from the road transport system through vision zero on road fatalities required a system designed to anticipate and accept human fault. The safe road system aimed to create a forgiving road system based on four principles which were, that road users made errors, were vulnerable, shared responsibility to reinforce all parts of the system, and to promote both ethical and societalvalues in road safety (Hall, 2011). The proponents further asserted that the solution to the problem of road crashes lay in another part of the same system. They concluded that a safe road system was greater than the sum of its parts (Safer Journeys, 2012; WHO, 2013; iRAP 2013; OECD, 2008).The safe systems approach theory had been used successfully in Sweden with vision Zero, in Netherlands with sustainable safety approach and Australia Transport Council which underpinnned the development of National Road safety from 2011 to 2020.This study adopted the safe systems approach to address the problem of implementation of pedestrian safety rulesin the city of Kisumu.

In the event of a crash, the safe system approach theory ensured that impact energies remained below the threshholds that would otherwise result in accidents. This threshhold varied with crash scenario, depending upon the level of protection offered to road users involved. Such was the case when survival chances of a pedestrian hit by a vehicle at a speed of more than 30km/hr and a restrained motor vehicle occupant at 50km/hr were greatly reduced.Speed as an important factor in implementation of pedestrian safety rules in the City of Kisumu was investigated in this study.

Road user interventions, risk related factors, vehicles and the road environment was addressed in an intergrated safe systems approach as effective preventive measures adopted in this study(OECD, 2008; Belin, 2012; Stigson,Krafft and Tingvall, 2008; WHO, 2013*)*. The safe systems approach had been found appropriate and effective in many settings globally. At times,this facilitated success in road safety where further progress had been a challenge (Mooren, 2010; WHO, 2013). Globally, over 50 countries had embraced the safe systems approach through the iRAP model (iRAP Kenya, 2009). The theory had been used successfully in Sweden with vision zero, Netherlands with sustainable safety approach and Australia Transport Council of 2004 which had initiated the development of national road safety from 2011 to 2020. This thesis included the safe systems approach theory and model in the theoretical framework and data collection instrument.

As a framework, the safe systems approach benefitted pedestrians by including examination of a range of risk factors to acess what exposed pedestrians to risk such as vehicle speed, poor road design, and inadequate enforcement of traffic laws and regulations. It also moved pedestrian safety research away from a narrow focus on a single or a few risk factors to a broader more integrated focus (WHO, 2013).Integrating a comprehensive approach would require road infrastructure, vehicle design and trafficcontrols like speedlimits, and enforcement of traffic laws and regulations - the focus areas that comprised the safe system approach (WHO, 2013). Through this, the variables in this thesis investigated the implementation of pedestrian safety rules moderated by the attitude of pedestrians.

Adopting assimilation of lessons learned, the safe system approach provided a basis forlow-and middle-income countries to avoid mistakes that were made by number developed countries where roads were designed for sole use by motor vehicles with no regard for the needs of pedestrians (WHO, 2013). Some progress in addressing the neglect of pedestrians in road design had been observed in China and India (Zegeer and Bushell, 2011, WHO, 2013) in collaboration with partners this however was not the case in the City of Kisumu. Collaboration which took the form of sharing responsibilities or activities to enhance implementation of pedestrian safety rules was part of the benefits that a city like Kisumu required. This collaboration was applicable to this study as it hoped to integrate

all road users including educators, engineers, and law enforcement officers in enhancing implementation of pedestrian safety rules. This thesis was anchored on the safe systems theory so that safe roads, safe vehicle, safe speed and safe road users, all the variables addressed in this study were investigated in relation to implementation of pedestrian safety rules. This was the gap the thesis had hoped to fill.

2.7.2 Grey System Theory

This thesis was also anchored on Deng Julong's (1982) Grey systems theory. The theory studied the analyzing, modeling, forecasting, decision making and controlling problems of grey system. The purpose of road accidents forecasting was to analyze the tendency of road accidents under existing road traffic conditions, evaluate the feasibility and practical effectiveness of road safety measures reasonably, control the factors affecting road accidents and reduce the traffic accidents. The characteristics such as nonlinearity, randomness and uncertainty in traffic systems made it difficult to forecast road accidents, the behavioural feature of traffic systems. Grey systems theory was simple and needed less original data to discover the rule and mode as well as good precision and reliability (Li and Wang, 2012). This theory was applied in this study since the aim of grey systems theory and its application was to bridge the gap existing between social science and natural science. The theory was also interdisciplinary, since it cut across a variety of specialized fields. The concepts of grey system, its theory and successful application in various fields had stood the test of time since 1982 (De Julong, 1982; 1989). In this study, therefore, road infrastructure risk reduction interventions that influenced road accidents such as adequacy of sidewalks were complex but had to be moderated by attitude of pedestrians to enhance the implementation of pedestrian safety rules.

2.7.3 Risk Homeostasis Theory

This study adopted the risk homeostasis theory as proposed by Wilde (1982; 1988; 1994), which asserted that individuals made decisions on whether to engage in specific behaviours or activities by weighing the relative utility of an action against its perceived risk (Wilde, 1982; 1988; 1994). While all actions involved some risk, risk homeostasis theory asserted that individuals would adjust their behaviour to maintain a static level of exposure to perceived hazard or harm. With respect to driving behaviour, risk homeostasis theory posited that drivers intuitively balanced the relative benefits of travelling at higher

speeds or engaging in other risky behaviour against their individual perceptions of how hazardous engaging in such behaviour might be. Where hazards were present and visible, risk homeostatis theory expected drivers to compensate for this perceived environmental hazard by adjusting behaviour to minimize their exposure to risk (Dumbaugh, 2005).

This theory was applicable to this study because drivers, the main force behind control of vehicles were responsible for the speed at which vehicles moved and were therefore the cause of pedestrian fatality or severe injury if they surpassed the design speeds of more than 30km/hr allowed on urban roads. Pedestrians' therefore risked death and severe injury with any speed limit of more than 10km/hr.The pedestrian walking speed was also averagely slow about 1.1m/s.This was far below the speed of motor vehicles thus a driver had a duty to responsibly share the road space with pedestrians by being conscious of their presence while driving to avoid causing accidents. Speed, driver and pedestrian behaviour on the road and roadsides were sub- variables in this study relevant to this theory. The other sub variable namely zebra crossing and type of pavement aimed at speed reduction for road users, and in line with the safe systems theory of safe speeds hoped to address implementation ofpedestrian safety rules in this study.

2.7.4 Summary of Theories

The three theories had a strong bearing to this study as summarized in Table. 2.1 The behavioural features of the road transport systems covered the attitude of pedestrians discussed in this study as a moderating variable.

Table 2.1: Summary of Behavioural and Engineering InterventionTheories

Theory	Arguments	Application to the study
Safe systems approach theory	Proper planning and implementation of road infrastructure interventions required safe roads, safevehicles, safe speed and safe road users to enhance pedestrian safety and walking as a mode of transport.	Road crashes were system failures, all parts of the system should function well for the good of the road transport system.
Risk Homeostatis theory	Drivers needed to be alert and conscious of the surrounding to accommodate other road users	Drivers were critical in pedestrian safety as vehicle operators and speed controllers. Safe vehicles and safe speed were key factors in pedestrian safety. Pedestrian fatalities and injuries could be avoided.
Grey systems theory	Addressed the nonlinearity, randomness and uncertainty associated with road accidents and helped prevent pedestrian accidents.	Was simple to use and used previous data in line with iRAP model and e*x post facto* design.

2.8 Conceptual Framework

In this study, the conceptual framework was used as a model to illustrate the interrelationship of concepts under investigation. The concepts, constructed into variables, were based on the objectives to maintain the study focus. The independent variable in this study was road infrastructure interventions, attitude of pedestrians was the moderating variablewhile implementation of pedestrian safety rules, the dependent variable.The model centered on the interrelationship between public education indicated by road safety awareness, children's traffic park and the Traffic Act, road engineering design indicated by adequacy of pedestrian facilities of sidewalks, zebra crossing and pavements. Enforcement of traffic laws was indicated by corruption, presence of police, sanctions and fines. The moderating variable namely attitude of pedestrians, was indicated by pedestrian behaviour along and across the road, as illustrated in the schematic diagram presented in Figure 1.

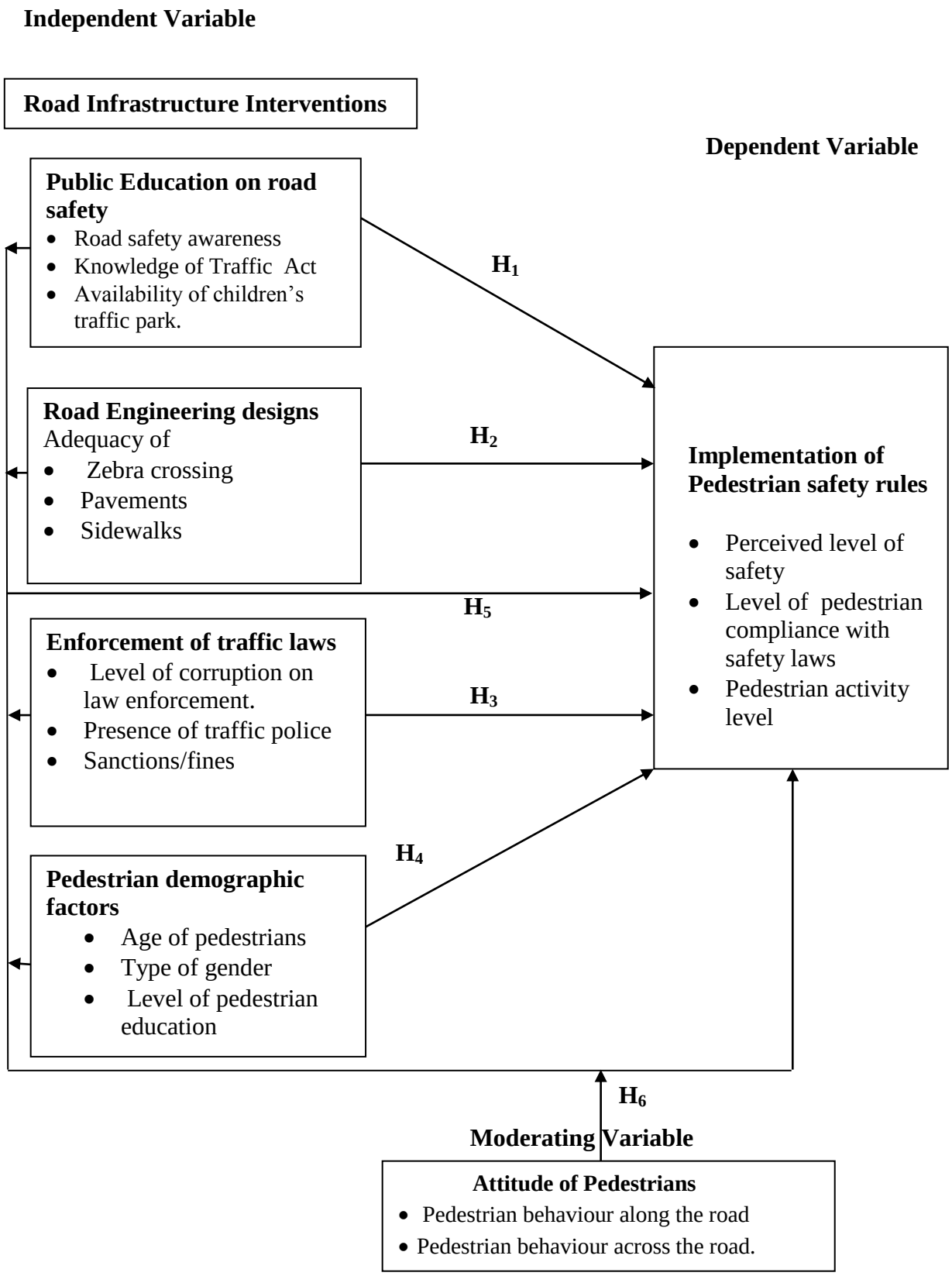


Figure 1. A Conceptual framework on the influence of attitude of pedestrians on the relationship between road infrastructure interventions and implementation of pedestrian safety rules (Source,2016).

The conceptual framework posits that road infrastructure interventions may have influenced implementation of pedestrian safety rules moderated by attitude of pedestrians. The moderator variable was indicated by pedestrian behaviour along and across the road.The conceptual framework was therefore linked to the independent variable which wasroad infrastructure interventions. These were constructed as public education, engineering, enforcement and demographic factors to implementation of pedestrian safety rules which was the dependent variable indicated by perceived level of safety, level of pedestrian activity and level of compliance to traffic laws. The conceptual framework outlined the input, process and output on the whole investigation. The input was drawn from the background and literature review and included the statement of the problem, objectives, research questions, and the process whichincluded the methods on how the problem was to be resolved and the output envisaged as the result- an improvement on implementation of pedestrian safety rules as an outcome variable (Wakhungu, 2008).

2.9 Summary of Research Gaps

The study was guided by the knowledge gaps as follows

Table 2.2: Showing Gaps in Knowledge from the Literature review

Author and year	Focus of the study	Methodology	Findings	Gaps in Knowledge	Focus of the current study
			Public Education on road safety and implementation of Pedestrian Safety rules		
Aligula E, Gariy A, Mutua J, Owegi F. Osengo and Olela (2005)	Urban public transport pattern in Kenya road safety status policy issues and challenges in towns and cities	A policy report by Kenya Institute for Public Policy Report and Analysis (KIPPRA) using Conceptual and analytical framework, Household travel survey, Travel census survey, Travel cost data survey, Travel vehicle operating crew survey, Government officials and key informant survey to provide quality public policy advice	The transport pattern, road safety status policy issues and challenges addressed only applied to other road users not pedestrians. The most important yet most overlooked mode of travel was walking. Pedestrian issues if well provided provide access to shopping facilities, schools and work. Walking caters for the urban poor who cannot afford other modes. Non motorized transport policy not implemented	Although the studies raised issues on some similar concepts and method it did not use star rating of roads, Ex post facto design, multiple regression analysis to measure association. Pedestrians not captured as target population. No policy as yet covers non motorized transport in Kenya. Few aspects of the traffic Act directly targets pedestrians	Testing the influence of public education in respect to knowledge of traffic act on implementation of pedestrian safety
Martin (2006)	A review of factors influencing pedestrian safety: to identify the problems ,evaluate potential solutions and apply suitable measures to the pedestrian behaviour on the streets *vis a vis* pedestrian safety in London	Literature searches from TRL knowledge Base on transport Research Abstracting and Cataloguing system (TRACS,ITRD,PROJEX),Researchers in the field of pedestrian safety,Video observations,Self report data, Surveys, Qualitative interviews and Focus Group Discussion	There were no simple universal solutions that would reduce pedestrian causalities in London due to large number of pedestrians and high traffic flows on London roads .Strategic level and hierarchical approach based on hot spots, systematically aimed at improving pedestrian safety. Recommendations aimed at enhancement of pedestrian crossing, suitable use of residential areas, shopping areas, outside schools, historic areas with high pedestrian and vehicle usage and mixed priority routes.	The study addressed the concept of implementing pedestrian safety from a developed world context in the city of London. The study discussed attitude of pedestrians but did not use it to moderate the relationship between the variables under investigation. The study did not use mixed method, pragmatism and ex post facto design	The moderating influence of attitude of pedestrians on the relationship between public education on implementation of pedestrian safety

Devito(2006)	The Highway Traffic Act of Toronto Canada on pedestrian and driver liability in the event of a collision in recent times	Basic assumptions-pedestrians acted rationally and reasonably, followed traffic rules, interviews and photographs of accidents	Pedestrians at their peril, believed that they had an absolute right of way when they sought to cross or in some other way, engaged upon a roadway. When pedestrians did not observe due care for their own safety not to mention the safety of others, the courts had not hesitated to find them either completely or partly responsible for the collision or injuries that resulted.	Although the study focused on public educations knowledge of the traffic it did not address road safety awareness, children's traffic park. It did not also address variables under road engineering designs, corruption on law enforcement, and pedestrian demographic factors moderated by attitude of pedestrians	Testing the level of road safety awareness on implementation of pedestrian safety
Pukose (2007)	Outcome of effects of new road traffic rules and regulations on the incidence and severity of passenger service vehicle related injuries at Kenyatta National Hospital.	A descriptive prospective study, inclusion criteria of 161 patients. Data analysis was presented in percentages.	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.	The study concentrated on public related road traffic accidents admitted at Kenyatta National Hospital , this study will focus on pedestrian accidents from a multidisciplinary approach from a project implementation context	Testing the availability and accessibility of children's traffic park on implementation of pedestrian safety.
Timperio *et al.*,(2004)	Examined associations between perceptions of local neighbourhood and walking and children in Australian primary schools 5-6,10-12 years old	The study used odds ratio, confidence interval in data analysis, it also used percentages.	The results showed that 5-6 year olds whose parents believed there was heavy traffic in their area were 2.8 times more likely to walk less. Perceptions of the local neighbourhods may influence children's physical activity.	The study captured public educations children traffic park but did not address road safety awareness, enforcement by presence of police creating a gap for integration of behavioural and engineering designs to address the implementation of pedestrian safety	Mixed method approach to examine parametric tests on implementing pedestrian safety

Road Engineering designs and implementation of pedestrian safety rules					
Mota S.K, Ryan S, Sallis J. F, Calfras K.J, Patrick K J. Nutter S.K (2005)	To establish influence of sidewalks on children's physical activity	Descriptive design was used to describe the availability of sidewalks. Observation checklist was used to beef up quantitative data Literature review from reports and articles	Presence and condition of sidewalks measured children's walking as an outcome variable.	The study did not use attitude of pedestrian as a moderating variable, it did not apply mixed method paradigm, did not triangulate the data collection instruments.	To combine public education, enforcement, demographic factors and moderates the influence on implementation of pedestrian safety.
Chen (2009)	To update the status, trends, causesexisting countermeasure, and issues in traffic safety, facing African countries. To stimulate discussion and inform policy makers in traffic safety policy formation.	Review of articles published in major scientific journals, internal reports by governments and institutions, from web. Journals searched for the last 12 years. Journals from diverse disciplines - traffic safety, injury prevention, medicine, economic, public health and general social science, localized journals in African countries. Multi disciplinary nature of field and potential special local issues unique to Africa reviewed. Articles reviewed for relevance and validity.	African countries facing serious challenges in traffic safety. Pedestrians alone account for more than 40% of total fatalities on African roads. There are limited countermeasures reported in Literature. Many African countries face challenges in their effort to improve traffic safety. Road traffic crashes and injuries are threatening human, social and economic development in many African countries. Much needs to be slowed or reversed. Future lies in the hands of the African people and the global world	The study discussed the road safety problem in Africa generally this study proposes to set it in the City of Kisumu. The pedestrian fatality remains high as in Kisumu hence the need to address the problem urgently. This study intends to adopt an all inclusive method such as mixed method approach to change the trend and slow down the fatality rate for pedestrians. Safe systems approach will be applied to enhance this as proposed in the current study	To test the influence of adequacy of pedestrian on implementation of pedestrian safety. To adopt mixed methods approach of reviewing the journals for relevance and validity.

Odera, Khayesi and Heda (2014)	Magnitude, causes and status of intervention as a cause of road traffic injuries in Kenya.	Descriptive analysis of secondary data from published and unpublished reports,	Interventions were sporadic, uncoordinated and ineffective. More than 75% of road traffic casualties were economically productive young adults with pedestrians being vulnerable. Pedestrians were likely to be killed in urban roads.	Although the study addresses the inadequacy of pedestrian facilities it did not include the need to integrate public education, enforcement, pedestrian demographic factors. The attitude of the pedestrians was not used to moderate the relationship between the variables as proposed by this current study.	To test the adequacy of sidewalks on implementation of safety moderated by attitude of pedestrians.
Onyango et al., (2012)	Infringement of sidewalks by street vendors in Urban spaces meant for pedestrians. Nature and patterns of street vending activities.	The study used purposive sampling was used to sample Kisumu Municipality administrators, Multi stage sampling to select the owner of street vending enterprise to respond to questionnaires. Content analysis was used to analyze qualitative data from FGD and interviews.Quantitative data was analyzed using percentages ,Multinomial logistic regression and Pearson Chi square (χ^2)	The street vendors identified the locations where they vend without any guideline. The sites taken at random made pattern of street vending haphazard within the urban built environment. Need to guide planning of street vending to integrate them in urban landuse.	The study cited inadequacy of pedestrian facilities but not public education's road safety awareness, knowledge of traffic act, adequacy of pedestrian facilities, corruption on law enforcement, presence of police, sanctions and fines	To moderate the influence of attitude on adequacy of pedestrian facilities and implementation of pedestrian safety using the safe systems theory and mixed method approach
Kirsten and Lawson (2006)	Review of influence of attributes in the physical environment on children's physical activity	33 quantitative studies to asses associations between physical environment and physical activity. Descriptive survey design and correlation design and data categorized into three dimensions – recreational infrastructure, transport infrastructure and local conditions	Children's participation was positively associated with publically provided road infrastructure i.e. sidewalks. Pavement was negatively associated with children's participation in physical activity. Youth found to be physically inactive	The study focused on adequacy of sidewalks but did not capture how attitude of pedestrians moderates the relationship between publice education, enforcement, and demographic factors.	To test the integration of safe systems approach to enhance the implementation of pedestrian safety using pragmatic ideal of applying what works.

Enforcement of traffic laws and implementation of pedestrian safety rules					
Asingo and Mitullah (2014)	To determine the magnitude of,reasons for,effects of non compliance with road safety measures and recommend policies to enhance compliance with road safety measures	The study used both primary and secondary data.Secondary data was obtained from scholarly publications and relevant government documents. Primary data was from standardized questionnaire administered to randomly selected intra and intercity road users in Nairobi, Embu and Siaya.Focus group discussion, key informant interview were held by senior officers from various sectors –Transport, traffic police department etc.The data was analyzed using basic quantitative techniques and presented in a descriptive and graphic manner.A total of 290 questionnaires were administered to all types of road users including 58 pedestrians.	The study found that the general compliance for pedestrians was about 37.6%.Non compliance among pedestrians was as high as 62.4%.The reasons for non compliance was pedestrian generally lacking knowledge requisite for safe use of roads.Pedestrians often crossed the road carelessly,had a strong penchant for ignoring safe means for road crossings such as zebracrossing.Pedestrians were accused of not keeping to their side of the road when walking and being ignorant of the most basic traffic rules and pedestrians failing to give way to motorists.	The study discussed compliance levels among various road users generally; the current study will focus on pedestrian road users specifically.The study was based on road safety policies in Nairobi, Embu and Siaya the current study will focus on the City of Kisumu.	To test the influence of corruption on enforcement of traffic laws on implementation of pedestrian safety rules moderated by attitude of pedestrians.
De langen et al.,(2001)	To establish a detailed and well tested set of traffic planning and road design methods and recommendations for urban pedestrian and bicycle traffic in Africa.	Using household survey, monitoring, planning design and implementation,observation,participation and pilot projects as methods of data collection that found documented first set of tested findings on all urban infrastructure planning and design situations in Africa that involved pedestrian and bicycle traffic.	The study was yet to cover all urban road infrastructure planning and design situations in Africa. The study recommended more field testing in more countries and cities in Africa and more experts vital to arrive at broader collection of proven planning methods, intervention menus and road designs. On policy formulation, the study reported that pro-walking policy could not be created from the outside if there were no pedestrians to walk. Ownership was a key concept in pedestrian safety and a strong focus on walking could help solve transport problems in Africa cities. The pedestrian pavement was only important if pedestrians were there to use them	The study, however ,did not address the variables this study proposes to incorporate under public education, enforcement, demographic factors and attitude of pedestrians	To test the presence of police on implementation of pedestrian safety rules.

Davis et al.,(2002)	To determine whether differences exist in restraint use by ethnicity and whether the differences were altered by presence of primary versus secondary restraint laws	Using data collected on motor vehicle crash victims admitted to two Level I trauma centers, data were obtained concurrently with hospitalization and entered into computerized trauma registered registry databases.	Comparison of restrained use in primary versus secondary enforcement states demonstrated significantly increased restraint use in all ethnic groups($p,<0.01$)States with secondary enforcement laws, varied significantly in restraint use with ethnicity and increased in all ethnic groups by presence of primary enforcement law.	The study used descriptive statistics, percentages, alpha and chi square this study hopes to use correlation analysis, Multiple analysis	To test the enforcement of traffic laws presence of police moderated by attitude of pedestrians on implementation of pedestrian safety.
Kipsosgei (2011)	To establish the challenges and opportunities in implementing and enforcing the new regulations	Using descriptive, comparative and cross sectional study design with a section of PSV operators sampled to participate in the study. Structured and unstructured questionnaire for PSVowners, drivers/conductors and commuters. Key informants were drawn from police, TLB, Local authority and matatu welfare associations. Sample size included 120 Psv operators. SPSS used for data processing and analysis. Data analysis involved descriptive statistics and hypothesis tested, Data was presented using simple tabular comparisons of means, graphs, charts and text.	There was significant change in terms of input and output of PSV[$p=0.05$],minimal changes observed on working conditions of PSV drivers/conductors, quality of transport service improved after regulations were implemented and key enforcers of regulations faced challenges in enforcing these regulations and two null hypothesis[H_0] rejected at $p=0.05$.New regulations were good however implementation and enforcement had hindered success Strict and consistent implementation and enforcement was necessary.	Although the study discussed road safety regulations in general it did not address pedestrian safety regulations specifically. There is need to integrate public education, engineering, pedestrian demographic factors and mixed methods approach as is proposed in this study	To test if attitude of pedestrians can moderate the relationship between sactions and fines on the implementation of pedestrian safety
Mead, Zegeer and Bushell (2013)	To compile all known research on the effect of the pedestrian safety countermeasures in PEDSAFE: Pedestrian Safety Guide and	Transportation Research Boards RID database, Pubmed, abstracts of presentation at annual Transportation Research Board Conferences were used to review pedestrian safety. Inclusion criteria included articles and reports using rigorous research methods.Sources came from peer reviewed journals Studies are limited to those that took place within the	Few studies have quantified the effects of sidewalks on pedestrian crashes or crash risk. Sidewalks are effective in certain types of locations and in high pedestrian activity .Sidewalks reduce types of crashes where pedestrians are struck while walking along the	The study addressed road engineering interventions' adequacy of sidewalks but did not integrate it with education, enforcement and pedestrian demographic factors moderated by attitude of pedestrians.	To test the moderating influence of attitude of pedestrians on the relationship between adequacy of pedestrian facility and implementation of pedestrian safety.

	Countermeasure Selection System To provide an complementary overview of the researchers,research methods and evaluation results that have guided the development and design of pedestrian safety countermeasures.	united states, Canada, Europe or Australia where pedestrian environment resembles conditions that engineers and planners might encounter in the United States. Tables, figures and graphs were used.	road.Sidewalk appropriate provision and adequacy would reduce the potential for such crashes.Raised zebra crossing and pavement have also been discussed.		
		Pedestrian Demographic factors and Implementation of pedestrian safety rules			
Scot, (2010) Salmon (2005) Shah (2003)	Age and gender	Descriptive survey used to get quantitative information	Age and sex important determinants of pedestrian accidents among the middle aged. Males more prone to accident as drivers	The study has not applied safe systems approach, Expost facto design, iRAP model, observation checklist.	To test the pedestrian demographic factors of age and gender on implementation of pedestrian safety
Muller and Riener (2011)	Conventional lighting systems in areas with low frequency of passes by. To describe the smart lighting system(SSL)system a first approach to accomplish for flexible lighting systems	Smart Street Lighting (SSL),a framework developed for a dynamic Switching of street of street lamps based on pedestrians location and desired safety (or fear) zones. Each pedestrian is localized via his/her smartphone, periodically sending location and configuration to the SSL server. For street lighting control, each and every lamppost is equipped with Zig –Bee based radio device, receiving control from the SSL server via Multi hop routing.	Application of the proposed SSL system has great potential to revolutionize street lighting, particularly in suburban areas with low - pedestrian frequency.SSL can help overcome the regurality requirement of co_2 emission reduction by switching off lampposts whenever they are not required.	The study presented results on a small scale the current study hopes to apply the findings on a large scale. The study introduces the novel SSL framework, which is a system for fast reliable and energy efficient street lamp switching based on pedestrian location and personal desire of safety. Safety zone definition and position estimation is accomplished using standards smartphone capabilities. The current study hopes to fill the gap from a social perspective.	To test the pedestrian Level of education on implementation of pedestrian safety.

Jeng and Fallat (2003)	Investigating solutions to benefit pedestrian accessibility around bus stops on route 9 in Mammouth and Middlesex countries, New Jersey.	The methods used in the study included literature review, field observations, on site survey, Lab study(videos and photographs) to explore drivers' perception of risk at unexpected pedestrian highway crossings.Hypothesis was used to test pedestrian level of comfort while crossing the road at marked locations.	The study concluded that educating pedestrians about safety devices and signals was important as many did not understand the flashing don't walk interval. Majority of transiters on route drive to the bus stop to parking is critical in determining crossing behaviour.	To domesticate the best practices drawn from New Jersey to the City of Kisumu.The attitude of pedestrian will moderate the relationship between road infrastructure and implementation of pedestrian safety	To test the pedestrian level of education on implementation of pedestrian safety
Odero and Khayesi(2003)	Policy neglect primarily caused by absence of reliable evidence on magnitude and nature of the problem of road safety.	Interviews of pedestrians and data presented in percentages	Males between the ages of 16 and 54 accounts for majority of injury from accidents in all countries about 15% of those killed in developing countries are children, much higher than industrialized countries.	The study addressed policy versus pedestrian gender but failed to address public educations road safety awareness, children's, corruption on enforcement of traffic laws.	To test hypothesis on the pedestrian gender and age on implementation of pedestrian safety

Attitude of pedestrian and implementation of pedestrian safety rules					
Elenora et al.,(2012)	Road safety attitudes and perceptions of pedestrians in Europe	Research instruments-SARTRE-4 Survey, interview, common questions. A sample size of 1,000 was used. The study area was 19 European countries 18 from EU and 1 from Israel. Trends was used to monitor .The target population included all road users (drivers, motorcyclists, pedestrian, cyclists) 200 respondents. Simple random sampling at national level. Descriptive analysis used.	10% - 30% of pedestrian often cross roads despite a red light showing.	The study addressed attitude of pedestrians from a global perspective in a developed country the current study will address attitude of pedestrians as a moderating variable from a developing country Kenya and a city in a formative stage in Kisumu	To test the moderating influence of attitude of pedestrians on the relationship between road infrastructure interventions and implementation of pedestrian safety rules.
Boyce and Geller(2000)	Community-wide intervention to improve pedestrian safety by giving guidelines for instutionalizing large scale-scale behaviour change	Using an A-B-A reversal design, sign promise cards. Baseline survey for before and after 6 week intervention, observation as data collection tools. Data was presented in frequencies and percentages	Driver yielding behaviour significantly increased throughout the study, from a baseline mean of 23%(n=979) to a mean of 44%(n=272)for 2 weeks after the removal of intervention materials and termination of publicity.Study recommended institutionalizing pedestrian safety campaigns	Although the study touched on pedestrian crossing behaviour as an attitude measure and road safety campaigns it did not discuss on enforcement of pedestrian traffic laws, corruption on law enforcement,presence of police, sanctions and fines creating a gap for the current study.	Combined influence of public education, engineering, moderated by attitude of pedestrians on implementation of pedestrian safety.
Munala and Maina (2010)	Understand the different views of drivers on the seriousness of road safety in Kenya	Using empirical and exploratory field survey design, The target population comprised passengers and drivers as active road users. Convenience/accidential choice based sampling, purposive /judgement sampling. Sample size 100 respondents. Data collection instruments included self administered questionnaires, participant observation, semi structured interviews. The location was Mombasa road between 2008-2009.Time was 6a.m-6p.m.Data analysis was descriptive and cross tabulation statistics	Fatigue of drivers was responsible for fatalities and injuries of other road users especially pedestrians	The study focused on driver characteristics as cause of injury and fatalities but left out concepts such as road safety awareness, traffic act, children's traffic plus other variables such as adequacy of sidewalks, zebra crossing, pavements	To test the safe systems approach system approach of safe road, safe vehicle, safe speed and safe road users on implementation of pedestrian safety.

Nambisan et al.,(2009)	To evaluate the effectiveness of the automatic pedestrian detection device and smart lighting system in improving pedestrian safety at a midblock crossing on an arterial in the Los vegas Metropolitan area.	The methodology entailed field observations conducted before and after, first with no crosswalk, then after installation of a crosswalk, observations and percentages.	The study revealed that after installation of an automatic detection system to detect presence of a pedestrian and brighten the crosswalk with high intensity lights, the number of pedestrian observed crossing at the improved site increased from 44-84 thus few pedestrian jay walked and more diverted to the facility. Percentage of pedestrians trapped in the crosswalk also reduced and percentage of motorists yielding increased from 22 to 35%.	The study focused on pedestrian demographic factors and the automatic detection device which can be replicated in the City of Kisumu if digital migration is affected .It however left out the role of road safety awareness, enforcement on corruption the use of interview, expost facto design as methods proposed in the current study.	Attitude was used as a moderating variable in the current study.

2.10 Summary of Reviewed Literature

The literature review in this study comprised road infrastructure interventions based on six objectives namely public education on road safety,road engineering designs,enforcement of traffic laws,pedestrian demographic factors,combined road infrastructure interventions and attitude of pedestrians on implementation of pedestrian safety rules,the theoretical framework and conceptual framework based on the concepts. Empirical review in this study was to identify gaps in knowledge from previous studies relevant to this current study.

Public education on road safety was indicated by road safety awareness, knowledge of the Traffic Act and availability of the childrens'traffic park from the global perspective to the City of Kisumu. Road engineering designs were reviewed in terms of adequacy of Pedestrian facilities specifically theZebra crossings, Pavements and Sidewalks.Enforcement of traffic laws was reviewed from level of corruption on law enforcement, presence of traffic police as well as sanctions and fines administered.

Pedestrian demographic factors were studied from global to the City of Kisumu level, in terms of Age of pedestrians;Type of gender and Level of pedestrian education.The combined road infrastructure interventions were also reviewed to highlight their combined possible influence on implementation of pedestrian safety rules. The implementation of pedestrian safety rules was reviewed as an outcome variable indicated by the perceived level of safety, level of pedestrian compliance with safety laws and level of pedestrian activity.

Attitude of pedestrians adopted the behaviour component of attitude where pedestrian behaviour while walking along and across the road was reviewed on implementation of pedestrian safety rules and possible integration of both behavioural and engineering interventions anticipated in addressing the problem of pedestrian accidents effectively. The theoretical framework examined safe systems approach theory, risk homoestatis theory and Grey systems theory. The conceptual framework modelled the interplay of relationships between the variables under investigation displayed in form of a diagram.This was to demystify the various concepts under investigation and ascertain their interconnectedness.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methodology that was used in conducting the study. These include the research paradigm, research design, target population, sampling selection technique and sample size, data collection instruments, validity and reliability of instruments, data collection procedures, data analysis techniques, testing of hypothesis,operationalization of variables and ethical considerations.

3.2 Research Paradigm

This study applied the mixed methods approach which incorporated the use of both qualitative and quantitative methods concurrently and sequentially in a single study (Bulsara, 2010; Migiro and Magangi, 2011).The mixedmethods approach provided a better understanding of the research problem rather than either research approach used alone (Bulsara, 2010; Creswell, 2008).This definition involved the how, what, where, why and value of mixing. The research questions called for a real-life contextual understanding, multilevel perspectives and cultural influences drawn from road infrastructure interventions, attitude of pedestrians and implementation of pedestrian safety rules.It employed rigorous quantitative research to assess thefrequency and magnitude of constructs and qualitative research to explore what the constructs meant and how they should be understood (Cresswell, Klassen, Planoclark and Smith, 2011).It also utilized a variety of methods to draw on the strengths of each and frame the inquiry within theoretical and philosophical positions (Johnson, Onwuegbuzie and Turner, 2007; Tashakkori and Teddlie, 2003; Bulsara, 2010;Cresswell et al;2011) with evidence gathered based on the type of question and theoretical foundation. Here,the world is not viewed as an absolute unity.

This study was anchored on pragmatism which focused on the research problem (Tashakkori and Teddie, 1998; 2003; Patton, 1990; 2002) which in this study was implementation of pedestrian safety rules.Pragmatism allowed for the use of a pluralistic approach of integrating road infrastructure interventions and attitude of pedestrians to derive knowledge on the problem. The pragmatic perspective which employs “what works” used a diversity of approaches, gave primacy to the importance of the research

problem and question, and valued both objective and subjective knowledge (Cresswell et al.,2011;Greene, 2007; Patton, 1990, Rossman and Wilson, 1985). This gave the researcher freedom to use both descriptive and inferential data analysis techniques and provided opportunities to integrate a variety of theoretical perspectives (Morgan, 2007) such as Safe systems approach theory, Grey theory and Risk haemostatic theory) and iRAP model in this study. The epistemological position was consequence-oriented, problem-centered, and pluralistic.

The proponents of pragmatism included Charles Sanders Peirce, William James, George Herbert, Mead, and JohnDewey (Cherryholmes, 1992; Murphy, 1990; Patton, 1990) and Hillary Putman who propound that pragmatism arose out of actions, situations, and consequences rather than antecedent conditions and were not committed to any one system of philosophy and reality (Johnson,Onwuegbuzie and Turner;2007;Cherryholmes, 1992; Murphy, 1990; Creswel, 2008). Researchers tended to choosemethods, techniques, and procedures of research that best met their expectations, and this formed the methodological perspective of the paradigm in this study.

The choice of pragmatism in this study had ontological, epistemological, axiological and methodological underpinnings.Axiologically, truth was what worked currently and was not on the basis of strict dualism between the mind and reality; reality did not depend on the mind(Awodele,2012). In this study, the axiological perspective was expected to createa balance between a value-free quantitative stand and a value laden qualitative stand, which worked in pragmatism. Epistemologically, the researcher selectively interacted with the research to allow distance from the research in positivism and post positivism while indulging with research in constructivism.The research distanced from the quantitative aspects and was part of the research on qualitative aspects, a blend that worked with pragmatism. Knowledge was what was adequate and legitimate. Pragmatists believedin not focusing too much on reality and the laws governing nature (Cherryholmes, 1992) but to completely change the subject (Rorty, 1983) as it opened the door to multiple methods, different worldviews, assumptions, forms of data collection and analysis in the mixed methods approach.

The rationale for applying mixed method approach was for triangulation, complementarily, initiation and expansion (Newmanand Benz, 1998; Martens, 2003; Punch, 2006; Creswell, 2008) and was relevant to this study in developing suitable research instruments and data analysis techniques where one method was used to inform another.In this study, the sampling techniques included both probability and non-probability such as simple random and purposive sampling to select pedestrians and the sampled roads(Watundu,Musa and Mukyasi,2011).The research instruments were a questionnaire, interview schedule,an observation checklist and document analysis to capitalize on the strengths ofeach instrument and complement the data collection process. Varying the methods of data collection enhanced validity, answering of questions from a number of perspectives and ensuring there were no gaps to information/data collected thereby minimizing pre-existing assumptions and appropriate when one methodology did not provide all the information required (Bulsara, 2010).

Triangulation of subjects included views and perspectives from different people such as pedestrians, system designers drawn from engineers, educators, law enforcers and parents in this study. Complementarity allowed the resesrcher to elaborate, enhance, illustrate, clarify the results and develop one method to another.It aimed at contextualized information and took a macro picture of the road transport system and added information about individual road users' different modes such as pedestrians.Complementarity involved comparing,validating,examining outcomes of experiences and processes,triangulating results,providing trends through illustrations of context (Plano Clark, 2010).

Methodologically, pragmatism allowed a balance between the deductive logic and inductive logic used in quantitative and qualitative research respectively(Johnson, Onwuegbuzie and Turner; 2007) as applied in the current study.This thesis therefore applied both *Ex post facto* design and descriptive survey design, triangulation of questionnaires, interview schedule,observation checklist and document analysis of data collection instruments,probability and non-probability sampling procedures, descriptive and inferential statistics, parametric and non-parametric statistics, test hypothesis using correlation and multiple regression analysis model, theoretical, conceptual frameworks, methods and principles which informed the choice of this paradigm.

3.2.1 Research Design

This study adopted both e*x post facto* design and descriptive survey designs. *Ex post facto* design was defined as where an independent variable(s) had already occurred and the researcher started with observation of a dependent variable(s), and then studied the independent variable in retrospect for possible relations to and effects on the dependent variable or variables (Kerliinger, 1964; Tuckman, 1978 Kerlinger and Ront, 1986; Kerlinger, 1986; Cohen, Manion and Morrision, 2000; Oso and Onen, 2009). *Ex post facto* design discovered a functional rather than causal relationship (Lord, 1973) since relationships did not necessarily mean causation, the functional relationship applied in this study. It suited this study because the independent variables, namely road infrastructure interventions and attitude of pedestrians had already occurred and would not be randomized, manipulated and controlled for research purposes.*Ex post facto* design was preferred in this study because the nature of the study focused on pedestrian fatalities and injuries which would have been impractical, costly or ethically questionable if carried out in any other design apart from *ex post facto* which would have required actual accidents to take place contrary to ethical considerations. Implementation of pedestrian safety rules, the dependent variable was therefore traced backwards or retrospectively for a possible functional relationship.

This *ex post facto* design entailed an explanatory, exploratory and embedded form.*Ex post facto* explanatory substituted for an experiment and still predicted and explained a relationship without observing an actual accident which was unethical, immoral and impractical (Ary,Jacobs and Razavich,1972) giving the study a proactive rather than reactive approach. It also provided a means of tackling research problems not possible in laboratory and expected to yield valuable clues concerning the nature of phenomena in terms of what goes with what, under what conditions, in what sequences and patterns.

Ex post facto exploratory design involved pilot testing, content analysis on previous research findings or documents, theory formulation, one's own observation, open ended questions, and test alternativehypotheses using inferential statistics from samples drawn from the target population to account for the results obtained.(Ary et al,1972) *Ex post facto* embedded design combined improvement in techniques, statistical methods and designs with partial control features including joining of both quantitative and qualitative

aspects of the study to complement the strengths of the design in this study. This allowed the use a variety of descriptive and inferential statistics in data analysis and interpretation.It also allowed triangulation of data collection instruments for both quantitative and qualitative data. Sources of weaknesses in *ex post facto* design such as lack of randomization, manipulation and control were mitigated by the strengths of pragmatism. Kerlinger, (1986,1964) justifies the use of *ex post facto* design in social science research where problems did not lend themselves to experimentation but to a controlled inquiry of the *ex post facto* kind. The current study focused on implementation of pedestrian safety rules as the research problem and the central research question under investigation.

The study also sought to apply descriptive survey research design which Fraenkel and Wallen (2014) defined as asking a large group of people questions about a particular issue. The information was obtained from a sample rather than the entire population at one point in time in line with the cross-sectional sub-type of descriptive survey study design. Gay and Alrasian (2006) confirmed its quantitative approach and determination of the status of a defined population with respect to certain variables. Its preliminary and exploratory study aspects allow the researcher to gather, summarize, present and interpret informationfor the purpose of clarity (Misigah,Kinyanjui and Ohaya,2013;Orodho, 2002; Borg and Gall; 1989) and interest to stakeholders. By involving a broad category of stakeholders, such as policy makers, educators, engineers, law enforcement officers, parents and pedestrians, the study sought views from sampled respondents on purposively selected roads. This ensured systematic collection of information from pedestrians by obtaining their responses to questions using questionnaires as an instrument ofdata collection. The design employed descriptive survey to establish opinions, knowledge and behaviour. Attitudes of pedestrians was incorporated as the moderating variable on the relationship between the road infrastructure interventions and implementation of pedestrian safety rules was used to make inferences to the population and to test hypotheses in this study.

Oso and Onen (2009) added that descriptive survey provided numeric descriptions of a sample as they were, as they would be and did not involve manipulation of the independent variable. The design allowed an economic, rapid data collection, and

generalization from a sample suitable for extensive research (Kothari, 2004; Grinnel and Unrau, 2010) as was appropriate in this study. The two research designs were chosenbased on descriptive and inferential data analysis (Awodele,2012) adopted in this thesis. *Ex post facto* design and descriptive survey design blended and complemented the strengths in a study that hoped to get the best of the difference.

3.3 Target Population

A target population comprises memberships from real or hypothetical set of subjects, persons or occurances to which the researcher would make generalization of the findings of the study (Misigah,Kinyanjui and Ohaya,2013;Borg and Gall, 2003). This study targeted road users from a universe population of 409,928 residents of the City of Kisumu,of pedestrians assumed to have either walked along or across the roads as well as drivers who had driven on the sampled roads. The 409,928residents (RoK, 2009 Census) therefore formed the researchers' target population from which an ideal sample of 384 respondents were conveniently selected to include 200 pedestrians and 100 drivers to whom the questionnaires were administered.The remaining 54 respondents were pedestrian road users drawn from educators, engineers, and traffic enforcement officers and parents who responded to the interview guide and a further 30 respondents to answerthe observation checklist respectively. The City of Kisumu had 110 roads registered by Kenya Urban Roads Authority (KURA, 2014) with a universe population of pedestrians assumed to be walking along or across the selected roads and exposed to the risk of injury and fatalities and drivers who both provided enough coverage for the study.

The study was conducted on 10 selected public roads in the City of Kisumu, Kisumu County, Kenya.The 10 selected roads were purposively chosen because of their high pedestrian activity which could provide the information required for this study.The 10 out of 110 sampled roads were based on design criteria,traffic criteria,landuse criteria and pedestrian activity criteria which was necessary to achieve the objectives of the current study as illustrated in Table 3.2 (Criteria for Sampling).The City of Kisumu was chosen for this study because, like other urban areas, the City of Kisumu was exposed to the wholesome influences of city life and was a cosmopolitan town within Kisumu County hence its suitability. The city lies within Latitude $0^0 20^{'}$S and $0^0 50^{'}$S and Longitude $33^0 20^{'}$E and $35^0 20^{'}$E. The City of Kisumu occupies a total area of 1,177.5sq km whereby

918.5 sq km covers arable land and water mass 259 sq km,it was the third largest city in Kenya after Nairobi and Mombasa and a transportation hub for this region(Agatha,Walingo and Othuon,2010). Divided into core urban, peri-urban and ruralzones, the City of Kisumu had a population of 409,928 residents (GOK, 2009; Statistical Abstracts, 2012) thus had a high population, high number of registered vehicles per thousand, high number of pedestrians and thus a high pedestrian activity appropriate for providing the respondents' urban roads and a focal point for this study.

The City of Kisumu was chosen for the study because of its high rate of pedestrian fatality and severity of injury at 45% with a high death rate of pedestrians in the productive age bracket for a single city, in comparison to the national figure which stood at 46% for Kenya. The 409,928 residents of the City of Kisumu therefore formed the researchers' target population of road users whose safety was not known.The pedestrians and drivers were expected to respond to the questionnaire, unstructured interview guide and observation checklist.

The choice of pedestrians and drivers was based on individual activity, mode of choice and travel pattern, since virtually all journeys begun and ended on foot. Pedestrians travelled on foot to work, shop, school, recreate and socialize and formed the single most road user group.The study drivers were targeted as the potential or actual cause of fatality or injuries for pedestrians on the road.The pedestrians who were selected conveniently gave useful information and knowledge to meet the objectives of this study.

3.4 Sample Size and Sampling Procedure

This section describes the sample size and sampling procedure used in the study.

3.4.1 Sample Size

Kerlinger (1986) states that sampling involves taking any portion of a target population or universe as a representative of that population or universe. Simple random sampling determined the desired sample size for this study(Burugu,Mulwa and Kyalo,2015) following Krejcie and Morgan's (1970) formula quoted in Isaac and Michael (1981:192) and applied at 95% confidence level to select the number of pedestrians from a universe population of 409,928 residents of Kisumu.

Simple random sampling applied as follows:-

$$\text{Sample size } S = \frac{\chi^2 NP\,(1-P)}{d^2\,(N-1) + \chi^2 P\,(1-P)}$$, in which

S = the desired sample size

N = the given population size

P = the population proportion for table construction assumed at .50, as the magnitude that yielded the maximum possible required.

d = the degree of accuracy as reflected by the amount of error that can be tolerated in the fluctuation of a sample proportion p about the population proportion p - the value of d being 0.05 in the calculations for entries in the table, a quantity equal to $\pm 1.96\sigma_p$

χ^2 = table value of chi square for one degree of freedom relative to the desired level of confidence which was 3.841 for the 0.95 Confidence Level(CL).

Consequently, a sample size of 384 pedestrians ideally met the established criterion. From a universe population of 409,938 residents of the City of Kisumu (GoK Census, 2009), a sample size of 384 pedestrians was not only ideal but also accurate and easily accessible within a geographical area where face to face contact was required and the cost of conducting research wasrelatively low for this method of sampling. A sample size of 384 from Krejcie and Morgan table minimized bias.

3.4.2 Sampling Procedures

This study applied both probability and non-probability sampling procedures to obtain a sample of roads and respondents. Probability sampling procedures included simple, stratified, quota and cluster random sampling.For simple random sampling, Fischer's formulae was used to calculate the sample size, stratified random sampling to control for gender and quota sampling for type of urban road on the ten sampled roads and cluster random sampling to divide the urban roads into clusters rather than use individual roads due to lack of sampling frame while non-probability sampling procedures included purposive and convenience sampling.

Purposive sampling, a non-probability procedure, was used to sample the ten urban roads. In this study, the unit of analysis was urban roads in the City of Kisumu. Purposive

sampling was ideal since the sample characteristics possessed by the 10 selected urban roads were deemed important for this research (Mugenda and Mugenda,2003). In this regard, from the sampled urban roads, with a high risk to pedestrians popularly called black spots and rated 1 or 2 star by star rating model (Opiyo, 2005). The justification for purposive sampling was applied to highlight their level of safety or likelihood of pedestrian risk of exposure to injury and fatalities. Out of the total of 110 urban roads under Kenya Urban Roads Authority (KURA) in the City of Kisumu, the 10 selected roads were divided into three broad categories based on surface type, length and width of roads as shown in Appendix v, within an identified geographical area of the City of Kisumu. The choice of 10 urban roads were expected to give a wider representation which would adequately serve the purpose of the study. The map of the City of Kisumu as in Appendix VI show the location of urban roads that informed the choice of the 10 sampled roads.

In order to investigate the number of respondents by sampled road, the respondents were asked to indicate the name of the road where they were when the study was conducted(Watundu,Musa and Mukyasi,2011). Allocating the number of respondents per road was important to ascertain if pedestrians were evenly distributed across or along the sampled roads under consideration(Doorley et al,2015) in this study.

The total number of respondents per road in line with iRAP model of star rating of high risk urban roads (iRAP, 2012, Opiyo, 2005) was listed and subdivided on the basis of gender through stratified sampling and urban roads comprising of highways and streets through quota sampling as presented in Table 3.1.

Table 3.1: Distribution of Respondents per Sampled Road

Name of road	Pedestrians	Drivers	Interviewed Road users	Observation	Total
Jomo Kenyatta Highway	22	11	7	4	44
Otieno Oyoo Street	14	7	3	2	26
Ondiek Highway	18	9	5	2	34
Achieng Oneko Road	13	6	3	2	24
Kakamega Road	23	12	6	2	43
Oginga Odinga Road	32	16	9	5	62
Nyerere Road	12	6	3	2	23
Kibos Road	12	6	3	2	23
Nairobi Road	17	8	5	5	35
Busia Road	37	19	10	4	70
Total	**200**	**100**	**54**	**30**	**384**

Source: Survey Data (2015)

Table 3.1 shows the number of respondents per sampled road including pedestrians,drivers,interviewees and observers by name of the road when the study was conducted(Watundu,Musa and Mukyasi,2011).The number of respondents by road was important to ascertain distribution across or along the sampled roads under consideration(Doorley et al.,2015) in this study Urban roads with high pedestrian activity were allocated more respondents. The allocation by road was aimed at reducing bias in the sampling procedure.The researcher used convenience sampling to select pedestrians as well as educators, engineers, planners, law enforcers to provide the requisite information through self-administered questionnaires adopted from iRAP star rating (iRAP model, 2012) in-depth interviews, observation checklist and document analysis.

The study findings on number of pedestrians by sampled road indicate that the highest proportion of respondents was on Busia Road with 70 respondents (18.220%) followed by Oginga Odinga road with 62(16.14%) Jomo Kenyatta Highway had 44 respondents (11.45%), Kakamega Road had 43 respondents (11.19%) Nairobi road had 35 respondents (9.11%),Ondiek Highway had 34 respondents (8.85%) and, while Otieno Oyoo Street 26 (6.77%) and Achieng Oneko Road 24(6.25%) showed moderate number of respondents, Kibos and Nyerere Roads each had 23 respondents (5.98%), had equal and the lowest

number in the sample.This implies that there was fair distribution of pedestrians per road as shown in Table 3.1.

Convenience sampling was a non-probability sampling procedure that was applicable in situations where a sampling frame was too big to allow the use of conventional methods. This would yield a sample size that may not have been managed effectively within the framework of available resources and time, given the geographic expanse (Mugenda and Mugenda, 2003). In such situations, a researcher selects a sample size that would be manageable and at the same time representative of the population attributes. Pedestrians were conveniently chosen to respond to the data collection instruments. Those absent from the ten selected urban roads did not form part of the sample.

The study used the justification behind convenience sampling to sample pedestrians and map of urban roads in theCity of Kisumu (Appendix VI) to sample the 10 selected urban roads. Cluster sampling was adopted as the unit of sampling for pedestrians as appropriate when population under investigation was large and widely spread over a large geographical area and simple random sampling was difficult. The probability procedure and version of cluster sampling known as area sampling was applied to select roads where the researcher involved the population within identified geographical area as indicated in the subsequent subsection.This sampling approach, based on the criteria of design; traffic, land uses and pedestrian activity for the selected urban roads and other sampling procedures as illustrated in Table3.2 was useful in maximizing diversity and variability in selected roads and respondents.

Table 3.2 Criteria for Sampling

Sampling Units	Sampling Procedures	Sampling Process / rationale
Urban roads: **Design criteria** Classified as Well done, Retrofitted and, Unsatisfactory- for adequacy of pedestrian facilities **Traffic Criteria** Low, medium and heavy traffic flow **Land usescriteria**- Residential, commercial and industrial, educational (usually mixed) **Pedestrian activitycriteria**-rated as high, medium, low based on appropriate number of pedestrians	Purposive (non probability) Cluster sampling(probability)	All the 10 selected urban roads out of a total of 110 according to the criteria in the sampling unit were studied.
Sample size	Simple random sampling (Probability)	Ensured the desired sample size was randomly distributed across the 10 roads.
Randomization of Pedestrians	Cluster random sampling (Probability)	Identified clusters when a sampling frame was missing.
Pedestrians' gender	Quota random sampling (non-probability) Stratified sampling(Probability)	Identified the male or female respondents and type of roads.
Professionals-Educators, Engineers, law enforcers and Pedestrians, parents	Purposive (non probability) Convenience (non-probability)	Allowed use of cases that possessed required characteristics
Pedestrians	Purposive (non-probability) Convenience (non probability)	The primary beneficiaries and users of the selected urban roads tovalidatethe information.

3.5 Research Instruments

This study applied four instruments namely questionnaire, interview schedule, observation guide and document analysis to collect quantitative and qualitative data. The survey questionnaire for pedestrians sourced quantitative data and interview schedule, observation guide and document analysis for educators, engineers, law enforcement officers and a section of pedestrians, as appropriate, sourced qualitative data to beef up quantitative data. This assisted the researcher in ensuringaccuracy of data collected. Survey questionnaire was suitable because of the high traffic volume of pedestrians walking along or across the selected urban roads which resulted in high pedestrian activity. The pedestrians would hopefully understand and answer questions concerning road infrastructure interventions on implementation of pedestrian safety rules as regular road users on the selected roads. Questionnaires were administered to all the pedestrians in the sample study as explained below.

3.5.1 Questionnairefor Pedestrians

The self-administered questionnaire adopted the iRAP star rating for pedestrians (iRAP, 2009 Kenya). iRAP's star rating consisted of a set of questions modified for pedestrians to respond to independently and measured the level of safety of pedestrians on the sampled roads. The iRAP star ratings according to Rogers,(2012) measured the level of safety attained by a given road network simply and objectively. Star ratings objectively quantified the level of risk associated with road designs. iRAP targeted roads where a majority of people were killed or seriously injured and expectedthem to identify where safe road infrastructure interventions could reduce death and injury. iRAP used globally consistent models to produce pedestrian star ratings where five star (green) roads were the safest while one(1) star (black) roads were the least safe. This study adopted the risk related factors quantified by iRAP's star ratings to construct the questions (iRAP Kenya, 2009). The questions took the form of five star rating which were closed ended type of questions to measure the adequacy of pedestrian facilities such as zebra crossing, pavement and sidewalks.

The questionnaires comprised both open and closed ended questions in line with the mixed methods approach. The open ended questions gave respondents freedom of response and capture qualitative data. The closed ended questions facilitated consistency of certain data across respondents and were quantitative. The questionnaire for pedestrians

(Appendix II) consisted of sections A, B, C, D, and E which were designed according to the objectives. Section A contained demographic information on gender and age on implementation of pedestrian safety rules. Section B contained questions on public education subdivided into road safety awareness, Traffic Act and children's traffic park on implementation of pedestrian safety rules. Section C contained items on road engineering designs, adequacy of pedestrian facilities of sidewalks, zebra crossing and pavement on implementation of pedestrian safety rules. Section D elicited information on enforcement of traffic laws with reference to corruption, presence of police and sanctions/fines of implementing pedestrian safety rules. Section E captured attitude of pedestrians in relation to the independent variable (road infrastructure interventions) and the dependent variable (implementation of pedestrian safety rules). The design and structure of the questionnaire plus the vigour of pilot testing ensured the validity and reliability of the data that the researcher collected. It also minimized bias on both the researcher and respondents'side (Kombo and Tromp, 2006) and enabled the response rate intended to be achieved.

The study applied a Likert summated rating method. In a Likert scale, the respondents place themselves ina continuum and a respondent's score are summed up and the resulting total used as an index of that person's attitude. Likert summated rating method measured pedestrian responses to attitudinal statements. The Likert scale contained quantitative, continuous, interval scaledand categoricaldata. Each statement in the attitude scale was structured on a five point scale of strongly agree (5), Agree (4), Undecided or Neutral (3), Disagree (2), strongly disagree (1) with 3 asthe middlemost. Respondents expressed their attitude towards each of the items in various subtitles by ticking only one response. As an interval scale for attitude measurement, the Likert scale enabled researchers to calculate mean scores, which were then compared. If well-constructed, the Likert scale had equal distance between each value and qualified to be interval scaled as was applied in this study. The self-administered questionnaires were accompanied by a coveringletter/letter of transmittal to explain the purpose of survey.

3.5.1b Questionnaire for Drivers

Questionnaire for drivers (AppendixIII) consisted of sections A, B, C, D, E designed according to the objectives. Section A contained demographic information on gender and age on implementation of pedestrian safety rules. Section B contained questions on public

education on road safety as road safety awareness, Traffic Act and children's traffic park on implementation of pedestrian safety rules. Section C contained items on road engineering designs as a measure of adequacy of pedestrian facilities specifically sidewalks, zebra crossing and pavement on implementation of pedestrian safety rules. Section D elicited information on enforcement of traffic laws with reference to corruption, presence of police and sanctions/fines on pedestrian safety rules. Section E captured attitude of pedestrians in relation to the independent variable (road infrastructure interventions) and the dependent variable (implementation of pedestrian safety rules).

3.5.2 Interview Schedule for Pedestrians

Kathuri and Pals (1993) posit that interview schedules are used as a follow up instrument to gather more data on all research questions(Ajowi and Obura,2012). This interview schedule was for the purpose of establishing rapport with respondents such as pedestrians and drivers on the selected roads in order to gauge the reliability of the responses they made in the questionnaire. The structured interview schedule was used to manage or control time taken during the interview.

The interview with pedestrians was in-depth to provide data that was not possible to obtain. It was also designed to be informal enough in orderto encourage more complete responses from respondents to reinforce information collected in the questionnaire. A few guiding open ended questions were used to probe the respondents for more information on the influence of road infrastructure interventions on implementation of pedestrian safety rules moderated by attitude of pedestrians. This was mainly used to make a follow up on issues that might not have been clarified by the questionnaire as in (Appendix III).This agrees with the recommendation of (Mugenda and Mugenda,2003).

The interview with pedestrians was based on a printed interview schedule exploring systematically the influence of attitude of pedestrians on the relationship between road infrastructure interventions and implementation of pedestrian safety rules. Open ended questions were ideal when the respondent had the key or critical information required and was reported in the interviewee's own words. The educators, engineers from KURA, planners, law enforcement officers and drivers responded to the interview schedule.The interview schedule had 10 items in total.

3.5.3 Observation Checklist

The study employed an observation checklist to get first hand information by seeing how adequately or not the pedestrians used pedestrian facilities other than rely on what they said they did, recorded information as it occurred and noticed unusual aspects including pedestrian crossing behaviour. The observation checklist was based on the objectives of the study and administered by trained research assistants and the principal researcher to do the rating. This observation checklist adopted the graphical type of rating scale to measure the attitude of the pedestrians as they behaved while using the pedestrian facilities along or across the urban roads. The observation checklist was used to beef up the questionnaire and provide qualitative data.

3.5.4 Document Analysis

This thesis analysed documents from the Kenya Urban Roads Authority (KURA), and Ministry of Roads (MOR) offices. The intention of the document analysis was to verify data collected from the questionnaires and interviews. Necessary documents including manual guides and policies such as the Traffic Act, transport policies, design, planning and implementation manuals, road safety policies, transport by-laws. A list of urban roads was requested from the relevant offices to facilitate the process. With the aid of research assistants, information regarding design, planning and implementation was collected. Likewise, information about implementation of pedestrian safety rules and enhancement of pedestrian safety was collected. This documentary analysis was expected to take four weeks.

3.5.5 Pilot Testing of Instruments

A pilot study is an important part of questionnaire development, particularly with regard to the identification of fundamental design errors (Booth, 1995). A pilot study determines the instrument's reliability for example their dependability, accuracy and adequacy. The pilot study was undertaken on a convenience sample of 2 public urban roads in the City of Kisumu but outside the ten sampled urban roads chosen for this study. The 2 urban roads did not form part of the sample thus were not used in the actual study. Inclusion of the two urban roads in pilot testing ensured that the sample represented key attributes of the bigger sampling frame. A convenience sample of 30 pedestrians (15 pedestrians from each road) considered adequate in an *ex post facto* design, was ideal to reveal inherent weaknesses in the research instruments and to participate in the pilot study.

Stratified random sampling procedure informed the choice of the desired urban roads by use of pieces of paper written 'yes' for pedestrian facilities required for the study and 'no' for those without. These papers were thoroughly shuffled in a box for the researcher to pick one selected urban road to use in the pilot study and pedestrians used in the piloting of the study. This ensured the pedestrians and sampled roads were accorded an equal chance of being selected.

In this research process, the pilot study pre-tested the questionnaire to reveal vague and ambiguous questions, unclear instructions, and unstructured difficult questions to iron out and make changes before the actual study. It captured important respondent comments and suggestions to improve instrument efficiency while adjusted approaches and strategies maximized the response rate.This was done to test for accuracy and increase reliability of the instrument.

As a result of the pilot study, a few minor changes were effected with regard to the wording of the questionnaire items.The researcher also got a general impression of the questionnaire, tested the soundness of items and an opportunity and estimated approximate time it was likely to take to answer the questionnaire before the actual study was carried out. This ensured relevance of the items to modify, replace and rephrase the questions so as to improve both the quality of the instrument and the reliability.The sample size reflected the fact that pedestrian facilities influenced the implementation of pedestrian safety rules along and across the roads. These were the options that were considered for pilot testing. The data collected during pilot-testing were prepared, analyzed and interpreted. Based on the outcomes, the instruments were reviewed further in readiness for data collection during the actual study.

3.5.6 Validity of the Instruments

Validity is the accuracy of measurement. It is the degree to which an instrument measures what it purports to measure (Sproul, 1995). It is concerned with soundness and the effectiveness of the measuring instruments (Oso and Onen, 2009).The validity of the instruments was a key component of research concerned with systematic and consistent error. The content validity wasconfirmed by specialists in the area of study at the University of Nairobi. The supervisors were consulted to examine the tools of data collection with a view to improving their contentvalidity as well as appraising and

amending the instruments. Their suggestion was used in revising the data collection instruments before preparing to use them during the actual study.Content validity was achieved according to representativeness by examining objectives and comparing them to content of instrument and using the pilot study. Construct validity supported the theory by assessment of various relationships to the major variable. It ascertained if the measure of the variable of interest (which was not directly observable) could be assumed as an accepted measure. This applied to measurement of attitude of pedestrians in this study.

3.5.7 Reliability of the Instrument

Reliability is the degree to which measures are error free and yield consistent results, that is, the consistency of measurement. Borg and Gall (1996) define reliability as the degree of internal consistency and how stable the measuring device is over time. The reliability of the research instruments in this study was confirmed through a pilot study.The pilot study determined the instruments' reliability, that is, their consistency, dependability and adequacy. The researcher determined the reliability of the attitude scale using the split-half method.

The split half method was used at the preset stage to establish the internal consistency of the instruments.The instrument for the two respondents(pedestrian,driver)were each split into two subsets labeled Section A, B, C, D and E. This took the odd-even approach(Best and Khan, 2004; Mugenda and Mugenda, 2003).To determine the coefficient of internal consistency or reliability coefficient, values varied between 0.00 (indicating no reliability) and +1.00 (indicating perfect reliability). The closer the value was to +1.00, the stronger the congruency measure (Adams and Schranevel, 1985). A value of 0.7 was therefore significant for the instrument to be considered reliable.

To ensure consistency and stability with which the instrument assessed the goodness of a measure, Pearson's Product Moment Correlation Coefficient(r) was calculated and correlated. This coefficient wascompared against a threshold of r =0.70 or 70% which indicated the coefficient to testing reliability (Uma Sukram 2007; Oso and Onen, 2009) and controlled for quality. The test was ideal for variables which theoretically remained stable over time. Conventionally, the value of at least 0.70 was acceptable in research

(Kathuri and Pals, 1993).The reliability coefficient for this study was 0.70 for pedestrian questionnaire and 0.72 for driver questionnaire respectively refer to (Table 3.3 and 3.4)

The researcher then used Spearman - Brown prophecy to compensate for the reduction of the instrument to one-half of its length. The reliability of the entire test items or instrument used the formula as shown below:-

$$R_{e=}\frac{2\mathrm{R}}{1+\mathrm{r}}$$

Where: R_e =Reliability Coefficient

R = Reliability

For pedestrians' questionnaire

$$R_{e=}\frac{2\mathrm{R}}{1+\mathrm{r}}$$

Re = 2 $\frac{0.70}{1 + 0.70}$

= 0.411x 2

= 0.823

For drivers'questionnaire

R_e = $\frac{2 0.72}{1 + 0.72}$

= 0.418 x 2

= **0.837**

However, the value of a reliability coefficient depended on the nature of the study. Cronbach's coefficient alpha formula tested reliability estimates for items which were not scored dichotomously or used with non-dichotomous responses. It was widely used where instruments such as rating scales were used in research.A reliability analysis was carried out for each of the instruments and items were deleted in order to maximize their reliability coefficient.

For the reliability of questionnaires for pedestrians an Alpha coefficients range in value from 0 to 1 was used to describe reliability of factors extracted from muti-point formatted

questionnaires or scales. According to Watundu,Musa and Mukyasi,(2011) the higher the score, the more reliable the generated scale.A questionnaire with items for six variables was used to collect data from pedestrians. The variables were public education on road safety, road engineering designs,enforcement of traffic laws, pedestrian demographic factors and attitude of pedestrians on implementation of pedestrian safety rules. Table3.3 shows the items that were deleted and the ones that were retained to improve the reliability of the scales whereby the corresponding optimal values of Cronbach's alpha was a measure of internal consistency.

Table3.3 : Reliability of Instruments for Pedestrians

Pedestrian Questionnaire	Items deleted to maximize reliability	Items remaining	Cronbach alpha after deletion
Public education on road safety.	3.2, 3.4, 3.5 & 3.6	3.1 & 3.3	0.67
Quality of road engineering design	4.4, 4.5, 4.6 & 4.7	4.1, 4.2 & 4.3	0.62
Enforcement of traffic laws	5.3, 5.4 & 5.5	5.1, 5.2 & 5.6	0.81
Pedestrian demographic factors	6.1, 6.2, 6.4 & 6.5	6.3, 6.6, 6.7 & 6.8	0.69
Attitude of pedestrians towards implementation of their safety rules	7.1, 7.6, 7.13 & 7.14	7.2, 7.3, 7.4, 7.5, 7.7, 7.8, 7.9, 7.10, 7.11 & 7.12	0.70
Implementation of pedestrian safety rules	8.1, 8.2 & 8.6	8.0, 8.3, 8.4, 8.5 & 8.7	0.72
Overall mean			**0.702**

See instruments in Appendix II

Table 3.3 indicates that, when some items were deleted, reliability was maximized and internal consistency improved to an acceptable level. The findings for quality of road engineering design was 0.62, Attitude of pedestrians was 0.70 and retained the highest number of items after deleting items 7.1, 7.6, 7.13 and 7.14, public education on road safety was 0.67, implementation of pedestrian safety rules was 0.72, pedestrian demographic factors was 0.69 and enforcement of traffic laws 0.81.This results are in line with what Roscoe, 1975; Adams and Schravel, 1985; Best, 1989; Borg and Gall, 1996; Best and Khan, 2004; Uma Sakaran, 2007; Oso and Onen, 2009 indicated that a reliability coefficient should be compared against a threshold of r=0.7 which was the coefficient for testing reliability. Where the individual figures realized in some of the scales were below the threshold of 0.7, the overall instrument had a reliability coefficient of 0.702 thus the instrument was considered reliable and internal consistency achieved. The results in this study showed an improved alpha after deletion of some items as

specified in Table 3.3 of the reliability of the instruments. In this study, the results for pedestrian questionnaire was 0.7

The reliability of instruments for measuring drivers' view on public education on road safety, road engineering design, on enforcement of traffic laws and implementation of pedestrian safety rules was checked using Cronbach's alpha. Table 3.4 shows that the reliabilities were at acceptable levels after indicated items were deleted.

Table 3.4: Reliability Coefficients of Questionnaires for Drivers

Instrument	Items deleted to maximize reliability	Cronbach's alpha after deletion
Public education	None	0.80
Road engineering design	3.2 & 3.5	0.67
Enforcement of traffic laws	None	0.62
Implementation of pedestrian safety rules	9.1	0.80
Instrument reliability		0.72

See instruments in Appendix II

Table 3.4 shows the acceptable levels of internal consistency that was reached by deleting items 3.2, 3.5 and 9.1 public education on road safety and enforcement of traffic laws had no items deleted. In this study, the results for drivers' questionnaire was 0.72.

3.6 Data Collection Procedure

The study began with seeking permission from relevant authorities followed by recruitment of research assistants to help with data collection and processing. Subsequently, consensus building between the lead or principal researcher and the research assistants was undertaken. The purpose of the session was to discuss feasibility of the research study design, timeline, logistic requirements and acquisition of a research permit. The session was used to discuss each of the instruments to ensure that they were well understood. At the end of the session, necessary adjustments such as rationalization of the budget, re-statement of unclear questions and instructions, removal of irrelevant questions and grammatical errors were effected before the final copies were produced.

Before embarking on the actual study, the researcher sought permission from the relevant authorities. A research letter of transmittal was drafted by the student to the University of

Nairobi and forwarded by the University to enable the researcher approach the Ministry of roads officials in charge of the sampled roads. The national research permit was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) as a research approval. The ten sampled urban roads were visited by the researcher and trained research assistants for purposes of observation, introduction, familiarization, distribution, administration and collection of questionnaires and to conduct interviews.

The data collection procedure entailed questionnaire administration. The researcher, together with the research assistants, self-administered the questionnaires. The cover letter stated when the questionnaire was likely to be collected. The researcher ensured that all the questionnaires and cover letter were printed and handed over to respondents who comprised pedestrians on the sampled urban roads within the City of Kisumu. The researcher created rapport, introduced the questionnaire and emphasized confidentiality to the respondents. The researcher conveniently administered the questionnaires to the respondents on either side of the road assuming they had either crossed or walked along the sampled roads. For the drivers, the researcher and the research assistants administered the questionnaires at the parking bays, garages, and car wash points or bus stations. The completed questionnaires were returned by the respondents to the researcher on the spot. This ensured that all completed questionnaires were collected. The percentage of duly filled in and returned questionnaires compared to the number of participants in the sample helped determine whether the pedestrians' responses were considered adequate for this study.

The data collection procedure also required the researcher and research assistants using an interview schedule to be presentable and prepared for the interview to increase the response rate. The researcher printed the open ended questions, contacted each respondent or potential respondent in person, and recorded the date and time at which the interview was conducted. The interview schedule was used for further clarification and to complement the questionnaire. The researcher conducted a face-to-face communication intended to elicit information or opinion from the interviewees. It helped to capture the meaning beyond the words. The targeted respondents comprised professionals such as engineers, town planners, KURA officials, educators, law enforcement officers, parents and indeed any pedestrian who was in a convenient position to give relevant information.

For document analysis in this research, the researcher searched the following bibliographic databases, University of Nairobi Library services specifically Library services portal which indexed various scholarly journals (2007-2014). Google scholar, research information on transport services, including reference from publications, workshops, journals and articles in the field of transportation (1960 to present) to collect secondary data.

Secondary data was collected from print materials obtained from Kenya Urban Roads Authority, National Development Plans, Ministry of roads, libraries, internet, publications, journals, magazines, iRAP star rating guides, dissertations and theses. The researcher read the documents and noted down relevant points related to the research topic, problem and question for content validity. This instrument was then administered to KURA officials, engineers, educators, planners to verify and validate the influence of road infrastructure interventions and attitude of pedestrians on implementation of pedestrian safety rules.This secondary data formed the document analysis on implementation of pedestrian safety rules from a worldwide perspective to the local context as was queried in this and domesticated to the City of Kisumu. Before data entry, the data collection instruments such as questionnaires, interview schedule, observation checklist and document analysis was checked for completeness and cleaned to ensure quality.

3.7 Data Analysis Techniques

Data analysis seeks to fulfill research objectives and answer research questions (Bryman and Cramer, 2009). The choice of analysis procedures depends on how well the techniques are suited to the study objectives and scale of measurement of the variables in question. This study applied mixed methods approach which combined both quantitative and qualitative analysis. The first step in data analysis involved quantitative data processing and analysis which began with editing in the field to minimize bias. This was followed by coding the data, entering it, cleaning, transformation, analysis and interpretation (Nachmias and Nachmias, 1996). Quantitative data was collected in quantities and was numerical in nature. From the data collection instruments, both types of data were captured, qualitative and quantitative. Qualitative information included open-ended questions, pre-test or pilot study, content analysis from narratives, thematic and descriptive methods and coded into qualitative data to enable quantitative analysis. The

findings were then compared and contrasted with empirical findings in the literature review to show how it converged or diverged from existing body of knowledge. The coded and quantitative data were then analyzed using descriptive statistics.

In descriptive statistics, data were described and summarized into distribution of scores or measurements such as measures of central tendency, variability, relationship and association in frequencies and percentages and presented in tables and graphs. Quantitative data were captured in a pre-designed entry screen using Statistical Package for Social Sciences (SPSS) for Windows 20 as software for data analysis. Frequencies were run to identify post entry errors and to show data distribution. Cross tabulations were run to indicate the relationships between independent and dependent variables.

The data collected using questionnaires was grouped according to specific objectives and research questions. Closed ended questions were awarded numerical scores. Open ended questions were analyzed on the basis of the frequency of the responses for qualitative purposes and to strengthen the quantitative data. In addition, the dependent variable, implementation of pedestrian safety rules was treated holistically and divided according to level of implementation.

Descriptive analysis involved a systematic qualitative description of the objectives or units of study for categorical variables and intensity with which certain themes or phrases had been used. It involved a detailed description of the objects/items that comprised the sample. Qualitative data analysis used descriptive statistics obtained in the field and transcribed in summaries in thematic areas. Direct quotes captured the text to explain certain issues of interest. Descriptive statistics determined whether the relationships and differences were real or by chance and estimated population parameters from sample data which was the ultimate purpose of research.

The second level of data analysis involved inferential statistics to infer about the population based on results obtained on samples to enable generalizations or inferences to be drawn. Statistical inference in this study therefore ascertained whether research findings were by chance, could allow replication or false inferences made from the sample. To do these, hypotheses were formulated to test how two or more variables were

related to each other. The two key types of hypotheses, testing parametric and non-parametrictests applied.Correlation analysis tested hypotheses H_1 H_2 H_3 H_4 using Pearson Product Moment Correlation denoted by r. Pearson Product Moment Correlation Coefficient tested statistical significance between a standardized slope whose value did not depend on the units of measurement and measure the degree of association between continuous data and interval scaled variables as applied in this study. The value of r lay between -1 and +1 with +1 being a perfect correlation. To measure the proportion of variance in the dependent variable that was explained by the independent variable(Soole,2013) Pearson Product Moment Correlation predicted the value of implementation of pedestrian safety rules from specific values of public education, engineering, enforcement, demographic factors and attitude of pedestrians from data which was continuous in nature and interval in scale.

Chi-square test established the relationship between the variables gender and frequency of accidents both of which were categorical in nature. It compared the observed from the expected and was non-parametric. ANOVA was run to determine whether there was significant differences between two or more samples selected at a probability level (Kirsten and Lawson,2006). The level of significance was tested at 95% confidence level with a margin of error of 5% or alpha level set at $p<0.05$ to reject or accept the hypotheses as is applicable in most social science studies(O'Dell,Smith,Michael and Born,2016). With a probability level set, ANOVA was expected to yield the F statistic to determine whether it was significant or not. If a Likert scale was used as a dependent variable in an analysis, normal theory statistics used ANOVA or regression. Multiple regression analysis was therefore used for H_5 and hierarchical multiple regression analysis for H_6 explained in 3.7.1,3.7.2 and 3.7.3 in the subsequent pages.

3.7.1 Correlation and Regression Models for Road Infrastructure Interventions and Attitude of Pedestrians on Implementation of Pedestrian Safety Rules.

Table 3.5 Variables and Indicators

	Variable	Indicator
Dependent Variable	Implementation of pedestrian safety rules (y)	Perceived level of safety Level of compliance with safety laws Pedestrian activity level
Independent variable	Public Education, Engineering, Enforcement and Demographic factors($X1, X_2, X_3, X_4$)	Road safety awareness (x_1); Traffic Act(x_2); Children's traffic park (x_3); Adequacy of zebra crossing(x_4); Pavement (x_5) Sidewalk(x_6) Corruption (x_7) presence of police (x_8) Sanction and fines (x_9)Age(x_{10}) Gender(x_{11})pedestrian education level (x_{12})
Combined Independent Variables	Combined influence of all the road infrastructure interventions X_5	Combined indicators of road infrastructure interventions x_1- x_{12}
Moderating Variable	Attitude of pedestrians X_6	Pedestrian behaviour along the road X_a Pedestrian behaviour across the road X_b

The following regression models guided the data analysis.

y	-	Dependent Variable
β_0	-	Constant Term
$\beta_1, \beta_2, \beta_3, \beta_n$	-	Beta Coefficients
$X_1, X_2, X_3 \ldots X_n$	-	Predictor variables
ε_i	-	Error Term

3.7.2 Correlation Models for Research Objective one, two, three and four and Regression Model for objective five and six

Based on the six hypotheses generated the following correlation models were applied for objectives one, two, three and four:-

H_1: There is a significant relationship between public education and implementation of pedestrian safety rules in the City of Kisumu.

Implementation of Pedestrian safety rules = *f* (public education, random error)

$$Y_j = \beta_0 + \beta_i x_i + \varepsilon_i$$

H_2: There is a significant relationship between road engineering designs and implementation of pedestrian safety rules in the City of Kisumu.

Implementation of pedestrian safety rules= *f* (road engineering designs, random error)

$Y_j = \beta_0 + \beta_2 x_2 + \varepsilon_i$

$H_{3:}$ There is a significant relationship between enforcement of traffic laws and implementation of pedestrian safety rules the City of Kisumu.

Implementation of pedestrian safety rules= *f (*enforcement, random error)

$Y_j = \beta_0 + \beta_3 x_3 + \varepsilon_i$

$H_{4:}$ There is a significant relationship between pedestrian demographic factors and implementation of pedestrian safety rules in the City of Kisumu.

Implementation of pedestrian safety rules= *f* (pedestrian demographic factors, random error).

$Y_j = b_0 + b_4 x_4 + \varepsilon_i$

H_5: There is a significant relationship between combined road infrastructure interventions and implementation of pedestrian safety rules in the city of Kisumu.

Implementation of pedestrian safety rules = *f* (Combined road infrastructure interventions, random error).

$Y_j = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_2 + \beta_4 X_4 + \varepsilon_i$

3.7.3 Multiple Linear RegressionModel for Research Objective Six

Multiple regression analysis was a parametric statistical test. It was applicable where two or more independent variables predicted a given dependent variable. The independent variables (predictor variables) and dependent variable (criterion variable) in this study tested Hypothesis six (H_6). In this study, the independent variables were used to form groups and the dependent variable analyzed. The attitude of pedestrians (moderator variable) was hypothesized to test the magnitude of relationship and degree of association for linear, and data thematically analyzed between road infrastructure interventions and implementation of pedestrian safety rules. The attitude of pedestrians acted as a special type of independent variable in a moderating variable capacity. The relationship between road infrastructure interventions and attitude of pedestrians on implementation of pedestrian safety rules was developed into a linear regression model as follows: -

$Y_j = \beta_0 + \beta_j x_j + \beta_m x_m + \varepsilon_i$

Where (j = 1,2…n) were the population regression coefficients for each independent variable X_i

β_j -Regression coefficient of the predictor variable

β_m -Regression coefficient of attitude of pedestrians

x_m - Attitude of pedestrians

β_0 - Population regression constant or intercept

x_i -The potential predictors or independent variables i.e. road infrastructure interventions

Y_j - The dependent variable

ε_i -The model error variable

This relationship was assumed to hold for all observations (i = 1, 2, 3 ...n). The inclusion of a random error$\varepsilon_i$was necessary because other unspecified variables influenced implementation of pedestrian safety rules. This model assumed that $Y_j$was normally distributed and continuous. The variance of $Y_j$was constant. The X_i was fixed and relation between X_j and$Y_j$was linear.

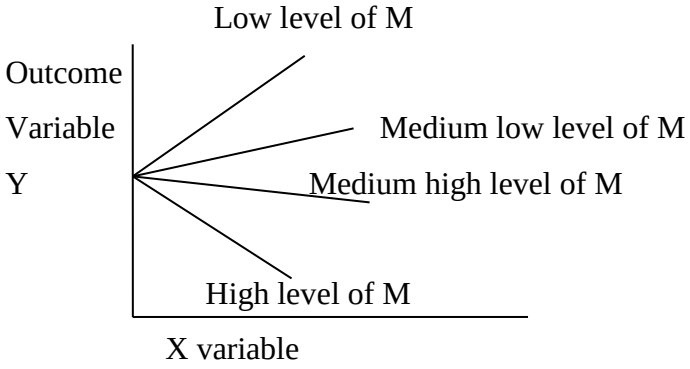
$H_{6:}$ There is a significant moderating influence of attitude of pedestrians on the relationship between road infrastructure interventions on implementation of pedestrian safety rules in the City of Kisumu.

Implementation of pedestrian safety rules= *f*(*road* infrastructure interventions, attitude of pedestrians and the interaction term between road infrastructure interventions and implementation of pedestrian safety rules, random error).

$$Y_j = \beta_0 + \beta_1 X + \beta_2 M + \beta_3 XM + \varepsilon_i$$

The attitude of pedestrians in the above equation played a moderation role. Moderation was the changing of a relationship as a function of some moderating influence (Little et al.,2007).When the moderating influence was measured in a continuous manner, this influence was generally modelled by creating a new variable that was the product of the variable that was being moderated(X) and the variable that was moderating (M).This interaction term (XM) was entered into aregression equation after estimating the mainlinear effects, the outcome (Y) of the moderating (M) and the moderated

variables(X). If the effect of (XM) was significant then the effect of X on Y was dependent upon the levels of M as shown below.



If $\beta_3$was statistically significant, then M moderated the relationship between Y and X.
Multiple regression analysis is applied when two or more independent variables are studied in relation to a single dependent variable. This involves predicting a criterion from a predictor variable and testing hypothesized relationships between predictors and a criterion. Regression analysis assigns weight to predictors to achieve optimum predictive accuracy with the available data.It is used when the data type is continuous and the level of measurement of each of the variables,interval and treated as such. In this study, the variables chosen as predictor variables were road infrastructure interventions and attitude of pedestrians as a special type of independent variable, called moderator variable and the criterion variable was implementation of pedestrian safety rules and continuous data in type. It tested hypothesissix (H_6) for not only the extent to which the linear combination of the independent variable influenced the dependent variable individually but also how they affected it when they were all put together. It also established which of the independent variables had greater influence when they were all acting together or how strongly related to the dependent variable the beta coefficient for each independent variable was.

3.7.4 Qualitative Data Processing and Analysis

Qualitative data processing and analysis began simultaneously with data collection. According to Best and Khan (2004) the challenge of qualitative data analysis involved making sense of large amounts of data, reduction in volume of information, identification of significant patterns and construction of a framework to communicate the existence of what the data revealed. Information obtained through qualitative methods was therefore

processed and analyzed in three steps. First, data was organized into key thematic areas. In the process, daily briefs were summarized after each interview session. The second step involved response description to produce interim reports and where additional information was required, data identification and sourcing was done. The third step involved systematic analysis and interpretation of the interim report which was then integrated with qualitative data in the main report as recommended in mixed methods approach. Qualitative data analysis was done concurrently with data collection or sequentially. Qualitative research in this study was used to supplement quantitative study. Variables were measured and analyzed according to objectives as illustrated in Table 3.7 below which shows operationalization of variables.

3.7.5 Tests of Hypotheses

Table 3.6 Statistical Tests of Hypotheses

Research Objectives	Hypothesis	Type of Analysis	Interpretation of Results
1. To establish the extent to which public education on road safety influences implementation of pedestrian safety rules on roads in the City of Kisumu	**Hypothesis1:** There is a significant relationship between public education on road safety and implementation of pedestrian safety rules on roads in the City of Kisumu.	Pearson's correlation	For $p<0.05$, H_0 was rejected and H_A accepted. For the strength of the relationships, r values was considered whereby: $+0.10<r<+0.29$; weak correlation;$+0.30<r<+0.49$; moderate correlation;$+0.5<r<+1.0$; strong correlation.
2. To examine how road engineering designs influence implementation of pedestrian safety rules on roads in the City of Kisumu.	**Hypothesis 2:** There is a significant relationship between road engineering designs and implementation of pedestrian safety rules on roads in the City of Kisumu.	Pearson's correlation	For $p<0.05$, H_0 was rejected and H_A accepted. For the strength of the relationships, r values was considered whereby: $+0<r<+1$
3. To assess the extent to which enforcement of traffic laws influences implementation of pedestrian safety rules on roads in the City of Kisumu.	**Hypothesis 3:** There is a significant relationship between enforcement of traffic laws and implementation of pedestrian safety rules on roads in the City of Kisumu.	Pearson's product moment correlation	For $p<0.05$, H_0 was rejected and H_A accepted. For the strength of the relationships, r values was considered whereby: $+0<r<+1$
4. To determine how pedestrian demographic factors influence implementation of pedestrian safety rules on roads in the City of Kisumu.	**Hypothesis 4:** There is a significant relationship between pedestrian demographic factors and implementation of pedestrian safety rules on roads in the City of Kisumu.	Pearson's product moment correlation	For $p<0.05$, H_0 was rejected and H_A accepted. For the strength of the relationships, r values was considered whereby: $+0<r<+1$
5. To establish the extent to which combined road infrastructure interventions influences implementation of pedestrian safety rules in the City of Kisumu.	**Hypothesis 5:** There is a significant relationship between combined road infrastructure interventions and implementation of pedestrian safety rules on roads in the City of Kisumu.	Multiple regression analysis	For $p<0.05$, H_0 was rejected and H_A accepted. For the strength of the relationships, r values was considered whereby: $+0<r<+1$
6. To assess the moderating influence of attitude of pedestrians on the relationship between road infrastructures interventions and implementation of pedestrian safety rules on roads in the City of Kisumu.	**Hypothesis 6:** There is a significant relationship between road infrastructure interventions and implementation of pedestrian safety rules moderated by attitude of pedestrians in the City of Kisumu?	Hierarchical Multiple regression analysis	For $p<0.05$, H_0 was rejected and H_A accepted. For the strength of the relationships, r values was considered whereby: $+0<r<+1$

Table 3.7: Operationalization of Variables

Objectives	Variables of the study	Indicators	Measurement	Research Paradigm	Research Design	Data collection instruments	Measurement Scale	Type of Statistical analysis	Tools of analysis
To establish the extent to which public education influences implementation of pedestrian safety rules in the City of Kisumu.	**Independent variables :** Public Education Road Safety	Road safety awareness -Traffic park -Traffic Act	Level of road safety awareness, Knowledge of the Traffic Act Availability of children's traffic park	Mixed method Approach Pragmatism	*Ex-post facto design*	Questionnaire Interview schedule Observation checklist Document analysis	Nominal Ordinal Interval	Parametric	Correlation and regression Analysis
To examine how road engineering designs influence implementation of pedestrian safety rules in the City of Kisumu	Road Engineering Designs	Sidewalks -Zebra crossing -Pavement	Adequacy of Zebra crossing Pavement Sidewalks	Mixed method Approach Pragmatism	*Ex-post Facto design*	Questionnaire Interview schedule Observation checklist Document analysis	Nominal Ordinal Interval	Parametric	Correlation and regression Analysis
Assess the extent to which enforcement influence implementation of pedestrian safety rules in the City of Kisumu	Enforcement of traffic laws	Corruption Police presence Sanctions/fine	Level of corruption Presence of police Enforcement of sanctions/fines	Mixed method Approach Pragmatism	*Ex-post facto design*	Questionnaire Interview schedule Observation checklist Document analysis	Nominal Ordinal Interval	Parametric	Correlation and regression `Analysis
Determine how demographic factors influence implementation of pedestrian safety rules	Pedestrian demographic factors	Age Gender Pedestrian education	Age of pedestrian Gender of pedestrian level of education	Mixed method Approach Pragmatism	*Ex-post facto design*	Questionnaire Interview schedule Observation checklist Document analysis	Nominal ordinal Interval	Parametric	Correlation and regression Analysis
Examine the moderating influence of attitude of pedestrians on the relationship between the road infrastructure interventions and implementation of pedestrian safety rules	**Moderating Variable :** Attitude of pedestrians on the road.	Behaviour of pedestrian along and across a road	Behaviour of pedestrian along o across a road Level of pedestrian safety, compliance and activity.	Mixed method Approach Pragmatism	*Ex-post facto design*	Interview schedule Observation checklist, Document analysis, Questionnaire	Nominal Ordinal Interval	Parametric Non Parametric	Hierarchical Multiple regression Analysis Chi –Square ANOVA-F statistic
	Dependent variable(outcome variable) Implementation of pedestrian safety rules	Level of pedestrian safety, compliance and activity.		Mixed method approach Pragmatism	*Ex-post facto design*	Questionnaire Interview schedule Document analysis Observation	Interval	Parametric	Multiple regression analysis

3.8 Ethical Considerations

The major ethical issues of concern were informed consent, privacy and confidentiality, anonymity and the researcher's responsibility. In this study, privacy and confidentiality of the respondents were a major ethical concern. To obtain valid samples, files and specific listshad to be accessed and this, in essence,was an infringement on confidentiality and privacy of the respondents. However, the respondents were given the freedom to ignore items that they did not wish to respond to (Oso and Onen, 2005).

Permission to carry out the research was sought from National Commission for Science, Technology and Innovation through the University of Nairobi and the Ministry of Roads through KURA and in the City of Kisumu from the County Commissioner and County Director of Education. Informed consent was sought from all the study respondents, which culminated in signing of the letter of transmittal (Appendix I, VIII, IX, X).

The research team observed three universal ethical principles, including respect for participants, beneficence and justice. In this regard, all participants gave consent after the researcher had fully explained the purpose of the study, its risks and benefits and that participation was voluntary. The participants were informed of the right to withdraw consent at any time without a penalty. All information including personal interviews was kept confidential.

CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents the study results on questionnaire return rate, demographic characteristics of respondents, reliability of questionnaires for the respondents, thematic and sub thematic areas as per the objectives. The thematic areas were drawn from road infrastructure interventions with specific sub-themes such as public education on road safety, road engineering designs; enforcement of traffic laws, pedestrian demographic factors on implementation of pedestrian safety rules for the first four objectives, the fifth objective was on the combined road infrastructure interventions and sixth objective on attitude of pedestrians as a moderator variable on the relationship between road infrastructure interventions and implementation of pedestrians safety rules. Quantitative analysis entailed the use of questionnaires for both descriptive and inferential statistics and qualitative statistical analysis for content analysis for each of the sampled groups. For each research objective, descriptive analysis was done by use of percentages, frequencies, arithmetic mean and standard deviation and presented in tables. Inferential analysis was done by correlation analysis and multiple regression analysis to test the significance of relationships under study. Qualitative analysis involved content analysis from the interview guide, observation walkability checklist and document analysis as data collection instruments developed by the researcher as survey instruments. SPSS version 20 was used as software to analyze data sets for fast and accurate presentation and interpretation.

4.2 Questionnaire Return Rate

The study used two types of questionnaires for each of the sampled groups which comprised of pedestrians and drivers. The total number of questionnaires delivered to respondents was 200 for pedestrians and 100 for drivers. Table 4.1 shows the Questionnaire Return Rate for the two sampled groups that were responded to and returned. Thus, the response rate for pedestrians and drivers was 100% which was considered adequate as per Saunders (2003) and Gay (2003) who stated that a return rate of more than 50% was acceptable in research.

The reason for the high response rate from pedestrians and drivers was that the questionnaires were collected on the spot. This might have exerted pressure on the pedestrians and drivers to return their questionnaires promptly as requested. There is also a possibility that since the study centred on pedestrian safety, the pedestrians and drivers might have felt that their input would help implement pedestrian safety rules which have become an issue of concern on urban road safety. The other reason which contributed to getting 100% response on questionnaires for both pedestrians and drivers was convenience sampling technique which enabled respondents from the two sampled groups to be conveniently sought on the basis of their willingnessto respond to the questionnaires until the targeted 200 pedestrians and 100 drivers respectively was achieved.

Table 4.1: Questionnaire Return Rate

Number	Sampled Group	Total used	Total returned	Percent
1	Pedestrians	200	200	100
2	Drivers	100	100	100

The 100% questionnaire return rate was sufficient for data processing and analysis as per Mugenda and Mugenda (2003) and Kothari (2004) who recommend that a questionnaire return rate of more than 50% is acceptable in research**.**

4.3 Demographic Characteristics of the Respondents

Demographic characteristics of respondents refer to their background information. In order to understand the demographic characteristic of respondent the researcher was dealing with, their background information was sought in relation to their distribution by gender, educational level; age and place of residence at the time of the study. Demographic information from the respondents was further discussed in the following subsequent sub themes.

4.3.1 Demographic Characteristics of Pedestrians

The demographic characteristics of the pedestrians that were considered by the study were gender, age of respondents, place of residence and educational level. Distribution of pedestrians by gender was important in ascertaining there even distribution to avoid gender bias in selection of respondents. Distribution of pedestrians by age bracket was done to ascertain that respondents were evenly distributed in respect to age to avoid bias in

selection of respondents. Age could influence a pedestrian's choice while walking along a road or crossing it. Age groups were classified into six categories. Distribution of pedestrians by level of education would most likely influence road infrastructure interventions and attitude of pedestrians on the urban roads. Level of education had four categories ranging from primary, secondary, tertiary and university. Distribution of pedestrians by place of residence was done to indicate the level of pedestrian activity on the selected roads. The place of residence was considered important in influencing road infrastructure interventions. It also determined the attitude of pedestrians concerning implementation of pedestrian safety rules. The responses of pedestrians are shown in Table 4.2.

Table 4.2: Demographic Characteristics of Pedestrians (N=200)

Demographic factors		**Frequency(n)**	**Percentage n(%)**
Gender			
	Female	88	44.0
	Male	112	56.0
	Total	**200**	**100.0**
Age(years)		**Frequency**	**Percent**
	Below 20	10	5.0
	Between 20 & 29	51	25.5
	Between 30 & 39	60	30.0
	Between 40 & 49	55	27.5
	Between 50 & 59	21	10.5
	60 years and above	3	1.5
	Total	**200**	**100.0**
Place of Residence		**Frequency**	**Percent**
	Rural	33	16.5
	Peri-urban	119	59.5
	Core urban	48	24.0
	Total	**200**	**100.0**
Educational level		**Frequency**	**Percent**
	Primary	13	6.5
	Secondary	49	24.5
	Tertiary	49	24.5
	University	89	44.5
		200	**100.0**

On distribution of pedestrians by gender in each of the selected roads, Table 4.2 illustrates that, out of 200 pedestrian respondents involved in the study, 112(56.0%) were male and 88(44.0%) were female. From these results, the majority of pedestrian respondents were thus male. This indicated that it was more likely to find males on urban roads than females. This finding could be attributed to the likelihood of more males than females being found on urban roads.

In order to establish the distribution of pedestrians by age, the pedestrians were asked to indicate their age within specified age brackets as shown in Table 4.2. Out of the 200 pedestrians, the highest proportion 60(30.0%) were aged between 30- 40 years followed by those in the 40-50 years age range 55(27.5%) and then 20 to 30 years age bracket 51(25.5%). The smallest number was between 60 - 70 years, a paltry 3(1.5%). This implies that of the 200 pedestrians, the proportion of those aged between 30-40 years was highest as well as those between 40-50 years. These were the productive working age group of most populations.

It was necessary to establish the place of residence of the respondents. The pedestrians were therefore asked to indicate their place of residence. Results on place of residence of pedestrians are shown in Table 4.2. In response to this, the study found that the majority of pedestrians 119(59.5%) lived in the peri-urban area. This was followed by those who lived in the core-urban area 48(24.0%) and then in the rural area 33(16.5%). From these results one may deduce that the majority of the pedestrians lived within or close to the city and walked at the beginning and end of their journey to and from the City of Kisumu.

The pedestrian education level was an important aspect of their demographic characteristics. The respondents were therefore requested to indicate their educational level ranging from primary to university. The educational level of pedestrian respondents is summarized in Table 4.2. Out of the 200 pedestrians, 89(44.5%), pedestrians had a university degree, the highest proportion in the sample. This was followed by pedestrians with secondary and tertiary education which were of the same proportion 49(24.5%), and lastly by primary school leavers who were 13(6.5%). Thus, slightly less than half of the pedestrians in the sample had a university degree. In general, all the pedestrians were in a position to implement pedestrian safety rules, irrespective of their level of education.

4.3.2 Demographic and Behavioural Characteristics of Drivers

The demographic characteristics of drivers considered were gender, age, place of residence and educational level. Distribution of the drivers by gender was important in ensuring that they were evenly distributed to avoid gender bias in their selection. Distribution of drivers by age bracket was done to ascertain that respondents were normally distributed in respect to age to avoid bias in their selection. Age could influence a driver's ability to drive safely along the road. Age groups were classified into six categories. Distribution of drivers by level of education would most likely have an

influence on road infrastructure interventions and attitude of pedestrians on the urban roads while level of education had four categories ranging from primary, secondary, tertiary and university. Distribution of drivers by place of residence was done to indicate their level of operation on the selected roads. The place of residence was considered important in establishing the influence of road infrastructure interventions and attitude of pedestrians concerning implementation of pedestrian safety rules. It was also important to seek information on drivers' experience over the years. The responses of drivers are shown in Table 4.3.

Table 4.3: Demographic Characteristics of Drivers (N=100)

Characteristics respondents		**Frequency**	**Percent**
	Female	23	23.0
Gender	Male	77	77.0
	Total	**100**	**100.0**
Age(years)		**Frequency**	**Percent**
	Below 20	4	4.0
	Between 20 & 29	26	26.0
	Between 30 & 39	38	38.0
	Between 40 & 49	21	21.0
	Between 50 & 59	10	10.0
	60 years and above	1	1.0
	Total	**100**	**100.0**
Residence		**Frequency**	**Percent**
	Rural	12	12.0
	Peri-urban	46	46.0
	Core urban	41	41.0
	Sub-total	99	99.0
	Missing	1	1.0
	Total	**100**	**100.0**
Educational level		**Frequency**	**Percent**
	Primary	13	13.0
	Secondary	26	26.0
	Tertiary	16	16.0
	University	45	45.0
	Total	**100**	**100**

Out of 100 drivers who participated in this study, 77(77.0%) were male and 23(23.0%) were female. The high number of male drivers sampled in this study implied that the job of driving is still male dominated. On age of respondents, the most typical age group for drivers in the sample was 38(38.0%) who fell in the age bracket of 30-40 years. 26(26.0%) fell in the age bracket of 20-30 years, 21(21.0%) fell in the age bracket of 40-50 years. The age group with the lowest number of drivers in the sample was 1(1.0%) whofell in the age bracket of 60-70 years.This suggested that drivers who had retired from active service were very few on the urban roads. A similar outcome was observed for drivers below 20

years who accounted for only 4(4.0%) of the drivers. On place of residence as a demographic characteristic, out of the 100 drivers who constituted the sample, 46(46.0%) lived in the peri-urban area and 41(41.0%) lived in the core urban area. Only 12(12.0%) lived in rural locations. This indicated that 87(87.0%) of drivers lived within easy reach of the city and its immediate environs and so were conversant with the road environment and in a better position to implement pedestrian safety rules. On the educational level, the highest proportion of drivers was that of university graduates 45(45.0%). This was followed by those with secondary education 26(26.0%), tertiary education 16(16.0%) and primary education 13(13.0%), in that order. Given that more than 70% of the drivers were well educated, it implied that their level of education was adequate to enable them implement pedestrian safety rules.

The study also sought information on drivers' experience. The results showed that this ranged from less than 1 year to 31 years, with a mean of 8.7 years (SD=6.5 years). The most typical driving experience was 5 years. The drivers were asked to indicate the period in months when they did not drive prior to data collection(Gray et al.,2015). Table 4.4 shows the responses of the drivers on driving experience.

Table 4.4: Showing Driving Experience in Years

Driving Experience(years)		
	Mean	8.69
	Mode	5
	Standard Deviation	6.463

The period in which respondents did not drive in the past 12 months is presented in Table 4.5.

Table 4.5: Period in which respondents did not drive in the 12 months before data collection

Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Number of drivers	11(11%)	2(2%)	2(2%)	6(6%)	5(5%)	2(2%)	2(2%)	_	1(1.0%)	1(1.0%)	_	3(3%)

The study found that in the month of January 11(11.0%), most of the drivers did not drive. This was followed by the months of April6(6.0%) and May 5(5%), in that order. No

drivers indicated the months of August and November, as the period in which they did not drive (Table 4.5).

The drivers were asked to indicate the day of the week when least driving took place prior to data collection. Table 4.6 shows the day of the week when least driving took place.

Table 4.6: Day of the week when least driving took place

Mon	**Tue**	**Wed**	**Thursday**	**Fri**	**Sat**	Sun
F %	F %	F %	F %	F %	F %	F %
13(13%)	2(2.0%)	6(6.0%)	2(2.0%)	5(5.0%)	10(10%)	38(38%)

The result demonstrated that least driving took place on Sunday at 38% followed by both Tuesday and Thursday at only 2% when drivers took leave from driving. This implies that most drivers took time off the road on Sunday hence least driving was registered on urban roads in the City of Kisumu on Sunday. This would probably allow them time to rest which was vital for implementation of pedestrian safety rules.

4.3.2.1 Use of phone while driving as a behavioural characteristic of drivers

It was important to assess the influence of drivers using the phone on implementation of pedestrian safety rules. The drivers were further asked to indicate whether they talked on phone or not while driving (Munala and Maina,2010). The findings are shown in table 4.7.

Table 4.7: Drivers' response on whether they talked on phone while driving or not

Talked on phone	**Frequency (n)**	**(n %)**
Yes	38	38.7%
No	60	61.3%
Total	98	100

Out of 98 drivers who responded when asked whether they talked on phone or not in a day while driving, 38(38.7%) were in the affirmative and 60(61.3%) said they did not talk on phone while driving as shown in Table 4.7.This implies that majority of respondents did not talk on phone while driving.

The drivers were also asked to indicate the number of times in a day they used their phones while driving. Table 4.8 shows the number of times drivers used their phones in any one day when driving.

Table 4.8: Number of Times Drivers Talked on Phone in a Day while Driving

Number of times on phone	Frequency (N)	Percent (%)
1	3	13.04
2	8	34.78
3	2	8.69
4	5	21.74
5	1	4.35
6	1	4.35
10	2	8.70
12	1	4.35
Total	**23**	100.0

The most frequent number of times drivers talked on phone while driving was twice, with a frequency of 8(34.78%). This was followed by four times with a frequency of 5(21.74%) and then once with a frequency of 3 times (13.04%). This implies that drivers did not implement pedestrian safety rules by talking on phone while driving which distracted their attention on the road. Consequent to the above findings, a χ^2 analysis was used to test whether talking on phone while driving was related to having an accident. Table 4.9 is a cross-tabulation for "talking on phone while driving" by "having accident in the last 12 months".

Table 4.9: Cross tabulation "talking on phone while driving with havingan accident in the last 12 months"

			Had accident in the last 12 months		**Total**
			Yes	**No**	
Talking on phone while driving	Yes	Count	6	31	**37**
		% within "Talking on phone while driving"	16.2%	83.8%	**100%**
		% within "Had accident in the last 12 months"	37.5%	38.8%	**38.5%**
	No	Count	10	49	**59**
		% within "Talking on phone while driving"	16.9%	83.1%	**100%**
		% within "Had accident in the last 12 months"	62.5%	61.3%	**61.5%**
Total		Count	16	80	**96**
		% within "Talking on phone while driving"	16.7%	83.3%	**100%**
		% within "Had accident in the last 12 months"	**100%**	**100%**	**100%**

The study indicates that out of a total of 37 drivers who talked on phone while driving, 31 drivers had no accident in the last 12 months while 6 drivers who had talked on phone while driving, had an accident in the last 12 months. On the other hand, 49 drivers who did not talk on phone while driving had had no accident in the last 12 months while 10 drivers who had talked on phone while driving had an accident in the last 12 months.

The observed value of χ^2 based on the above cross tabulation was .009 (*df* =1) with a 2-sided asymptotic significance of .925. This finding suggests that having an accident is not contingent upon use of a mobile phone while driving (α=.05).Therefore, there seems to be other things that may influence implementation of pedestrian safety rules apart from talking on phone while driving. However, there is need to take measures to control driving while talking on phone since it is likely to have a negative influence on implementation of pedestrian safety rules. A respondent interviewed on Jomo Kenyatta Highway had this to say on drivers' use of phone while driving

> *"Although drivers claim they are not distracted by phones while driving, most accidents occur when they are either talking on phone or texting." Shoe vendor, Jomo Kenyatta Highway.*

This quote therefore means that talking on phone or texting while driving should be curbed or addressed for effective implementation of pedestrian safety rules and drivers should observe that for safe driving.

4.3.2.2 Number of drivers who had an accident in the last 12 months

Implementation of pedestrian safety rules depends on drivers' ability to drive safely. The drivers were asked to indicate the number of times they had been involved in an accident in the last 12 months. Table 4.10 shows the number of drivers who had an accident in the last 12 months.

Table 4.10: Number of drivers who had an accident in the last 12 months

Response on number of accidents	Frequency (n)	n%
Yes	16	16
No	81	81
Missing	3	3
Total	100	100

A total of 16 (16.0%) drivers indicated that they had an accident in the last 12 months. This was against a total of 81 drivers (81%) who had no accident in the last 12 months. Thus, the majority of drivers had no accident in the last 12 months. Given that 16 out of 23 respondents indicated having beeninvolved in accidents, the high number of accidents is likely to have far reaching consequences on implementation of pedestrian safety rules if not managed. There was therefore need to have strict rules on use of phones while driving. This would enhance implementation of pedestrian safety rules.

4.4 Tests of Statistical Assumption Analysis of Likert-type Data

This section explores the significance of multi-collinearity in regression analysis, the different methods of remedying multicollinearity situations and test results for multicollinearity analysis. The section further discusses the use of Likert scale in data analysis.

4.4.1 Test for Multi-Collinearity of Independent Variables

Multi-Collinearity is defined as a situation where at least two independent variables in a statistical model are linearly related such that the correlation coefficient(r) is either greater or less than zero (Alin, 2010). This signifies the non-independence of predictor variables especially in regression type analysis. Multicolinearity, occurs if more than two and above independent variables are interrelated.Multicolinearity exists in all studies except in designed experiments. Researchers are more concerned with the impact on the analysis than its presence (Baguley, 2012). Pedace (2013) states that multicollinearity has a significant impact only when correlation coefficient of the inter-related independent variables is equal to or greater than 0.8 whereas multicollinearity does not affect the overall regression model and associated statistics such as p values and R^2 or the general predictions made using the overall model.

In this study,the independent variables were public education on road safety,road engineering design,enforcement of traffic laws,pedestrian demographic factors and attitude of pedestrians.In this study, pairwise collinearity of the independent variable was performed and the resultant correlation matrix is presented on Table 4.11.

Table 4.11: Multi-collinearity Matrix of Independent Variables

	Public Education on road safety	Road Engineering designs	Enforcement of traffic laws	Pedestrian demographic factors	Attitude of pedestrians
Public Education on road safety	1.000	0.070	0.227	0.145	0.050
Road engineering designs	0.070	1.000	0.150	0.118	0.130
Enforcement of traffic laws	0.227	0.150	1.000	0.068	0.346
Pedestrian demographic factors	0.145	0.118	0.068	1.000	0.066
Attitude of pedestrians	0.050	0.130	0.346	0.066	1.000

From the findings in Table 4.11, public education had a Pearson product moment correlation (R) of 0.07 with road engineering design,0.23 with enforcement of traffic laws,0.145 with pedestrian demographic factors and 0.05 with attitude of pedestrians.This shows that none of the independent variables had multi-collinearirty effect with public education on road safety.

Road engineering design on a similar note, had a correlation (R) of 0.15,0.118 and 0.13 with enforcement,pedestrian demographic factors and attitude of pedestrians respectively thus no multicollinearity effect since R<0.8.As for enforcement of traffic laws,there was a correlation of 0.068 and 0.346 with pedestrian demographic factors and attitude of pedestrians respectively thus no multicollinearity effect. Similarly,pedestrian demographic factors had a correlation of 0.066 with attitude of pedestrians.

Overall,the correlation between the independent variables were low with the highest being the correlation between enforcement of traffic laws and attitude of pedestrians which was 0.346. This indicated that all the correlations were below the threshold of 0.8.Consequently,it was possible to assess the individual effect of the independent variables on the dependent variable.The result does not reveal large pairwise collinearities ($r<0.8$).

4.4.2 Analysis of Likert-scale Data

The study used a questionnaire to collect quantitative data. The questionnaire was designed in a Likert format and organized into groups each addressing one of the six variables under study (Frauke et al., 2008,Misigah,Kinyanjui and Ohaya,2011). Each Likert item generated a response from an ordinal 5 point Likert response categories, strongly disagree=1, Disagree=2, neutral=3, Agree=4 and strongly Agree=5. For each variable, a composite score was generated by summing up the scores of the 5 Likert items extricating a particular variable to create an interval Likert scalewith lowest score of 5 and maximum of 25 (Cariffio and Perla, 2007; Maurer and Pierce, 1998).

The combinations were adjusted slightly to ensure that each category had sufficient data (cases) to enable application of the simple regression model. For the dependent variable, implementation of pedestrian safety rules, a category was created to measure it as an outcome variable. The data was then subjected to parametric tests such as Pearson Product Moment Correlation and Multiple Regression Analysis. As Cariffio and Perla (2007) and Creswell (2008), pointed out, parametric tests can be performed on summed up scores of Likert scale data (that assumes interval scale) provided that the data is of appropriate shape and size and multiple categories are developed within a scale with equality of variance. While agreeing with them on the application of the methods on Likert data, Norman (2010) demonstrated that sample sizes, normality, singularity, heteroscedasticity and phericity and ordinal-level measurement could not hinder the use of parametric methods due to their robustness. Norman (2010) thus concludes that the methods could be used without fear of reaching the wrong conclusion.

4.5 Descriptive Statistics on Road Infrastructure Interventions

In this section, pedestrian views on road infrastructure interventions are presented. In particular, their findings on public education on road safety, road engineering design, and enforcement of traffic laws, pedestrian demographic factors and attitude of pedestrians as a moderating variable on implementation of pedestrian safety rules are presented.

4.5.1Public Education on Road Safety and Implementation of Pedestrian Safety Rules

Public education on road safety is a road infrastructure intervention aimed at enhancing implementation of pedestrian safety rules.Public education on road safety as a requirement for pedestrians was indicated by road safety awareness,knowledge of the traffic act and children's traffic park in this study.

4.5.1.1 Pedestrians view on public education on road safety and implementation of pedestrian safety rules

In this section, results on the first objective that sought the pedestrians' view on public education on road safety as a road infrastructure intervention is presented. One of the items developed to measure pedestrians' view of public education on road safety was concerned with whether publicity and advertising about road safety should be increased. The respondents were requested to respond to statements on a five point Likert scale of 1-5 where 1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree. The responses for pedestrians are given in Table 4.12.

Table 4.12: Public Education on Road Safety and Implementation of Pedestrian Safety Rules

Statements	SA	A	N	D	SD	Mean	Std.Dev
1.Publicity and advertising should be increased	131(65.5%)	57(28.5%)	3(1.5%)	3(1.5%)	6(3.0%)	4.52	0.856
2.Increasing knowledge of the Traffic Act	135(67.5%)	45(22.5%)	6(3.0%)	4(2.0%)	10(5.0%)	4.455	1.016

On statement 1, which was that publicity and advertising about road safety be increased, the majority of respondents 131(65.5%) strongly agreed that publicity and advertising about road safety should be increased. This was followed by 57(28.5%) who agreed with the statement. Only 6(3.0%) strongly disagreed with the statement. From this outcome, it is evident that pedestrians believed that publicity and advertising about road safety was inadequate. Statement 2 was concerned with pedestrians' view concerning their knowledge of the Traffic Act. On this point,the majority 135(67.5%) strongly agreed that

their knowledge in this important area should be increased. Only 10(5.0%) strongly disagreed with the statement.

In order to establish pedestrians' overall view of the level of public education on road safety, the mean value for the responses in the items were calculated. The findings were based on a scale of 1 to 5 where 1 was the lowest level of public education on road safety while 5 was the highest level of public education on road safety. The distribution was positively skewed (Skewness =2.27) with a mean of 4.52. Thus, pedestrians' level of public education on road safety was below average.

4.5.1.2 Drivers' view on Public Education on Road Safety

Ten statements were used to measure drivers' perception on public education on road safety on a five point Likert scale of 1-5 where 1=Never, 2 = Rarely, 3=sometimes, 4=Often, 5=Very Often. Table 4.13 shows the responses for each of the 10 statements.

Table 4.13: Drivers' Responses on Public Education on Road Safety

Statement	Very often		Often		Sometimes		Rarely		Never		Mean	Std. Dev
	F	%	F	%	F	%	F	%	F	%		
Driving when too tired	13	13	14	14	35	35	26	26	12	12	2.9	.185
Driving when drunk	37	37	15	15	9	9	9	9	30	30	3.2	.706
Driving too close to a pedestrian in front	16	16	20	20	23	23	25	25	16	16	2.95	.321
Breaking speed limit on urban roads	23	23	24	24	23	23	18	18	12	12	3.28	.326
Driving after taking drug which impairs ability	15	15	13	13	28	28	21	21	23	23	2.76	.349
Bad weather leading to poor visibility for pedestrians	15	15	23	23	33	33	20	20	8	8	3.17	.161
Driving defective vehicle	25	25	20	20	23	23	19	19	13	13	3.25	.366
Driver's poor vision	18	18	25	25	23	23	25	25	9	9	3.18	.250
Bad road signboard	24	24	27	27	27	27	18	18	4	4	3.49	.159

The findings on Table 4.13 indicate that statement 1 which required drivers to express their knowledge of public education on road safety based on whether more pedestrian accidents occurred when they drove when too tired had 13(13%) respondents indicating that quite often they drove when too tired, 14(14%) often, 35(35%) sometimes, 26(26%)

rarely drove when too tired and 12(12%) never drove when too tired. This implied that the majority of the drivers drove when too tired and probably that was the reason why implementation of pedestrian safety rules was low leading pedestrian accidents. Statement 2 required drivers to indicate if they drove when drunk, in response to this 37(37%) responded that they drove when drunk very often, 15(15%) often drove when drunk, 9(9%) were sometimes drunk, 9(9%) rarely drove when drunk, 30(30%) never drove when drunk. Statement 3 which was on driving too close to a pedestrian in front16(16%) indicated that they very often drove close to a pedestrian in front, 20(20%) often drove close to a pedestrian in front, 23(23%) sometimes drove close to a pedestrian in front, 25(25%) rarely drove close to a pedestrian in front, 16(16%) never drove close to a pedestrian in front. Statement 4 which was on breaking speed limits on urban roads 23(23%) stated that, very often, they broke speed limits on urban roads, 24(24%) often, 23(23%) sometimes broke a speed limit on urban roads,18(18%) rarely broke the speed limit on urban roads, 12(12%) never broke the speed limit on urban roads.

Statement 5, which was on driving after taking drug which impairs ability revealed that 15(15%) drivers very often drove after taking drugs, 13(13%) often drove after taking drugs, 28(28%) sometimes drove after taking drugs, 21(21%) rarely drove after taking drugs, 23(23%) never drove after taking drugs. Statement 6 which was on bad weather leading to poor visibility for pedestrians had 15(15%) who very often drove on bad weather with poor visibility, 23(23%) often, 33(33%) sometimes, 20(20%) rarely, 8(8%) never. Statement 6, which was driving a defective vehicle,had a mean of 3.25 and a standard deviation of .0366. This results indicate that the majority of the respondents 25(25%) admitted they very often drove a defective vehicle, 20(20%) often, 23(23%) sometimes, 19(19%) rarely and 13(13%) never drove a defective vehicle. Statement 7, which was drivers' poor vision had a mean of 3.18 and a standard deviation of .250.This results indicate that the majority of the respondents 25(25%) drove with a poor vision, 18(18) often, 23(23%) sometimes, 25(25%) rarely and 9(9%) never. Statement 8, which was bad road signboard, had a mean of 3.49 and a standard deviation of .159. This results indicate that the majority of the respondents 27(27%) often, 27(27) sometimes, 24(24%) very often, 18(18%) rarely and 4(4%) never used bad road signboard.

Summatively, based on the drivers attitude and how they perceived public education on road safety the most important factor perceived by drivers to contribute to increasing number of pedestrian accidents in the City of Kisumu was bad road signboard (Mean=3.49). This was followed by breaking the acceptable speed limit allowed on roads in urban areas (Mean=3.28), driving defective vehicle (Mean=3.25), driving when drunk (Mean=3.20) and bad weather leading to poor visibility for pedestrians (Mean=3.17), in that order. However, the respondents indicated that these did not happen very often. Rather, they happened sometimes or often. On the other hand, the factors which were perceived to contribute rarely or sometimes to increasing number of pedestrian accidents in the City of Kisumu were quality of pavement surface, driving after taking drugs which impairs ability, driving too close to a pedestrian in front and driving when too tired. This implied that public education on road safety was vital to implementation of pedestrian safety rules. Drivers' views on public education on road safety were in agreement to the pedestrian views on the same showing that public education on road safety in the City of Kisumu should be improved.

Knowledge of the Traffic Act as an indicator of public education on road safety by drivers was tested using 6 statements, withstatement 1 being the legal limit of alcohol, statement 2 overlapping/obstruction/driving on pavement or through a petrol station, statement 3 over speeding, statement 4 causing death through careless driving, statement 5 driving under the influence of alcohol and statement 6 which was on eye testing for licensed drivers. Table 4.14 shows the number of drivers who responded to the question on the legal limit of alcohol for drivers. 82% of the drivers gave a wrong answer with only 8 % giving a correct one. This shows the extent of drivers' lack of knowledge regarding the limit of alcohol when driving which would negatively influence implementation of pedestrian safety rules if the level of knowledge of the Traffic Act is not raised.

Table 4.14: Drivers' View on Public Education on Road Safety

Statements	Responses			
	Yes	No	Missing	Total
Driver's knowledge of the legal limit of alcohol (0.8mg/ml)	8(8%)	82(82%)	10	100
Driver's response on whether overlapping/obstruction/driving on pavement/petrol station to avoid traffic is a traffic offence	13(13%)	85(85%)	2	100

When asked whether overlapping, obstruction, driving on pavement or through a petrol station to avoid traffic is not an offence, 85% of the drivers gave the correct response as shown in Table 4.14. This indicated that the majority of drivers were aware that overlapping, obstruction, driving on pavement or through a petrol station to avoid traffic was indeed an offence. This may imply that the drivers' attitude to implementation of pedestrian safety rules was negative hence their impunity in implementing the pedestrian safety rules.

Therefore, apart from lack of knowledge of the legal limit of alcohol when driving, drivers were reasonably knowledgeable with regard to the Traffic Act. This implied that improving public education on road safety through knowledge of the Traffic Act would probably increase implementation of pedestrian safety rules.

4.5.2 Road Engineering Design

Road engineering design is a road infrastructure intervention aimed at enhancing implementation of pedestrian safety rules. Road infrastructure provision is the main requirement for road safety in urban environments for pedestrians. Road engineering design in this study was indicated by adequacy of sidewalks, pavements and zebra crossings.

4.5.2.1 Pedestrians' View on Road Engineering Design

The second objective sought pedestrians' views on road engineering designs, specifically adequacy of such as sidewalks, pavement and zebra crossings. It was important to get information on adequacy of pedestrian facilities to ascertain the extent to which it influenced implementation of pedestrian safety rules. The three statements developed to measure the road engineering design-adequacy of pedestrian facilities were quality of design of zebra crossing, suitability of the width of sidewalks and pavement quality. The respondents were requested to respond to statements on a five point Likert scale of 1-5 where 1=very poor, 2=poor, 3=Average, 4=Good, 5=Very good. Statement 1, 2 and 3 and their responses are presented in Table 4.15.

Table 4.15: Pedestrians' View on Road Engineering Design-adequacy of Pedestrian Facilities

Statements	Very good	Good	Average	Poor	Very poor	Mean	Std. Dev
Quality of design of zebra crossing is good	34(17.0%)	55(27.5%)	51(25.5%)	22(11.0%)	37(18.5%)	3.14	1.343
	SA	**A**	**N**	**D**	**SD**	**Mean**	**Std.Dev**
Width of side walk is suitable for pedestrians	18(9.0%)	91(45.5%)	10(5.0%)	22(11.0%)	58(29.0%)	2.94	1.450
Pavement quality is good	6(3.0%)	85(42.5%)	15(7.5%)	24(12.0%)	70(35.0%)	2.67	1.401

Three statements developed to measure pedestrians view on adequacy of pedestrian facilities were, Statement 1 which stated that quality of design of zebra crossing is good had a mean 3.14 and standard deviation of 1.343. Out of the 200 respondents who participated in the study, 34(17.0%) agreed that the quality of road design was very good, 55(27.5% as good, 51(25.5%) average, while 22(11.0%) stated that the quality of road design was poor and 37(18.5%) very poor respectively. This implied that the pedestrians' view on quality of zebra crossing in the City of Kisumu was summatively good from the views of a majority 140 pedestrians out of the 200 pedestrians who scored average and above. Statement 2 which stated that the width of the sidewalk was suitable for pedestrians had a mean of 2.94 and a standard deviation of 1.450. Out of the 200 who responded to the question, 18(9.0%) strongly agreed that the width of the sidewalks was suitable for the pedestrians, 91(45.5%) agreed, 10(5.0%) were neutral or undecided on whether the width of the sidewalks was suitable for the pedestrians, 22(11.0%) respondents disagreed and 58(29.0) strongly disagreed. Statement 3 which stated that pavement quality was good had a mean of 2.67 and standard deviation of 1.401. Out of a possible 200(100%)respondents, 6(3.0%) strongly agreed, 85(42.5%) agreed, 15(7.5%) neutral or undecided, 24(12.0%) disagreed and 70(35.0%) strongly disagreed. On a scale of 1 to 5, the only item in which the mean was above 3 was "quality of design of zebra crossing is good" with a mean of 3.14 followed by "width of sidewalk is suitable for pedestrians" with a mean of 2.94. "Pavement quality is good" was third with a mean of 2.67. Notwithstanding the findings so far stated on each of the items, pedestrians' overall view of the quality of road

engineering design was measured by mean values for the responses in the items. The distribution is near normal (Skewness = -0.29) with a mean of 2.9150 suggesting that in general, pedestrians' rating of road engineering design was average.

4.5.2.2 Drivers' view on the Influence of Road Engineering Design on Implementation of Pedestrian Safety Rules

Road engineering design for drivers had three statements which asked the extent to which they agreed or disagreed with statements on road engineering design in the City of Kisumu, and five statements regarding drivers' opinion on issues about roads in the City of Kisumu.

The three statements were rated on a five point Likert scale of 1-5 in which 1 was =strongly disagree, 2= disagree, 3 = Neutral, 4 = Agree and 1 = strongly agree. Table 4.16 shows the drivers responses to the items.

Table 4.16: Drivers' Level of Agreement with Road Engineering Design Statements

Statements	SA	A	N	D	SD	Mean	Std Dev
It is important to improve road condition	87(87%)	10(10)	0(0%)	1(1%)	2(2%)	1.21	0.686
There is need to improve road lighting	78(78%)	17(17%)	3(3%)	1(1%)	1(1%)	1.30	0.674
It is necessary to construct underground passages and bridges for pedestrians	46(46%)	21(21%	9(9%)	7(7%)	17(17%)	2.28	1.518

In general, majority of drivers either disagreed or strongly disagreed with the statements. In particular, with reference to importance of improving road conditions for pedestrian use in the City of Kisumu, 87(87%) strongly agreed while 10% agreed. With reference to the need to improve road lighting, 78(78%) strongly agreed while 21(21%) agreed. Lastly, with reference to the necessity to construct underground passages and bridges for pedestrians, 46(46%) strongly agreed and 21(21%) agreed. Drivers were generally in agreement that road engineering design in the City of Kisumu should be improved to enhance implementation of pedestrian safety rules.

4.5.2.2.1 Drivers' Opinion Regarding Roads in the City of Kisumu

Drivers were further asked five statements on road engineering designs that focused on the driver's opinion about roads in the City of Kisumu. This was on a five point Likert scale of 1-5 where 1 was =Very bad, 2 was =Bad, 3 was =Fair, 4 was= Good and 5 was =Excellent. The results are presented in Table 4.17.

Table 4.17: Drivers' Opinion Regarding Issues on Roads in the City of Kisumu

	Very bad	Bad	Fair	Good	Excellent	Mean	Std Dev
Pavement quality	27(27%)	40(40%)	27(27%)	5(5%	1(1%)	2.13	0.906
Pedestrian facilities	39(39%)	37(37%)	20(20%)	4(4%)	0(0%)	1.89	0.863
Road width, roundabout circumference and lighting	31(31%)	39(39%)	24(24%)	3(3%)	3(3%)	2,08	0.971
Adequacy of sidewalks	32(32%)	42(42%)	21(21%)	2(2%)	3(3%)	2.02	0.943
Traffic lines and signs	55(55%)	26(26%)	13(13%)	4(4%)	2(2%)	1.71	0.983

A total of 27 drivers (27%) indicated that pavement quality was very bad while 40(40%) indicated that it was bad. Only 1 driver (1%) rated pavement quality as excellent. Similarly, 39 drivers (39%) observed that pedestrian facilities were very bad, 37(37%) noted they were bad while 20(20%) saw them as fair. Only a paltry 4% indicated that pedestrian facilities were good. No driver rated pedestrian facilities as excellent.

Drivers indicated that road width, roundabout circumference and lighting were inadequate with 31 drivers (31%) rating it as very bad, 39(39%) bad and 24(24%) fair. Only 3(3%) rated it as good and 3(3%) as excellent. This is in agreement with Dumbaugh and Ewing, (2009) findings that narrow streets have an effect on driver behaviour as it forces them to drive cautiously on narrow streets. Sidewalks were rated by drivers as inadequate. In particular, 32(32%) rated the adequacy of sidewalks as very bad, 42(42%) as bad and 21(21%) as fair. Traffic lines and signs were no exception with the majority of drivers (55%) rating it as very bad, 26(26%) as bad and 13(13%) as fair. This implies that drivers felt that pedestrian facilities were inadequate as far as implementation of pedestrian safety rules were concerned hence the need to improve them.

4.6 Enforcement of Traffic Laws

Enforcement of traffic laws is an important component of pedestrian safety on the road. Pedestrian view on enforcement of traffic laws as a road infrastructure intervention was therefore sought using items presented as statements.

4.6.1 Pedestrians' View on Enforcement of Traffic Laws

Three items were used to measure this variable. These were "I am law abiding", "Drivers should be fined for causing risky behavior" and "Quality of pedestrian safety enforcement". Table 4.18 shows pedestrians' response regarding these items on a scale of 1-5 where 1 = strongly disagree, 2= disagree, 3=Neutral, 4=agree, 5=strongly agree.

Table 4.18: Enforcement of Traffic Laws

Statement	SA	A	N	D	SD	Mean	Std.Dev
I am law abiding	84(42.0%)	86(43.0%)	21(10.5%)	(3.5%)	(1.0%)	4.215	0.844
Drivers should be fined for displaying risky behavior on the road	119(59.5%)	64(32.0%)	6(3.0%)	5(2.5%)	5(2.5%)	4.425	0.874

Those who strongly agreed with the statement "I am law abiding" were 84(42.0%) while those who agreed were 86(43.0%). A very small proportion 2(1.0%) strongly disagreed. Therefore, pedestrians in the City of Kisumu generally considered themselves as law abiding and so were likely to implement pedestrian safety rules.

Sometimes, drivers cause accidents through carelessness. When asked whether drivers should be fined for displaying risky behaviour on the road, the majority of pedestrians 119(59.5%) strongly agreed followed by 64(32.0%) who agreed as provided in Table 4.21. Only 5(2.5%) strongly disagreed with the statement. This is an indication that pedestrians were generally of the opinion that drivers should be fined for displaying risky behaviour on the road. Information also showed that an overwhelming majority of pedestrians (95.5%) supported the increase in quality of enforcement of traffic laws for pedestrians. This indicates that majority pedestrians were dissatisfied with the quality of enforcement of traffic laws in the City of Kisumu.

In order to establish pedestrians' overall view of enforcement of traffic laws, the mean values for the responses in the items were calculated and the summary of findings shows that the distribution was negatively skewed (Skewness = -1.39), with a mean of 3.8825. This suggests that in general, pedestrians' rating of enforcement of traffic laws was above average.

4.6.2 Drivers' views on Enforcement of Traffic Laws and Implementation of Pedestrian Safety Rules

Enforcement of traffic laws for drivers had 4 sub themes with a total of 16 statements. Four statements were on road usage, four were on drivers' opinion regarding issues about roads, three were on drivers' opinion regarding issues about drivers as road users, and five were on drivers' view about traffic police in the city of Kisumu. The results on drivers' opinion on statements regarding road usage are presented on Table 4.19.

Table 4.19: Drivers' Opinion on Statements regarding Road Usage

Statements	SA	A	N	D	SD	Mean	Std Dev
Drivers who break traffic rules make me angry	53(53%)	40(40%)	4(4%)	1(1%)	2(2%)	4.41	0.793
I am worried when family member is driving	12(12%)	21(21%)	19(19%)	35(35%)	13(13%)	3.16	1.245
There is need for more enforcement of traffic laws	59(59%)	30(30%)	5(5%)	2(2%)	4(4%)	1.62	0.972
Pedestrians violate traffic rules more than drivers	19(19%)	26(26%)	18(18%)	24(24%)	13(13%)	2.86	1.333

The study results on drivers' opinion regarding statements on road usage as presented in Table 4.19 indicate that the majority of drivers 53(53%) strongly agreed that drivers who broke traffic rules angered them. This was followed by 40(40%) of the drivers who agreed with the statement. A similar outcome was observed by 59(59%) who strongly agreed that there was need for more enforcement of traffic laws while 30(30% agreed with the statement.

4.6.2.1 Drivers' Views on Issues about Roads

Drivers' views on issues about roads were important to ascertain their role on implementation of pedestrian safety rules. The drivers were asked to indicate their views on issues about roads which were on driver traffic behaviour, pedestrian behaviour, traffic control and behaviour of traffic police. In response to this, the drivers' traffic behaviour was rated poorly, with 40(40%) indicating that their behaviour was fair, 33(33%) bad and 13(13%) very bad. Only a paltry 3(3.0/%) indicated that drivers' behaviour was excellent while 11(11%) saw their behaviour as good. Similar to this was the fact that only 12(12%) of the drivers thought that pedestrians displayed good behaviour. The rest thought that pedestrian behaviour was fair 47(47%), bad 27(27%) or very bad 14(14%). This trend was maintained for traffic control and behaviour of traffic police as indicated in Table 4.20.

Table 4.20: Drivers' Views on Issues about Roads

Statements	Very bad	Bad	Fair	Good	Excellent	Mean	Std Dev
Drivers traffic behaviour	13(13%)	33(33%)	40(40%)	11(11%	3(3%)	2.58	0.955
Pedestrian behaviour	14(14%)	27(27%)	47(47%)	12(12%)	0.0	2.57	0.879
Traffic control	26(26%)	42(42%)	21(21%)	8(8%)	3(3%)	2.20	1.015
Behaviour of traffic police	40(40%)	29(29%)	23(23%)	5(5%)	3(3%)	2.02	1,054

These findings indicate that whereas drivers' traffic behaviour and pedestrian behaviour were considered satisfactory, traffic control and behaviour of traffic police were poorly rated. This implies that if both driver and pedestrian behaviour is maintained, the implementation of pedestrian safety rules may be enhanced. However, enforcement of traffic laws on roads needs to be improved to implement pedestrian safety rules.

4.6.2.2 Drivers' Opinion Regarding Issues about Drivers as Road Users

The study also sought the opinion of drivers on implementation of pedestrian safety rules.The results are presented in Table 4.21.

Table 4.21: Drivers' Opinion Regarding Issues about Drivers as Road Users

Statements	Very bad	Bad	Fair	Good	Excellent	Mean	Std Dev
Driver's ability to drive safely	8(8%)	7(7%)	42(42%)	39(39%	4(4%)	3.24	0.944
Driver's knowledge about traffic rules	10(10%)	24(24%)	40(40%)	23(23%)	3(3%)	2.85	0.989
Quality of driver's training	14(14%)	12(12%)	37(37%)	31(31%)	6(6%)	3.03	1.114

The most common rating for drivers' ability to drive safely, knowledge about traffic rules and quality of drivers' training was "Fair" at 42(42%) on ability to drive safely, 40(40%) on drivers' knowledge about traffic rules and 37(37%) quality of drivers' training respectively. This indicates a satisfactory opinion about drivers on implementation of pedestrian safety rules.

4.6.2.3 Drivers' View on Statements about Traffic Police

Drivers' view on statements about traffic police is presented in Table 4.22.

Table 4.22: Drivers' view on Statements about Traffic Police

Statements	SA	A	N	D	SD	Mean	Std Dev.
Traffic police work well	1(1%)	11(11%)	17(17%)	41(41%	30(30%)	2.12	0.998
Traffic police are too few to be effective	21(21%)	29(29%)	10(10%)	22(22%)	18(18%)	2.87	1.440
Traffic police discriminate	31(31%)	37(37%)	10(10%)	18(18%)	4(4%)	2.27	1.196
Behaviour of traffic police is good	6(6%)	9(9%)	20(20%)	34(34%)	31(31%)	2.25	1.169
Traffic police are corrupt	67(67%)	16(16%)	7(7%)	6(6%)	4(4%)	1.64	1.106

It is evident from Table 4.22 that 41% of the drivers were of the view that traffic police did not work well while 30% strongly disagreed with the statement. Very few either agreed (11%) or strongly agreed (1%) with the statement. On the other hand, 29% agreed that traffic police were too few to be effective, with 21% indicating that they strongly agreed with the statement.Concerning discrimination by traffic police, 37% of the drivers

agreed that there was discrimination while 31% agreed strongly with the statement. Only 18% disagreed and 4 % strongly disagreed with the statement.

Drivers' opinion on behaviour of traffic police was rated low, with 34% disagreeing with the statement that "the behaviour of traffic police is good". Close to this were 31% of the drivers who strongly disagreed with the statement. An overwhelming 67% of the drivers strongly agreed that traffic police were corrupt, while 16 % agreed with the statement that the traffic police were corrupt. This is an indication that most drivers held the view that traffic police were corrupt.

4.7 Pedestrian Demographic Factors

Pedestrian demographic factors as road infrastructure interventions were indicated by age, gender and pedestrian education level in this study.

4.7.1 Pedestrians Perspective on the Influence of Pedestrian Demographic Factors on Implementation of Pedestrian Safety Rules

In order to establish the influence of pedestrian demographic factors on implementation of pedestrian safety rules, the respondents were asked questions. Four statements were used to measure pedestrian demographic factors associated with implementation of pedestrian safety rules as illustrated in Table 4.23.

Table 4.23: Pedestrian Demographic Factors and Implementation of Pedestrian Safety Rules

Statements	SA	A	N	D	SD	Mean	Std.dev
1. You just need your feet to walk not education	35 (17.5%)	27(13.5%)	18(9.0%)	63(31.5%)	57(28.5%)	3.40	14.63
2. Level of education determines decisions made while using the roads	57(28.5%)	66(33.0%)	25(12.5%)	27(13.5%)	25(12.5%)	3.52	13.60
3. Female pedestrians are keen when using pedestrian crossing	54(27.0%)	51(25.5%)	32(16.0%)	39(19.5%)	24(12.0%)	3.36	13.75
4. My age makes it easy to use pedestrian crossing	42(21.0%)	87(43.5%)	25(12.5%)	27(13.5%)	19(9.5%)	3.53	12.32

Statement 1 required pedestrians to answer if they needed education to walk or just their feet. In response to this, out of the 200 respondents, 35(17.5%) strongly agreed, 27(13.5%) agreed, 18(9.0%) were neutral or undecided, 63(31.5%) disagreed 57(28.5%) strongly disagreed. Statement 2 was on whether pedestrian education level determined decisions made while using the road and out of the 200 respondents, 57(28.5%) strongly agreed, 66(33.0%) agreed, 25(12.5%) were undecided, 27(13.5%) disagreed and 25(12.5%) strongly disagreed. Statement 3 was on whether females were keener while using a pedestrian crossing. In response to this, out of 200(100%) respondents, 54(27.0%) strongly agreed, 51(25.5%) agreed, 32(16.0%) were undecided, 39(19.5%) disagreed and 24(12.0%) strongly disagreed. Statement 4 on whether age, as a factor, made it easy to use a pedestrian crossing 42(21.0%) strongly agreed, 87(43.5%) agreed, 25(12.5%) gave neutral responses or undecided, 27(13.5%) disagreed and 19(9.5%) strongly disagreed.

Mean responses to the four statements were all above average. The highest mean was for statement 4 which qualified age as a factor which makes it easy to cross a zebra crossing. This was followed by statement 2 on pedestrian education level as a determinant for decisions made while crossing a road. Thus, of all the pedestrian demographic factors, age was considered the most important factor when crossing a pedestrian crossing. Pedestrian education level as a determinant of decision making when crossing a road came second.

In order to establish pedestrian overall view on the association between pedestrian demographic factors and implementation of pedestrian safety rules, the mean values for the responses in the items were calculated and the distribution was slightly negatively skewed (Skewness = -0.52) with a mean of 3.4513. This suggests that, in general, the majority of pedestrians viewed pedestrian demographic factors as influencing implementation of pedestrian safety rules.

4.8 Overall Drivers' View on Road Infrastructure Interventions

The study sought the drivers' view on road infrastructure interventions which combines both engineering and behavioural interventions. It was, therefore, important to seek the views of drivers on public education on road safety, enforcement of traffic laws and implementation of pedestrian safety rules as summarized and presented in Table 4.24.

Table 4.24: Mean of Drivers' Views on Road Infrastructure Interventions (N=100)

Views of drivers on Road infrastructure interventions	Mean	Std. Deviation
View on public education on road safety	3.1180	0.8183
View on enforcement of traffic laws	1.8275	0.5344
View on implementation of pedestrian safety rules	3.5398	0.6142

The findings indicate that drivers' view was best on implementation of pedestrian safety rules at (Mean=3.5398, SD=0.6142) followed by view on public education on road safety (Mean=3.1180, SD=0.8183). Their view on enforcement of traffic laws was below average (Mean=1.8275, SD=0.5344).It could therefore be inferred that drivers were positive about implementation of pedestrian safety rules and public education on road safety. Drivers, however, expressed a negative opinion on enforcement of traffic laws.

4.9 Attitude of Pedestrians towards Implementation of Pedestrian Safety Rules

Attitude of pedestrians focused on the behaviour component of attitude that pedestrian's exhibit when they cross the road or while walking along the road. In order to establish the influence of attitude of pedestrians on implementation of pedestrian safety rules, respondents were asked a set of 10 statements. The respondents were furtherrequested to respond to 7 statements on a five point Likert scale of 1-5 where 1=strongly disagree, 2=disagree, 3=neutral, agree=4, strongly agree=5 for the first three statements.The next four statements were rated as never=1, rarely=2, Often=3, very often=4. Out of the 10 statements which measured attitude of pedestrians towards implementation of pedestrian safety rules, 7 statements in Table 4.25 received above average ratings.

Table 4.25: Attitude of Pedestrians towards Implementation of Pedestrian Safety Rules

Statements	SA	A	N	D	SD	mean	std.Dev
Crossing a street at night in a well-lit area.	106(53.0%)	71(35.5%)	6(3.0%)	9(4.5%)	7(3.5%)	4.31	0.986
Standing clear of buses, hedges, parked cars or obstacles before crossing a road	63(31.5%)	96(48.0%)	20(10.0%)	12(6.0%)	8(4.0%)	3.97	1.012
Always walking on the sidewalk where there is one.	65(32.5%)	53(26.5%)	62(31.0%)	17(8.5%)	3(1.5%)	3.80	1.037
		Very often	**Often**	**Rarely**	**Never**	**mean**	**std.Dev**
Wearing headphones while crossing a road		4(2.0%)	7(3.5%)	23(11.5%)	165(82.5%)	3.75	0.615
Using a mobile phone when crossing a road		3(1.5%)	5(2.5%)	49(24.5%)	140(70.0%)	3.65	0.608
Looking before crossing without relying solely on signals		103(51.5%)	71(35.5%)	20(10.0%)	6(3.0%)	33.36	0.782
Staying sober when walking near or crossing a road		103(51.5%)	67(33.5%)	19(9.5%)	10(5.0%)	3.32	0.845

The findings from the seven statements in Table 4.25 indicated that Statement 1 which was crossing a street at night in a well-lit area had a mean of 4.31 and a standard deviation of 0.986. These results indicate that the majority of respondents 79(39.5%) said that they rarely crossed a street at night in a well-lit area, 76(38%) responded with often and 30(15%) very often and lowest at 15(7.5%) who never crossed a street in a well-lit area. Statement 2 which was standing clear of bushes, hedges, parked cars or obstacles before crossing a road had a mean of 3.97 and a standard deviation 1.012.This result indicates that majority 96(48%) agreed, 63(31.5%) strongly agreed, 20(10%) were neutral while 12(6%) disagreed and 8(4%) strongly disagreed .This implies that pedestrians were keen on their own safety when using the road.

Statement 3, which was always walking on the sidewalk where there is one, had a mean of 3.80 and a standard deviation of 1.037.These results indicate, that the majority of the respondents 65(32.5%) strongly agreed, 62(31.0%) agreed, 53(26.5%)were neutral, 17(8.5%) disagreed and 3(1.5%) strongly disagreed. Statement 4, Wearing headphones while crossing a road had a mean of 3.75 and a standard deviation of 0.615. These results

indicate that the majority of the respondents 165(82.5%) never wore headphones while crossing the road, 23(11.5%) rarely used headphones, 7(3.5%) often wore headphones and the lowest was 4(2%) who wore headphones while crossing the road. Statement 5, using a mobile phone when crossing theroad had a mean of 3.65 and a standard deviation of 0.608. The majority of the respondents 140(70%) never used mobile phones while crossing the road, 49(24.5%) rarely used a mobile phone while crossing the road, 5(2.5%) often and the lowest was 3(1.5%) who claimed they very often used a mobile when crossing the road.

Statement 6, Looking before crossing without relying solely on signals had a mean of 3.36 and a standard deviation 0.782.Majority of respondents 103(51.5%) indicated that they very often looked before they crossed the road without relying solely on signals, 71(35.5%) often looked before they crossed the road, 20(10%) rarely looked before they crossed the road without relying on signals and the lowest was 6(3%) never looked before crossing without relying solely on signals. Statement 7, staying sober when walking near or crossing a road had a mean of 3.32 and a standard deviation of 0.845. Majority of respondents 103(51.5%) responded that they were sober when walking or crossing the road, 67(33.5%) often, 19(9.5%) rarely stayed sober and 10(5%) never stayed sober when walking or crossing the road. Summatively statement 1 had the highest mean of 4.31 and a standard deviation of 0.986.This implies that pedestrians implemented pedestrian safety rules in the City of Kisumu. Summatively, areas in which pedestrians showed a positive attitude towards safe use of the included crossing a street at night in a well-lit area, standing clear of buses, hedges, parked cars or obstacles before crossing a road, looking before crossing without relying solely on signals and staying sober when walking near or crossing a road. There were however, areas where pedestrians showed negative attitude towards safe use of the road such as wearing headphones while crossing a road, using mobile phones when crossing a road in addition to not carrying a flash light when walking at night and not crossing streets at marked cross walks. This negative attitude is however, likely to hinder implementation of pedestrian safety rules and therefore should be addressed. In order to establish the overall attitude of pedestrians towards implementation of pedestrian safety rules, the mean values for the responses in the statements was calculated .The results show that the distribution was negatively skewed (Skewness = -.61), with a mean of 3.4573 and SD=.4126. This implied that, in general, pedestrians'

attitude towards implementation of pedestrian safety rules was above average and therefore positive.

4.10 Implementation of Pedestrian Safety Rules

Implementation of pedestrian safety rules refers to perceived level of safety, level of pedestrian compliance with safety laws and pedestrian activity level as an outcome variable.

4.10.1 Pedestrians' View on Implementation of Pedestrian Safety Rules

Five statements were used to measure implementation of pedestrian safety rules as illustrated in Table 4.26.

Table 4.26: Implementation of Pedestrian Safety Rules

No. Statement	SA	A	N	D	SD	mean	std. Dev
1. I obey traffic rules when walking along the road	82(41.0%)	90(45.0%)	14(7.0%)	7(3.5%)	7(3.5%)	4.17	0.955
2. The engineers should ensure safety is in-built on the roads for pedestrians	122(61.0%)	64(32.0%)	7(3.5%)	5(2.5%)	2(1.0%)	4.49	0.770
3. The level of road safety awareness improves implementation of pedestrian safety rules	123(61.5%)	66(33.0%)	6(3.0%)	4(2.0%)	1(0.5%)	4.53	0.701
4. Age is critical in implementing pedestrian safety rules	61(30.5%)	81(40.5%)	16(8.0%)	21(10.5%)	21(10.5%)	3.70	1.292
5. Female pedestrians follow regulations relating to implementation of pedestrian safety rules always	40(14.5%)	52(18.5%)	42(21.0%)	37(26.0%)	29(20.0%)	3.19	1.342

The five statements from Table 4.26 on implementation of pedestrian safety rules were:

"I obey traffic laws when walking along the road", "the engineers should ensure safety is in-built on the roads for pedestrians", "the level of road safety awareness improves implementation of pedestrian safety rules", "Age is critical in implementing pedestrian

safety rules and female pedestrians follow regulations relating to implementation of pedestrian safety rules always".

Statement 1, which was "I obey traffic rules when walking along the road" had a mean of 4.17 and a standard deviation of 0.955. The results indicate that the majority of respondents 90(45%) agreed that they obeyed traffic rules while walking along the road, 82(41.0%) strongly agreed 14(7.0%), 7(3.5%) disagreed and 7(3.5%) strongly disagreed with the statement.

Statement 2, on whether the engineers should ensure safety is in-built on the roads for pedestrians had a mean of 4.49 and a standard 0.770. These results indicate that majority of the respondents 122(61.0%) strongly agreed, 64(32.0%) agreed, 7(3.5%) were neutral about the statement, 5(2.5% disagreed) and 2(1.0%) strongly disagreed with the statement. Statement 3," the level of road safety awareness improves implementation of pedestrian safety rules" had a mean of 4.53 and a standard deviation of 0.701. These results indicate that the majority of the respondents 123(61.5%) strongly agreed, 66(33.0%) agreed, 6(3.0%)were neutral, 4(2.0%) disagreed and 1(0.5%) strongly disagreed.

Statement 4, which was" age is critical in implementing pedestrian safety rules" had a mean of 3.70 and a standard deviation of 1.292. Majority of the respondents 81(40.5%) agreed that age was critical in implementing pedestrian safety rules, 61(30.5%) strongly agreed, 16(8.0%) were neutral on age as a critical factor, 21(10.5%) disagreed and 21(10.5%) strongly disagreed with the statement on age as a critical factor on implementation of pedestrian safety rules.

Statement 5, which was" female pedestrians follow regulations relating to implementation of pedestrian safety rules" always had a mean of 3.19 and a standard deviation of 1.342. The majority of the respondents 52(18.5%) agreed that female pedestrians followed regulations relating to implementation of pedestrian safety rules, this was followed by 42(21.0%) whose responses were neutral or undecided, 40(14.5%) strongly agreed, 37(26.0%) disagreed and 29(20.0%) strongly disagreed.

In order to establish pedestrians' overall view on implementation of pedestrian safety rules; the mean values for the responses in the items were calculated. The distribution was negatively skewed (Skewness = -.36), with a mean of 4.0150 and SD=.5811. In general, pedestrians' view of implementation of pedestrian safety rules was above average, with the majority of pedestrians holding a positive view about implementation of pedestrian safety rules in the City of Kisumu.

4.10.2 Drivers' view on Implementation of Pedestrian Safety Rules

Drivers' views on implementation of pedestrian safety rules were measured using 16 statements spread out in 2 sub-themes. The first sub theme had 8 statements which were on how often drivers performed certain actions when driving. The second sub-theme also had 8 statements based on how often drivers made specific offences when driving. The statements were on a five point Likert scale of 1-5 where 1=Never, 2= rarely, 3=Sometimes, 4=Often and 5 =Very Often. The respondents were asked questions on how often they performed certain actions when driving .Table 4.27 shows drivers' responses to the 8 statements.

Table 4.27: How Often Drivers Performed Certain Actions when Driving

Statements	Very often	Often	Sometimes	Rarely	Never	Mean	Std Dev.
1. Driving when too tired	4(4%)	4(4%)	32(32%)	44(44%)	16(16%)	3.64	0.938
2. Driving when drunk	6(6%)	1(1 %)	8(8%)	17(17%)	68(68%)	4.40	1.092
3. Driving too close to a car	6(6%)	9(9%)	33(33%)	30(30%)	22(22%)	3.53	1.114
4. Breaking the speed limit	7(7%)	5(5%)	33(33%)	30(30%)	24(24%)	3.60	1.124
5. Driving after taking drug which influences behaviour	6(6%)	2(2%)	16(16%)	24(24%)	52(52%)	4.14	1.137
6. Talking on the phone while driving	3(3%)	5(5%)	31(31%)	34(34%)	27(27%)	3.77	1.004
7. Driving defective vehicle	3(3%)	5(5%)	8(8%)	33(33%)	51(51%)	4.24	1.006
8. Traffic mix with high pedestrian activity	4(4%)	16(16%)	22(22%)	27(27%)	31(31%)	3.65	1.192

As shown in Table 4.27, the highest proportion of drivers (44%) rarely drove when too tired. This was followed by 32% who reported that they sometimes drove when too tired and 16% who never did. This is a positive outcome because not many drivers drove when

too tired, often or very often. A proportion of 68% indicated that they never drove when drunk while 17% reported that they rarely did so. This is optimistic as only a dismal 8% of drivers reported that they sometimes drove when drank. Similar results were obtained for "Driving too close to a car", "Breaking the speed limit", "Driving after taking drug which influences behavior", "Talking on the phone while driving" and "Driving defective vehicle" as indicated in Table 4.27. This implies that drivers were keen on implementing pedestrian safety rules which was in line with the safe systems approach adopted in this study. This would mean safe roads for all road users.

4.10.2.1 How often Drivers made Specific Offences when Driving

The second set of 8 statements was on how often drivers made specific offences when driving. Table 4.28 presents results on the 8 statements based on how often drivers made specific offences when driving.

Table 4.28: How often Drivers made Specific Offences when Driving

Statement	Very often	Often	Sometimes	Rarely	Never	Mean	Std Dev.
Going against traffic	33(33%)	25(25%)	17(17%)	14(14%)	11(11%)	2.45	1.366
Breaking speed limits	36(36.%)	25(25.%)	20(20%)	10(10%)	9(9%)	2.31	1.300
Driving after taking drug which influences behaviour	8(8%)	5(5%)	12(12%)	22(22%)	53(53%)	2.88	1.365
Talking on phone while driving	8(8%)	4(4%)	35(35%)	26(26%)	27(27%)	3.60	1.163
Not stopping on line at intersection	20(20%)	20(20%)	31(31%)	10(10%)	19(19(%)	2.88	1.365
Driving in a criss-cross manner	13(13%)	23(23%)	27(27%)	18(18%)	19(19%)	3.07	1.305
Not allowing pedestrians to cross the road at designated points	12(12%)	21(21%)	22(22%)	21(21%)	24(24%)	3.24	1.349
Parking temporarily in a forbidden place	3(3%)	3(3%)	19(19%)	37(37%)	38(38%)	4.04	0.984

The study results on Table 4.28 indicate that, 33(33%) drivers reported that they very often went against traffic, followed by 25(25%) who often, 17(17%) sometimes, 14(14%) who rarely and 11(11 %) who never went against traffic rules. Similarly, the highest proportion of drivers who broke speed limits was 36(36%) and this happened very often.

This was followed by those who broke speed limits often 25(25%), sometimes 20(20%), rarely 10(10% and never 9(9%). More drivers therefore seem to have been going against traffic and breaking speed limits which negatively influenced implementation of pedestrian safety rules.

Contrary to the above outcomes, fewer respondents reported having driven after taking drugs that influence behaviour. More specifically, the majority 53(53%) reported that they never drove after taking drugs that influence behaviour. Only a paltry 8% reported driving under such conditions very often and 5% often. Similar to this was that drivers tended not to talk on phone while driving, with only 8% reporting that they talked on phone very often while driving while meager 4% did so often. This implies that both driving under the influence of drugs and while talking on phone did not negatively influence the implementation of pedestrian safety rules. The conclusion may have been that there must have been another cause that influenced implementation of pedestrian safety rules which led to pedestrian accidents outside the scope of the objectives under investigation in this study.

Further to the above, most drivers avoided parking temporarily in forbidden places. In particular, 38(38%) never parked temporarily in a forbidden place while 37(37%) rarely did so, and 19(19%) sometimes did so. Only a small proportion of 3(3%) parked temporarily in forbidden places very often, and the same proportion (3%) did so often. Majority of drivers were keen on implementing pedestrian safety rules. However, there was need to reinforce the rules on speed limits and on drunk driving to enhance pedestrian safety on urban roads.

4.11 Test of the Hypotheses

In this section, a valid conclusion was necessary to get a clear interpretation of the findings based on the proposed hypotheses. Pearson correlation coefficient between pairs of variables was used to determine correlation while simple and multiple linear regression analysis were used to determine the model equations. The Pearson Product Moment Correlation Coefficient denoted by ‘r’ (Lucey, 2002) provides the strength of association between two variables, a dependent variable and an independent variable. Pearson Product moment correlation coefficient ‘r’ is between -1 and +1. On the other hand, linear

regression provides the coefficients of variables as defined in a linear equation model. The influence of selected road infrastructure interventions on implementation of pedestrian safety rules was presented. The specific road infrastructure interventions were public education on road safety, road engineering design, enforcement of traffic laws and pedestrian demographic factors. These road infrastructure interventions were moderated by attitude of pedestrians on implementation of pedestrian safety rules.

4.11.1 Testing of Hypothesis One

Hypothesis one tested if there was a significant relationship between public education on road safety and implementation of pedestrian safety rules in the City of Kisumu. The null hypothesis was stated as follows:

$H_0$1: There is no statistically significant relationship between public education on road safety and implementation of pedestrian safety rules in the City of Kisumu.

Using the aggregate scores for items in the public education scale and implementation of pedestrian safety rules scale, Pearson Product Moment Correlation(r) wascomputed to examine if a significant relationship existed between the two variables on the sample data at 95% confidence level. The result is presented in Table 4.29.

Table 4.29: Correlation between Public Education and Implementation of Pedestrian Safety Rules

		Implementation of Pedestrian Safety Rules
Public education on Road safety	Pearson Correlation	0.176
	Sig. (2-tailed)	0.013
	N	200

The result showed that there was a statistically significant positive relationship between public education on road safety and implementation of pedestrian safety rules (r= 0.176, p = 0.013). This means that, as public education on road safety increased, implementation of pedestrian safety improved. Thus the null hypothesis was rejected since there is a positive relationship between public education on road safety and implementation of pedestrian safety rules.

In order to determine the equation relating public education and implementation of pedestrian safety rules, a simple linear regression analysis was run between the two variables and the results are presented in Table 4.30.

Table 4.30: Linear Regression Model for Public Education on Implementation of Pedestrian Safety Rules

Model	Unstandardized Coefficients		Standardized Coefficients	t	P
	B	Std. Error	Beta		
(Constant)	3.421	0 .240		14.270	0.000
Public education on Road safety	0.132	0 .053	0.176	2.512	0.013

From the model summary, public education on road safety accounted for a paltry 3.1% of the variance in implementation of pedestrian safety rules. The coefficient of public education on road safety was statistically significant (p= 0.013) and therefore, the equation connecting the two variables is as follows:

$Y_j = \beta_0 + \beta_i x_i + \varepsilon_i$

$\hat{Y} = 3.421 + 0.132X$ where:-

$\hat{Y}$ is implementation of pedestrian safety rules and

X is public education on road safety and

The result shows that public education on road safety contributes 0.132 unit change in implementation of pedestrian safety rules.

4.11.2 Test of Hypothesis Two

This subsection tested the hypothesis that there is a significant relationship between road engineering designs and implementation of pedestrian safety rules in the City of Kisumu. The null hypothesis was stated as follows:

$H_0 2$: There is no statistically significant relationship between road engineering designs and implementation of pedestrian safety rules in the City of Kisumu.

Pearson Moment Correlation Analysis was conducted between aggregate score of road engineering design and implementation of pedestrian safety rules with the result presented in Table 4.31.

Table 4.31: Correlation for Road Engineering Design on Implementation of Pedestrian Safety Rules

		Implementation of pedestrian safety rules
Road engineering design	Pearson Correlation	-0.094
	Sig. (2-tailed)	0.186
	N	200

The relationship between road engineering design and implementation of pedestrian safety rules was not statistically significant (r=-0.09, p=0.186) indicating that road engineering does not statistically significantly influence implementation of pedestrian safety rules at 5% level of significance. Based on this finding, the null hypothesis was accepted since there is no statistically significant relationship between road engineering design and implementation of pedestrian safety rules.

A linear regression model was used to determine the equation connecting road engineering design and implementation of pedestrian safety rules. The results are presented in Table 4.32.

Table 4.32: Regression Model for Influence of Road Engineering Design on Implementation of Pedestrian Safety Rules

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.094[a]	.009	.004	.57999

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	.591	1	.591	1.757	.186[b]
	Residual	66.604	198	.336		
	Total	67.195	199			

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	4.166	.121		34.410	.000
Road Engineering Design on implementation of road safety	-.052	.039	-.094	-1.326	.186

a. Dependent Variable: Implementation of pedestrian safety rules

The regression output show that the coefficient of road engineering design was not statististically significant (p = .186) as p>.05 thus road engineering design does not statistically influence implemenattation of pedestrian safety rules.

4.11.3 Test of Hypothesis Three

This subsection tested the hypothesis that there is a significant relationship between enforcement of traffic laws and implementation of pedestrian safety rules in the City of Kisumu. The null hypothesis was stated as follows:-

$H_0$3: There is no statistically significant relationship between enforcement of traffic laws and implementation of pedestrian safety rules in the City of Kisumu.

Pearson Product Moment Correlation coefficient(r) was computed to examine if a statistically significant relationship existed between the variables on the sample data at 95% confidence level. The results are presented in Table 4.33.

Table 4.33: Influence of Enforcement of Traffic Laws on Implementation of Pedestrian Safety Rules

		Implementation of Pedestrian safety rules
Enforcement of traffic laws	Pearson Correlation	0.281
	Sig. (2-tailed)	0.000
	N	200

The results showed that there was a statistically significant positive relationship between enforcement of traffic laws and implementation of pedestrian safety rules (r=0.281, p=0.001). This implies that an improvement in enforcement of traffic laws leads to a statistically significant improvement in implementation of pedestrian safety rules.

A linear regression model was used to determine the equation connecting enforcement of traffic laws and implementation of pedestrian safety rules. The results are presented in Table 4.34.

Table 4.34: Regression Model for Influence of Enforcement on Implementation of Pedestrian Safety Rules

Mode	Unstandardized Coefficients		Standardized Coefficients		sig.
	B	Std. Error	Beta	t	
(Constant)	2.748	0.310		8.851	0.000
Enforcement of Traffic Laws	0.328	0.080	0.281	4.114	0.000

R^2 = 0.079 R^2 adjusted =0.074 Se = 0.5592, F (1,198) = 16.928 (p <.001)

The result demonstrated that the coefficient of enforcement of traffic laws was significant ($p<0.05$). The model summary gave R^2 =0.079, which means that enforcement explains 7.9 % of the variation in implementation of pedestrian safety rules. The ANOVA table F (1,198) = 16.928 with $p<0.001$ indicates that regression is a good fit for analysis of the data. The coefficients table shows that the coefficient of the constant term and the coefficient of enforcement are statistically significant ($p <0.001$) thus the model equation becomes;

$\hat{Y} = 2.748 + .328X$ where;

$\hat{Y}$ is Implementation of pedestrian safety rules and

X is Enforcement of traffic rules.

The regression coefficient was statistically significant (t=4.114, p<.05). Thus, a unit increase in enforcement of traffic laws is associated with an increase of 0.328 in implementation of pedestrian safety rules.The null hypothesis was therefore rejected and the study concluded there was a significant relationship between enforcement of traffic laws and implementation of pedestrian safety rules.

4.11.4 Testing Hypothesis Four

This subsection tested the hypothesis that there is a statistically significant relationship between pedestrian demographic factors and implementation of pedestrian safety rules in the City of Kisumu. The null hypothesis was stated as follows:-

$H_0$4: There is no statistically significant relationship between pedestrian demographic factors and implementation of pedestrian safety rules in the City of Kisumu.

Pearson Product Moment Correlation Coefficient(r) was computed to examine if a significant relationship existed between the variables on the sample data at 95% confidence level. The results are presented in Table 4.35.

Table 4.35: Correlation between Pedestrian Demographic factors and Implementation of Pedestrian Safety Rules

Characteristic		Implementation of Pedestrian Safety Rules
Combined Pedestrian demographics factors	Pearson Correlation	0.416
	Sig. (2-tailed)	0.000
	N	200

Pedestrian demographics factors implementation of pedestrian safety rules had a positive correlation ($r = 0.416$) which was statistically significant ($p < 0.001$). This implies that for every positive change in pedestrian demographic factors, there is a corresponding change of 0.416 on implementation of pedestrian safety rules which is statistically significant. The null hypothesis was therefore rejected and the study concluded thatthere was a significant relationship between pedestrian demographic factors and implementation of pedestrian safety rules.

A linear regression model was further used to determine the equation connecting pedestrian demographic factors and implementation of pedestrian safety rules. The results are presented in Table 4.36.

Table 4.36: Regression Output for Implementation of Pedestrian Safety Rules on Pedestrian Demographic Factors

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Summary	416[a]	0.173	0.169	0.52967

Model		Sum of Squares	Df	Mean Square	F	Sig.
ANOVA	Regression	11.646	1	11.646	41.510	.000[b]
	Residual	55.549	198	.281		
	Total	67.195	199			

Model	Model	Unstandardized Coefficients		Standardized Coefficients		Sig
scoefficient		B	Std. Error	Beta	T	
	(Constant)	2.988	0.164		18.254	.000
	Pedestrian demographic factors	0.297	0.046	0.416	6.443	.000

$R^2 = 0.173$, R^2 adjusted=0.169, Se= 0.52967, F-stat: 41.510 on 1 and 198 df, $p = 0.000$

The model summary showed that the amount of variance shared in common between pedestrian demographics and implementation of pedestrian safety rules was 17.3% (R^2 = 0.173).The ANOVA shows that regression is a good fit for our data with F (1,198) = 41.510 which is statistically significant (p<0.001). The coefficients table presented p-values (0.001) less than the level of significance (0.05) hence the simple regression model is given as

$$\hat{Y} = 2.988 + 0.297X$$

Where:

$\hat{Y}$ is Implementation of pedestrian safety rules and

X is pedestrian demographic factors

A change of 1 unit in pedestrian demographic factors is thus associated with a corresponding change of 0.297 units in implementation of pedestrian safety rules. The result indicated that the coefficient of pedestrian demographic factors was significant (p<0.05).

4.11.5 Test of Hypothesis Five

This subsection tested the hypothesis that there is a significant relationship between combined road infrastructure interventions and implementation of pedestrian safety rules in the City of Kisumu. The null hypothesis was stated as follows:-

$H_0$5: There is no statistically significant relationship between combined road infrastructure interventions and implementation of pedestrian safety rules in the City of Kisumu.

A multiple linear regression analysis was conducted with the road infrastructure interventions as the predictor variables and implementation of pedestrian safety rules as the outcome variable. The regression output is presented in Table 4.37.

Table 4.37: Regression Output for Influence of Combined Road Infrastructure Interventions and Implementation of Pedestrian Safety Rules

Model Summary	R	R Square	Adjusted R Square		Std. Error of the Estimate	
	.504[a]	0.254	0.238		0.50717	
Model ANOVA		Sum of Squares	df	Mean Square	F	Sig.
	Regression	17.036	4	4.259	16.558	.000[b]
	Residual	50.159	195	0.257		
	Total	67.195	199			
Model coefficients		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	1.933	0.367		5.271	0.000
	Public Education on road safety	0.049	0.048	0.065	1.012	0.313
	Road Engineering Designs	-0.057	0.035	-0.103	-1.642	0.102
	Enforcement of Traffic Laws	0.267	0.74	0.229	3.594	0.000
	Pedestrian demographic factors	0.289	0.045	0.404	6.406	0.000

R^2 =0.254, R^2 adjusted=0.238, Se= 0.50717, F-stat: 16.558 on 4 and 195 df, p = 0.000

The model shows the independent variables (public education, road engineering design, enforcement of traffic laws and pedestrian demographic factors) account for 25.4% (R^2 = 0.254) of the variance in the dependent variable (Implementation of Pedestrian safety rules). The ANOVA shows that regression is a good fit for our data with F (4,195) =16.558 which is statistically significant ($p<0.05$). This provides a basis for rejection of the null hypothesis. The null hypothesis was therefore rejected and the study concluded there was a significant relationship between combined road infrastructure interventions and implementation of pedestrian safety rules.

However, on examining the coefficients of the variables, the constant term, enforcement of traffic laws and pedestrian demographic factors were found to be statistically significant ($p <0.001$) while public education ($p = 0.313$) and road engineering design ($p = 0.102$) were not statistically significant. Consequently, the multiple regression model equation becomes:

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon$

$Y=1.933+0.267\ X_3 + 0.289\ X_4$ where Y is the implementation of pedestrian safety rules and X_3 and X_4 are the enforcement of traffic laws and pedestrian demographic factors respectively.

4.11.6 Test of Hypothesis Six

In this subsection, the hypothesis tested moderating influence of attitude of pedestrians on the relationship between road infrastructure interventions and implementation of pedestrian safety rules in the City of Kisumu. In particular, the influence of attitude of pedestrians on the relationship between road infrastructure interventions namely public education on road safety, enforcement of traffic laws, pedestrian demographic factors and implementation of pedestrian safety rules was reported in this section. To determine if attitude of pedestrians had amoderating effect, the null hypothesis tested was:-

$H_0 6$: There is no statistically significant moderating influence of attitude of pedestrians on the relationship between road infrastructure interventions and implementation of pedestrian safety rules in the City of Kisumu.

4.11.6.1 Attitude of Pedestrians as a Moderator in the Relationship between Public Education on Road Safety and Implementation of Pedestrian Safety Rules

In order to establish whether attitude of pedestrians moderated the influence of public education on road safety towards implementation of pedestrian safety rules, a hierarchical linear regression analysis was conducted. In the first step, implementation of pedestrian safety rules was included as the dependent variable with public education on road safety and attitude of pedestrians as the independent variables (predictors). In the next step, the interaction of public education and attitude of pedestrians was included as the predictor variable. In order to determine the interaction term between public education and attitude of pedestrians towards implementation of pedestrian safety rules, the individual variables were mean centered and their products determined. The findings are shown in the subsequent tables.

Table 4.38: Regression output for moderation effect of attitude of pedestrian on the influence of public education on implementation of pedestrian safety rules

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
					R Square Change	F Change	df1	df2	Sig. F Change
1	.303[a]	.092	.083	.55656	.092	.962	2	197	.000
2	.308[b]	.095	.081	.55699	.003	.698	1	196	.405

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.172	2	3.086	9.962	.000[b]
	Residual	61.023	197	.310		
	Total	67.195	199			
2	Regression	6.388	3	2.129	6.864	.000[c]
	Residual	60.807	196	.310		
	Total	67.195	199			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.273	.392		.795	.000
	Public education on road safety	.119	.051	.159	.336	.021
	Attitude of pedestrians	.349	.096	.247	.636	.000
2	(Constant)	.619	2.018		307	.759
	Public education on road safety	.494	.451	.657	.095	.275
	Attitude of pedestrians	.818	.571	.581	.434	.153
	Int _ public education and attitude	-.106	.127	-.621	.835	.405

a. Dependent Variable: Implementation of pedestrian safety rules

From the model summary, the model with only the predictor variables and the dependent variables (model 1) has a statistically significant (p = .000) F change while model 2 with the interaction term is not statistically significant (p = .405). However, there is small change in R^2 = 0.003 (0.3%) due to addition of the interaction term thus indicating that there is a little moderation effect which is not statistically significant (p = .405). therefore, there is no moderation effect.

From the ANOVA table, both model 1 F (2, 197) = 9.962 and model 2 F (3, 196) = 6.864 are statistically significant with p=.000 indicating the models fit the analysis of the variables.

From the coefficients table, the interaction term between public education on road safety and attitude of pedestrians towards implementation is not statistically significant (p = 0.405). Thus, attitude of pedestrians does not have a moderation effect on the influence of public education on road safety towards implementation of pedestrian safety rules.

Given a model equation of $\hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_1 M_{int.}$

Where; $\hat{Y}$ = Dependent variable (Implementation of Pedestrian Safety Rules)

β_0 = Constant of the equation

β_1 = Constant of the independent variable (Public Education)

β_2 = Constant of the Interaction term

$X_1 M_{int}$ = Interaction term between public education and attitude of pedestrians

Removing the terms which are not statistically significant, the equation becomes $\hat{Y} = 0.619$

4.11.6.2Moderation effect of Attitude of pedestrians and Road Engineering Design on the implementation of pedestrian safety rules

In order to establish whether attitude of pedestrians moderates the influence of Road Engineering Design towards the implementation of pedestrian safety rules, a hierarchical linear regression analysis was conducted. In the first step, implementation of pedestrian safety rules was included as the dependent variable with Road Engineering Design and attitude of pedestrians towards implementation included as the independent variables (predictors). In the next step, the interaction of Road Engineering Design and attitude of pedestrian was included as the predictor variable. In order to determine the interaction term between road engineering design and attitude of pedestrians towards implementation of pedestrian safety rules, the individual variables were mean centered and their products determined. The findings are shown in the subsequent tables.

Table 4.39: Regression output for moderation effect of attitude of pedestrian on the influence of road engineering design on implementation of pedestrian safety rules

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
					R Square Change	F Change	df1	df2	Sig. F Change
1	.266[a]	.071	.061	.56305	.071	7.478	2	97	.001
2	.266[b]	.071	.056	.56448	.000	.001	1	96	.977

ANOVA[a]

Model		Sum of Squares	Df	Mean Square		Sig.
1	Regression	4.741	2	2.371	.478	.001[b]
	Residual	62.454	197	.317		
	Total	67.195	199			
2	Regression	4.742	3	1.581	.960	.002[c]
	Residual	62.453	196	.319		
	Total	67.195	199			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.896	.370		.825	.000
	Road Engineering Design	-.035	.038	-.063	.905	.367
	Attitude of pedestrians	.353	.097	.250	.618	.000
2	(Constant)	2.920	.899		.248	.001
	Road Engineering Design	-.043	.303	-.078	.143	.887
	Attitude of pedestrians	.346	.255	.246	.356	.177
	Int_road engineering design and attitude	.002	.087	.016	.028	.977

a. Dependent Variable: Implementation of pedestrian safety rules

From the model summary, the model with only the predictor variables and the dependent variables (model 1) had a statistically significant (p = .001) F change while model 2 with the interaction term was not statistically significant (p = .977). Further, there was no change in R^2 = 0.000 (0.0%) due to addition of the interaction term thus indicating that there was no moderation effect (p = .977).

From the ANOVA table, both model 1 F (2, 197) = 7.478 and model 2 F (3, 196) = 4.960 were statistically significant with p=.001 and p = .002 respectively indicating the models fitted the analysis of the variables.

From the coefficients table, the interaction term between road engineering design and attitude of pedestrians towards implementation of pedestrian safety rules was not statistically significant (p = 0.977). Thus, attitude of pedestrians did not have a moderation effect on the influence of Road Engineering Design towards implementation of pedestrian safety rules.

Given a model equation of $\hat{Y} = \beta_0 + \beta_1 X_2 + \beta_2 X_2 M_{int.}$

Where; $\hat{Y}$ = Dependent variable (Implementation of Pedestrian Safety Rules)

β_0 = Constant of the equation

β_1 = Constant of the independent variable (Road Engineering Design)

β_2 = Constant of the Interaction term

$X_2 M_{int}$ = Interaction term between Road Engineering Design and attitude

Removing the terms which are not statistically significant, the equation becomes:

$\hat{Y} = 2.920$

4.11.6.3 Moderation effect of Attitude of pedestrians on the influence of Enforcement of Traffic Laws on the implementation of pedestrian safety rules

In order to establish whether attitude of pedestrians moderated the influence of enforcement of traffic laws on the implementation of pedestrian safety rules, a hierarchical linear regression analysis was conducted. In the first step, implementation of pedestrian safety rules was included as the dependent variable with enforcement of traffic laws and attitude of pedestrians towards implementation of pedestrian safety rules included as the independent variables (predictors). In the next step, the interaction of enforcement of traffic laws and attitude of pedestrians was included as the predictor variable. In order to determine the interaction term between enforcement of traffic laws and attitude of pedestrians towards implementation, the individual variables were mean centered and their products determined. The findings are shown in the subsequent tables.

Table 4.40: Regression output for moderation effect of attitude of pedestrian on the influence of enforcement on implementation of pedestrian safety rules

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	f1	df2	Sig. F Change
1	.329[a]	.108	.099	.55148	.108	11.971	2	197	.000
2	.365[b]	.133	.120	.54513	.025	5.614	1	196	.019

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.282	2	3.641	11.971	.000[b]
	Residual	59.913	197	.304		
	Total	67.195	199			
2	Regression	8.950	3	2.983	10.039	.000[c]
	Residual	58.245	196	.297		
	Total	67.195	199			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			Std. Error	Beta		
1	(Constant)	.141	.387		5.525	.000
	Enforcement of traffic laws	.254	.084	.217	3.034	.003
	Attitude of pedestrians	.258	.101	.183	2.557	.011
2	(Constant)	-3.876	2.568		-1.509	.133
	Enforcement of traffic laws	1.809	.662	1.549	2.735	.007
	Attitude of pedestrians	2.061	.767	1.463	2.686	.008
	Int_enforcement and attitude	-.464	.196	-2.147	-2.369	.019

a. Dependent Variable: Implementation of pedestrian safety rules

From the model summary, the model with only the predictor variables and the dependent variables (model 1) had a statistically significant (p = .000) F change while model 2 with the interaction term was not statistically significant (p = .019). However, there was considerable change in R^2 = 0.025 (2.5%) due to addition of the interaction term thus indicating that there was a little moderation effect which was statistically significant (p = .019).

From the ANOVA table, both model 1 F (2, 197) = 11.971 and model 2 F (3, 196) = 10.039 were statistically significant with p=.000 indicating the models fit the analysis of the variables.

From the coefficients table, the interaction term between enforcement of traffic laws and attitude of pedestrians towards implementation of pedestrian safety rules was statistically

significant (p = 0.019). Thus, attitude of pedestrians had a moderation effect on the influence of enforcement of traffic laws on implementation of pedestrian safety rules.

Given a model equation of $\hat{Y} = \beta_0 + \beta_1 X_2 + \beta_2 X_2 M_{int.}$

Where; $\hat{Y}$ = Dependent variable (Implementation of pedestrian safety rules)

β_0 = Constant of the equation

β_1 = Constant of the independent variable (Enforcement of traffic laws)

β_2 = Constant of the Interaction term

$X_2 M_{int}$ = Interaction term between Enforcement and attitude

Removing the terms which were not statistically significant, the equation became:

$\hat{Y} = -3.876 + 1.809X_2 - 0.464X_2 M_{int.}$

4.11.6.4 Moderation effect of Attitude of pedestrians on the influence of Pedestrian demographic Factors on the implementation of pedestrian safety rules

In order to establish whether attitude of pedestrians moderated the influence of pedestrian demographic factors on the implementation of pedestrian safety rules, a hierarchical linear regression analysis was conducted. In the first step, implementation of pedestrian safety rules was included as the dependent variable with enforcement of traffic laws and attitude of pedestrians towards implementation included as the independent variables (predictors). In the next step, the interaction of pedestrian demographic factors and attitude if pedestrians was included as the predictor variable. In order to determine the interaction term between enforcement of traffic laws and attitude of pedestrians towards implementation of pedestrian safety rules, the individual variables were mean centered and their products determined. The findings are shown in the subsequent tables.

Table 4.41: Regression output for moderation effect of attitude of pedestrian on the influence of pedestrian demographic factors on implementation of pedestrian safety rules

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
					R Square Change	F Change	df1	df2	Sig. F Change
1	.468[a]	.219	.211	.51613	.219	27.622	2	197	.000
2	.469[b]	.220	.208	.51700	.001	.339	1	196	.561

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.716	2	7.358	27.622	.000[b]
	Residual	52.479	197	.266		
	Total	67.195	199			
2	Regression	14.807	3	4.936	18.466	.000[c]
	Residual	52.388	196	.267		
	Total	67.195	199			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			Std. Error	Beta		
1	(Constant)	1.999	.332		6.020	.000
	Pedestrian demographic factors	.281	.045	.393	6.198	.000
	Attitude of pedestrians	.303	.089	.215	3.395	.001
2	(Constant)	1.336	1.188		1.125	.262
	Pedestrian demographic factors	.482	.349	.675	1.381	.169
	Attitude of pedestrians	.494	.340	.351	1.452	.148
	Int_Pedestrian demographic factors and attitude	-.058	.099	-.328	-.582	.561

a. Dependent Variable: Implementation of pedestrian safety rules

From the model summary, the model with only the predictor variables and the dependent variables (model 1) had a statistically significant (p = .000) F change while model 2 with the interaction term was not statistically significant (p = .561). Further, there was no change in R^2 change = 0.001 (0.1%) indicating that there was no moderation effect which was not statistically significant (p = .561).

From the ANOVA table, both model 1 F (2, 197) = 27.622 and model 2 F (3, 196) = 18.466 were statistically significant with p=.000 indicating the models fitted the analysis of the variables.

From the coefficients table, the interaction term between pedestrian demographic Factors and attitude of pedestrians towards implementation of pedestrian safety rules was not statistically significant (p = 0.561). Thus, attitude of pedestrians did not have a moderation effect on the influence of enforcement of traffic laws on implementation of pedestrian safety rules.

Given a model equation of $\hat{Y} = \beta_0 + \beta_1 X_2 + \beta_2 X_2 M_{int.}$

Where: $\hat{Y}$ = Dependent variable (Implementation of Pedestrian Safety Rules)

β_0 = Constant of the equation

β_1 = Constant of the independent variable (Demographic Factors)

β_2 = Constant of the Interaction term

$X_2 M_{int}$ = Interaction term between Demographic Factors and attitude

Removing the terms which were not statistically significant, the equation became:

$\hat{Y} = 1.336$ (Other terms not statistically significant)

4.11.6.5 Multiple Regression Models for Moderation Effect of Attitude of Pedestrians

Multiple regression models were used to establish the combined moderating influence of attitude of pedestrians on the relationship between road infrastructure interventions and implementation of pedestrian safety rules. Based on Davis (2008) it was developed into multiple population regression models as follows:-

$Y = b_0 + b_j X_i + b_k M + b_l X_i M + \varepsilon_i$

Where b_0 is coefficient of the constant term

b_j is the coefficient of the independent variables (1,2,3 & 4)

b_k is the coefficient of the moderating variable

b_l is the coefficient of the interaction terms (1,2,3 &4)

X_i is the independent variable (X_1, X_2, X_3& X_4)

M is the moderating variable

$X_i M$ is the interaction term.

ε_i is the error term

The results of the multiple regression model obtained were in under Table 4.43.

Table 4.42: Regression Model for Moderating Effect of Attitude of Pedestrians on the relationship between Road Infrastructure Interventions and implementation of pedestrian safety rules.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.519[a]	.270	.251	.50300	.270	14.317	5	194	.000
2	.538[b]	.289	.256	.50134	.020	1.321	4	190	.263

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.112	5	3.622	14.317	.000[b]
	Residual	49.083	194	.253		
	Total	67.195	199			
2	Regression	19.440	9	2.160	8.594	.000[c]
	Residual	47.755	190	.251		
	Total	67.195	199			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.479	.425		3.477	.001
	Public education	.050	.048	.067	1.060	.291
	Road Engineering Design	-.050	.035	-.091	-1.446	.150
	Enforcement of traffic laws	.215	.078	.184	2.755	.006
	Pedestrian demographic factors	.279	.045	.390	6.200	.000
	Attitude of pedestrians	.192	.093	.136	2.062	.041
2	(Constant)	-4.943	2.935		-1.684	.094
	Public education on road safety	.240	.429	.320	.559	.577
	Road Engineering Design	.223	.278	.403	.801	.424
	Enforcement of traffic laws	1.477	.659	1.264	2.240	.026
	Pedestrian demographic factors	.267	.349	.374	.766	.445
	Attitude of pedestrians	2.096	.860	1.488	2.436	.016
	Int _ for public education and attitude	-.053	.121	-.308	-.434	.664
	Int _ road engineering design and attitude	-.080	.080	-.508	-.997	.320
	Int _ enforcement and attitude	-.376	.195	-1.740	-1.927	.050
	Int _ pedestrian demographic factors and attitude	.002	.099	.009	.017	.987

a. Dependent Variable: Implementation of pedestrian safety rules

From the output, 28.9% (R^2 = 0.289) of the variation in dependent variable is explained by the independent variables. The results of ANOVA suggest that the predictor variables not excluded from the model (Road infrastructure interventions, Attitude of pedestrians), could be used to predict the dependent variable (implementation of pedestrian safety rules) given F-value of 8.594 d.f. (9,190) and p-value 0.000 ($p \leq 0.05$) significance level which is statistically significant. It can be concluded that there is a regression relationship between predictor variables combined with attitude of pedestrians and implementation of pedestrian safety rules.

The table ofcoefficients shows that only the standardized coefficient for attitude of pedestrians is 1.488 (p=0.016) and for the interaction term between enforcement of traffic laws and attitude is -0.376 (p = 0.050) that were statistically significant. However, the coefficient of the constant term was -4.943 (p = 0.094) which was not statistically significant. Since there was a statistically significant moderation effect of attitude of pedestrian on the relationship between enforcement of traffic laws towards implementation of the pedestrian safety rules, the null hypothesis was rejected.

From the regression output in Table 4.44, only terms with statistically significant coefficients were included, the multiple regressions linear model therefore is:-

$Y = 1.477X_3 + 2.096M - .376\ X_3M$

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the findings, discussions, conclusions, contribution to the body of knowledge, recommendations of the study and suggestions for further research. The summary of findings section presents summary of the main findings and results of test of hypotheses for each study objective. The conclusions are made and presented based on the research objectives which informed the findings, analysis, interpretation and discussion in the study. Based on the conclusions, contribution to the body of knowledge was examined which consisted of new information from findings of the study. Recommendations were based on the results for policy and practice and gaps in knowledge identified for further research.

5.2 Summary of the Findings

This section presents a summary of findings based on the six objectives that guided the study. In the first objective, the study investigated the influence of public education on road safety on implementation of pedestrian safety rules in the City of Kisumu. The study found the pedestrians' level of public education on road safety to bebelow average and this would influence their implementation of pedestrian safety rules. Further, based on the first hypothesis $H_{1,}$ (H_0: There is a significant relationship between public education on road safety and implementation of pedestrian safety rules in the City of Kisumu), it was concluded that there was a statistically significant relationship between public education on road safety and implementation of pedestrian safety rules at ($p=0.013$; $p<0.05$) which approved the alternative hypothesis earlier stated. To further test the moderating influence of attitude of pedestrians on the relationship between public education on road safety and implementation of pedestrian safety rules, the study used public education on road safety, attitude of pedestrians and their interaction term as independent variables in a linear regression model, with implementation of pedestrian safety rules as the dependent variable.

Second, the study investigated the influence of road engineering designs on implementation of pedestrian safety rules in the City of Kisumu. Hypothesis H_2 (H_0: There

is no significant relationship between road engineering designs and implementation of pedestrian safety rules). It was concluded that there was no statistically significant relationship between road engineering designs and implementation of pedestrian safety designs (p=0.186; p >0.05).This was contrary to what was earlier hypothesized.

Third, the study analysed the influence of enforcement of traffic laws on implementation of pedestrian safety rules. Hypothesis$H_{3.}$ (H_0: There is no significant relationship between enforcement of traffic laws and implementation of pedestrian safety rules), it was concluded that the relationship between enforcement of traffic laws and implementation of pedestrian safety rules was statistically significant (p=0.001; p<0.05).

Fourth, the study examined the influence of pedestrian demographic factors on implementation of pedestrian safety rules in the City of Kisumu. Hypothesis$H_{4.}$ (H_0: There is no significant relationship between pedestrian demographic factors and implementation of pedestrian safety rules).It was concluded that there was a statistically significant relationship between pedestrian demographic factors and implementation of pedestrian safety rules (p=0.001; p<0.05).

Fifth, the study analysed the combined influence of road infrastructure interventions on implementation of pedestrian safety rules in the City of Kisumu using multiple regression analysis.Hypothesis$H_{5.}$ ($H_{0:}$ There is no significant relationship between the combined road infrastructure interventions and implementation of pedestrian safety rules). Regarding this, it was concluded that the road infrastructure interventions accounts for 25.4% of the variance in the dependent variable (implementation of pedestrian safety rules). The ANOVA showed that regression was a good fit for the data with F (4,195) =16.558 which was statistically significant (p<0.05). The results indicated that only the constant term (p=0.000), the coefficient of enforcement of traffic laws (p=0.000) and coefficient of pedestrian demographic factors (p=0.000) were statistically significant (p<0.05). Public Education (p=0.313) and road engineering designs (p=0.102) were not statistically significant.

Sixth, the study analysed the moderating influence of attitude of pedestrians on the relationship between road infrastructure interventions and implementation of pedestrian

safety rules in the City of Kisumu. Attitude of pedestrians was perceived as behaviour of pedestrians while walking along the road and while crossing the road.Hypothesis$H_{6.}$ ($H_{0:}$ The relationship between public education on road safety and implementation of pedestrian safety rules does not depend on attitude of pedestrians). Regarding this, it was concluded that the strength of the relationship between public education on road safety and implementation of pedestrian safety rules did not depend on attitude of pedestrians ($p=0.405$; $p>0.05$). The study therefore found no statistically significant relationship between public education on road safety and implementation of pedestrian safety rules moderated by attitude of pedestrians.

On the hypothesis H_6 part (ii), (H_0: The strength of the relationship between road engineering designs and implementation of pedestrian safety rules does not depend on attitude of pedestrians ($p=0.977$; $P>0.05$). On Hypothesis H_6 part (iii) (H_0: The strength of the relationship between enforcement of traffic laws and implementation of pedestrian safety rules does not depend on attitude of pedestrians), it was concluded that the strength of the relationship between enforcement of laws and implementation of pedestrian safety rules depend on attitude of pedestrians($p=0.019$; $p<0.05$), Hypothesis H_6 part (iv) ($H_{0:}$The strength of the relationship between pedestrian demographic factors and implementation of pedestrian safety rules does not depend on attitude of pedestrians).On this, it was concluded that the strength of the relationship between pedestrian demographic factors and implementation of pedestrian safety rules does not depend on attitude of pedestrians ($P=0.561$; $p>0.05$). Overall, out of the four road infrastructure interventions, attitude of pedestrians only moderated the relationship between enforcement of traffic laws ($P=0.05$; $p\leq0.05$) and implementation of pedestrian safety rules.

5.3 Discussions of the Study

This section discusses the influence of road infrastructure interventions and attitude of pedestrians on implementation of pedestrian safety rules on ten selected roads in the City of Kisumu, Kenya, in line with the research objectives.

5.3.1 Public Education on Road Safety Influences Implementation of Pedestrian Safety Rules

One of the items for pedestrians' view of public education on road safety was concerned with whether publicity and advertising about road safety should be increased.Most of the respondents were in strong agreement that publicity and advertising about road safety should be increased. It is therefore evident from this outcome that pedestrians believed that publicity and advertising about road safety was inadequate. This finding is similar to that of pedestrians' view concerning their knowledge of the Traffic Act where many pedestrians were of the opinion that their knowledge of the Traffic Act should be increased. These findings justify the recommendations stressed on motorists' fault as a pedestrian crash factor and driver education which should be encouraged andemphasized to put pedestrian safety, pedestrian crossing laws, drivers' responsibility and liability and education on hazardous pedestrian behavior (Chen, 2010; Kim et al,2008; Knezek, 2007; NJDOT, 2005; NJTPA,2011).

Further, reviews on related literature suggested that road safety communications advertising needed to be close to the point of impulse such as with radio, outdoor advertising, variable message signs and bus boards to be effective. In order to establish pedestrians' overall view of the level of public education on road safety, the study found that the distribution was positively skewed meaning the pedestrians' rating of public education on road safety was far below average. This implied that public education on road safety in the City of Kisumu was inadequate as far as pedestrians were concerned. These findings concur with reviews documented that there was little research on effectiveness of education strategiesthat targeted adults and a further observation that the educational efforts targeting adults tended to emphasize passive changes for older pedestrians rather than decisions that people made when about to cross roads (Chen,2010; Holland and Hill,2007; Knezek et al., 2007;NJTPA,2011).

In establishing the influence of public education on road safety and implementation of pedestrian safety rules, the correlation was statistically significant which indicataed that as public education on road safety improved, implementation of pedestrian safety rules also increased. Public education on road safety had a negligible influence on implementation of pedestrian safety rules and as much as the correlation coefficient was statistically significant, it was a weak one based on criteria set out earlier in Chapter

Three. However, this relationship seemed to contradict the findings of Martin (2006) who found that becauseyounger children were more likely to be influenced by road safety campaigns than older children, pedestrian safety education could improve children's road safety knowledge, their implementation of pedestrian safety rules and their observed road crossing behaviour (Conlon,2013). This was also corroborated by Miller (2000) who suggested that road user education could help promote desirable attitudes and behaviour in child pedestrians (Miller,2000; Martin, 2014).

On drivers' view on public education, enforcement of traffic laws and implementation of pedestrian safety rules, the study established that drivers' view was best on implementation of pedestrian safety rules followed by their view on public education on road safety. However, their view on enforcement of traffic laws was below average. It was therefore inferred that drivers were positive about implementation of pedestrian safety rules and public education on road safety. However, they were not happy about the level of enforcement of traffic laws.

Based on the drivers' attitude and how they perceived public education on road safety, the most important factor perceived by drivers to contribute to increasing number of pedestrian accidents in the city of Kisumu was bad road signboard. This was followed by breaking speed limit on urban roads, driving defective vehicle, driving when drunk and bad weather leading to poor visibility for pedestrians , in that order. On the other hand, the factors which were perceived to contribute rarely or sometimes to increasing number of pedestrian accidents in the city of Kisumu were quality of pavement surface, driving after taking drug which impairs ability, driving too close to a pedestrian in front and driving when too tired. Similarly, Martin (2014) and Miller (2000) observed that in case of drivers, road safety education could in turn promote desirable attitudes and behaviors and that improvements in driver behaviour were likely to have desirable impacts on pedestrians because "better" driving behaviour would reduce vehicle-pedestrian conflicts (Martin, 2006). To increase implementation of pedestrian's safety rules, road infrastructure interventions should have been put in place for education of driver's especially young drivers who were less likely to take pedestrians into consideration when driving (Martin, 2014).

Drivers' knowledge of the Traffic Act was tested using 6 items, namely, legal limit of alcohol,overlapping/obstruction/driving on pavement or through a petrol station, over

speeding, causing death through careless driving; driving under the influence of alcohol and eye testing for licensed drivers.Most of the drivers gave a wrong answer while only very few drivers gave the correct answer. This shows the extent of drivers' lack of knowledge regarding the limit of alcohol when driving. When asked whether overlapping, obstruction, driving on pavement or through a petrol station to avoid traffic was not an offence.The drivers who gave the correct response indicated that the majority of drivers knew that overlapping, obstruction, driving on pavement or through a petrol station to avoid traffic was indeed an offence. Similar responses were recorded for knowing that over speeding risked a fine or imprisonment, causing death by careless driving was treated like murder, driving under the influence of alcohol was an offence and eye test was mandatory for licensed drivers. Therefore, apart from lack of knowledge of the legal limit of alcohol when driving, drivers were reasonably knowledgeable with regard to the Traffic Act.

In testing whether the attitude of pedestrians moderated the relationship between public education on road safety and implementation of pedestrian safety rules, it was necessary to use public education on road safety, attitude of pedestrians and their interaction term as independent variables in a linear regression model, with implementation of pedestrian safety rules as the dependent variable. The analysis produced a multiple R of .31. This suggests that the three independent variables explained 9.6% of the variance in the dependent variable. A linear regression model involving the four variables was generated and it was evident that the interaction term was not statistically significant (t=.96, p>.05). Therefore, attitude of pedestrians did not moderate the relationship between public education on road safety and implementation of pedestrian safety rules. This was contrary to what was earlier hypothesized.

During the interview sessions with pedestrians, one of the themes that arose was their knowledge and awareness on road usage. It was found that poor road usage by the pedestrians could also be attributed to their insufficient knowledge and awareness of some of the traffic symbols and rules. For instance, one student said that:

> *"Most of the road users especially the motorists are not aware of the traffic act and their use by pedestrians and this should therefore be incorporated into the lessons at the driving school for motorists. Pedestrians should also learn about safety through public education on road safety as this will enhance road safety awareness among the pedestrians and even the motorists"* [Form Four Student]

Similar sentiments were echoed by one of the traders whose comment on the public education on road safety was that:

> *"Public education on road safety is still poor and road user education is also very bad among the pedestrians and motorists as such, there is rampant breakage of traffic rules which ultimately increases the chances of accident*" [Trader]

It can therefore be deduced that public education on road safety, specifically level of road safety awareness and enforcement of traffic rules and its usage was still low. This could negatively influence the implementation of pedestrian safety rules in the City of Kisumu as earlier observed by Devito (2006) who documented that pedestrians, at their peril, believed that they had a right on the road when they sought to cross or walk along the road. Pedestrians who cared less for their safety and that of other road users were partly or completely held responsible by the courts for the injuries and collisions that occurred.

5.3.2 Road Engineering Designs Influence Implementation of Pedestrian Safety rules in the City of Kisumu

Pedestrians' view of the quality of road engineering design was assessed using three items. The items addressed the quality of design of zebra crossing, suitability of the width of pedestrian sidewalks and pavement sstudy. Descriptively, the study found that majority of the respondents who participated in the study, agreed that the quality of road design was very good (Misingah, Kinyanjui and Onyango, 2013). This implied that the pedestrians' view on quality of zebra crossing in the City of Kisumu was summatively good from the views of a majority 140 pedestrians out of the 200 pedestrians who scored average and above. This agrees with what Ogendi and Odero (2012) cited about zebra crossing as sustained implementation strategies that support pedestrian safety. Otsyeno (2011) in line with this had proposed, that an awareness of existing interventions by pedestrians enhanced their road safety and their safe arrival as road users at a destination.This they further reported, depended on what the engineers and planners had designed. Raised Zebra Crossing (RZC), also created a strong improvement in safer crossing for pedestrians (Mburu, 2002, De Langen, Rwebangira, Kitandu and Mburu, 1999) hence the adequate provision in the City of Kisumu was ideal for enhancing implementation of pedestrian safety rules. De Langen, Opiyo and Tembele (2001) however caution that there was a false sense of safety from the zebra- white and black painting that increased accident hazards

when naïve pedestrians under-estimated the risks. This implies that the pedestrians were not satisfied with the adequate provision of sidewalk. Reynolds et al., (2009) in a similar view agrees that, absence of sidewalks posed the highest risk and the presence of sidewalks associated with the lowest risk. Rogers,(2012) also cited limited sidewalks provision and as few as only two pedestrian crossing facilities, a hindrance to implementation of pedestrian safety rules.

These results suggest that pedestrians did not have serious problems with quality of design of zebra crossings as compared to adequacy of sidewalks and pavement quality which were rated below average. This implies that sidewalk and pavement provision were inadequate and there was need to improve their provision to enhance implementation of pedestrian safety rules. Previous research in urban areas, in agreement with this indicated that road widening occurs at the expense of pedestrian safety (Dumbaugh, 2005b; 2009; Gondo, 2010). Wide lanes had adverse effects on pedestrian safety by increasing their exposure to risk of death or severe injury).

In summary, it was noted that measuring the quality of road engineering design, the distribution was near normal (Skewness = -.29) with a mean of 2.9150 and SD=1.0521.This suggests that, in general, pedestrians' rating of road engineering design was in the average range. This rating by the pedestrian seemed to contradict that of Mitullah and Makajuma (2009) who found that the roadway was poorly designed and the capacity was extremely constrained such that(Mueller,Rivara and Bergman,1987) matatus (paratransit) invaded sidewalks with impunity thereby compromising the safety of pedestrians. Over speeding motorists during off peak hours had also made the roadway difficult to cross by pedestrians. The use of sidewalks by motorized traffic when the roadway was congested had further exposed pedestrians to accidents. Similarly, De Langen et al. (2001) suggested in his study that large concrete slabs without side restraint should be laid well otherwise it was hard for pedestrians to use and almost became impassable.

Drivers were also asked the extent to which they agreed or disagreed with three statements regarding road engineering design in the city of Kisumu (Watundu, Musa and Mukyasi, 2011). In particular, with reference to importance of improving road condition in the City

of Kisumu, the residents o strongly agreed that the road condition should be improved. The residents also agreed on improvement of road lighting. Lastly, with reference to the necessity to construct underground passages and bridges for pedestrians,the residents unanimously agreed. From these responses, it could be deduced that drivers were generally in agreement that road engineering design in the City of Kisumu should be improved.

In the second road engineering design set of questions, drivers were asked about their opinion regarding five issues touching on roads in the City of Kisumu.The drivers indicated that pavement quality was very bad while others indicated that it was bad. Only 1 driver rated pavement quality as excellent. In a similar vein,some drivers observed that pedestrian facilities were very bad, bad and fair. Only few drivers indicated that pedestrian facilities were good, with no driver rating the pedestrian facilities as excellent. Drivers were also not happy with road width, roundabout circumference and lighting either, rating it as very bad, bad and fair. Only a small percentage of drivers rated it as good and excellent.

Sidewalks were also rated by drivers as inadequate. In particular, pedestrians rated the adequacy of sidewalks as very bad, bad and fair. Traffic lines and signs were no exception with the majority of drivers rating it as very bad, bad and fair. This was also noted through the observation walkability checklist where it was noted that although the sidewalks were available, they were less continuous thus posing several challenges to the pedestrian. The observation on the non-continuity was generally negative ranging from awful, some problems and many problems showing that sidewalks were quite a challenge to the pedestrian as it was the most common observation on most of the streets. Further, maintenance of the sidewalk was also a challenge with the observation on the streets revealing that it was generally low with ratings of awful, many problems and some problems reported from observations. A great challenge on pedestrian movement, as observed along the streets, was the high traffic volume on the sidewalks. This was a leading challenge as indicated by the findings where combined observations of awful to causing some problems was generally reported. Overally, the sidewalks were not blocked with utility poles as the observation rated the sidewalks suitable for pedestrian use from Good to Excellent. The observations also revealed other problems specified as; narrow

sidewalks, poor drainage, bushes along the road, sidewalks used by other traffic such as boda-boda and matatu stopping abruptly on the sidewalks causing jam and inconveniences. Problems regarding sidewalks were identified along Oginga Odinga Street, Angawa Avenue, Achieng Oneko road and Nyerere road.

On testing hypothesis two, for the influence of road engineering designs on implementation of pedestrian safety rules in the City of Kisumu. Hypothesis H_2 (H_0: There is no significant relationship between road engineering designs and implementation of pedestrian safety rules). The conclusion was that there was no statistically significant relationship between road engineering designs and implementation of pedestrian safety designs ($p=0.186$; $p > 0.05$).This was contrary to what was earlier hypothesized. The relationship could have therefore been due to chance or other factors not investigated in the current study. However, besides the questionnaire other data collection instruments such as the observation walkability checklist, interview and document analysis through Literature Review beefed up the information on a relationship which was not significant through the hypothesis test.

During an interview with an educator, one senior resident lecturer on road safety stated that owing to poorly designed roads, specifically Zebra crossings, pavements and sidewalks with little focus on pedestrians, there was a traffic mix on the roads causing high pedestrian activities which exposed the pedestrians to accidents. The respondent said that: -

> *"Roads in the City of Kisumu are not safe for all road users especially pedestrians. For instance, provision of the zebra crossing for pedestrian use was inconvenient or not adequately provided for, zebra crossings were inadequate/few, their location was also inappropriate. Sidewalks were infringed on by informal traders. Besides, on use of the roads for all pedestrians, the physically challenged were not given consideration in entrance to buildings. There were more stairs compared to ramps which would have been ideal for the physically challenged"* [Senior Resident Lecturer]

These sentiments were also supported by one of the informal traders during the interview, when she said that:

> *"Pedestrian facilities (zebra crossing, sidewalks and pavement) are inadequately provided for and this can promote risky usage of the*

roads by both the motorist and the pedestrians". [Informal Trader, Otieno Oyoo Street].

In similar vein, one of the educators also pointed out that:

> *"Because of the poor road design of the existing roads, there are no designated bus stages and this is causing the pedestrians to board and alight from vehicles anywhere, hence promoting traffic mix and competition for space*" [Educator]

Similarly, one of the students who were interviewed on this said that:

> *"Pedestrian facilities such as sidewalks, zebra crossing and pavements are not adequately provided for. The quality of the road is poor. Sidewalks are shared by informal traders and motorists overlap onto sidewalks during rush hours risking the pedestrian lives on the sidewalk"* [Student]

From the above responses, it can be deduced that the existing road engineering design is not adequate enough to accommodate the interest of all the road users especially the pedestrians and people with disabilities. Onyango et al., (2012) also observed that because of lack of proper road engineering design and planning, the street vendors identified the locations where they vend without any guideline. The sites occupied randomly made patterns of street vending haphazard within the urban built environment. Onyango et al. (2012) therefore suggested that there is need to guide planning of street vending to integrate them in urban land use. This was confirmed by Ogendi and Odero, (2012) who had earlier asserted that pedestrian safety was increasingly being threatened by road fatalities and severe injuries due to inadequacy of sidewalks, zebra crossing and pavements.

5.3.3 Enforcement of Traffic Laws and Implementation of Pedestrian Safety Rules in the City of Kisumu

Enforcement of traffic laws is an important component of implementation of pedestrian safety rules on the road (Chen, 2010).The three items used to measure this variable were "I am law abiding", "Drivers should be fined for causing risky behaviour" and "Quality of pedestrian safety enforcement". The study found that pedestrians' response regarding the items were in agreement, with only a very small proportion strongly disagreeing with the statements. Therefore, pedestrians in the City of Kisumu generally considered themselves as law abiding.

Sometimes drivers cause accidents through carelessness. Therefore, when asked whether drivers should be fined for committing risky behaviour on the road, cumulatively, the respondents were positive with the statement. This is an indication that pedestrians were generally of the opinion that drivers should be fined for displaying risky behavior on the road. Information also showed that an overwhelming majority of pedestrians were for the increase in quality of enforcement of pedestrian safety rules, indicating pedestrian dissatisfaction with the quality of enforcement of traffic laws in the city of Kisumu.

In establishing the pedestrians' overall view of enforcement of traffic laws, the mean values for the responses in the items were calculated and the study found that the distribution was negatively skewed (Skewness = -1.39), with a mean of 3.8825 and SD=.5190. This suggested that in general, pedestrians' rating of enforcement of traffic laws was above average. Further, the relationship between enforcement of traffic laws and implementation of pedestrian road safety rules showed that there was a correlation coefficient of 0.281. This was statistically significant at $p<0.05$ (2-tailed), indicating that as enforcement of traffic laws improved, implementation of pedestrian road safety rules also improved. The variance shared in common between enforcement of traffic laws and implementation of pedestrian safety rules was therefore 7.9%. A linear regression analysis showed that the regression coefficient was statistically significant ($t=3.741$, $p<.05$). Thus, an increase of 0.328 units in enforcement of traffic laws was associated with an increase of 1 unit in implementation of pedestrian safety rules. A previous study by Litman et al., (2014) on pedestrian planning policies drawn from the Traffic Act seem to support enforcement of traffic laws as important in enhancing the implementation of pedestrian safety rules. Similarly, the Traffic Act Amendment Bill of 2014 supported the findings as it was meant to provide the public with education that would improve the level of compliance with traffic rules.

Drivers' opinion regarding enforcement of traffic laws on drivers who broke traffic rules had a majority of drivers agreeing with the statement. A similar outcome was observed where drivers agreed that there was need for more enforcement of traffic laws. Drivers' traffic behaviour was rated poorly, with many drivers indicating that their behavior was fair, bad and very few indicating that drivers' behaviour was excellent and good. Similar to this was the fact that only few drivers thought that pedestrians displayed good

behaviour. The rest thought that pedestrian behavior was fair and bad. This trend was maintained for traffic control and behaviour of traffic police. These findings indicate that whereas drivers' traffic behaviour and pedestrian behaviour were considered satisfactory, traffic control and behaviour of traffic police were poorly rated.

Drivers' view on statements about traffic police shows that drivers were of the view that traffic police did not work well while others strongly disagreed with the statement. Very few either agreed or strongly agreed with the statement. On the other hand, the respondents agreed that traffic police were too few to be effective, with few indicating that they strongly agreed with the statement. On the issue of discrimination by traffic police, many drivers agreed that there was discrimination . This shows that drivers were not happy with the behaviour and manner in which the traffic police officers were carrying out their duties. In similar vein, Traffic Focus (2012) reiterated that corruption in traffic safety enforcement manifests itself when corrupt traffic officials allow motorists who speed, or who drive unroadworthy vehicles, to proceed with their journey, making the consequences for other road users be potentially disastrous. A breakdown in public trust of the integrity of traffic officials is likely to result in an increase in lawlessness among road users.

5.3.4 Pedestrian Demographic Factors and Implementation of Pedestrian Safety Rules in the City of Kisumu

Four items were used to measure pedestrian demographic factors associated with implementation of pedestrian safety rules. Mean responses to the items were all above average. The highest mean was for the item which qualified age as a factor which makes it easy to cross a zebra crossing. This was followed by pedestrian education level as a determinant of decisions made while crossing a road. Thus, of all the pedestrian demographic factors, age was considered the most important factor when crossing a pedestrian crossing. This supports the findings by Scot (2010) Salmon (2005) Shah (2003) who all found that age and sex were important determinants of pedestrian accidents among the middle aged. They also found that males were more prone to accident as drivers as supported by Odero and Khayesi (2003) who also found that (Gwilliam, 2000) male between the ages of 16 and 54 accounts for majority of injury from accidents in all countries. About 15% of those killed in developing countries were children, and this was

much higher than in industrialized countries. Odero, Khayesi and Heda (2014) on place of residence had found that pedestrians were more likely to be killed in urban roads confirming their urban residential location (Komba, 2006, Wilde, 2002). Previous findings from Muller and Reiner (2011) had proposed the use of Smart Street Lighting (SSL) in sub urban areas with low pedestrian frequency to revolutionize pedestrian locations and enhance the desired safety in the otherwise (fear) zones. This study found street lit areas in the core urban and peri-urban areas as having high pedestrian activity.

Pedestrian education level as a determinant of decision making when crossing a road followed closely. In order to establish pedestrians' overall view of enforcement of traffic laws, the mean values for the responses in the items were calculated and the distribution was found to be slightly negatively skewed (Skewness = -0.52) with a mean of 3.4513 and SD=.8132. This suggests that in general, the majority of pedestrians viewed their demographic factors as being closely associated with implementation of pedestrian safety rules. This concurs with the findings of Jeng and Fallat (2003) who also foundthat educating pedestrians about safety devices and signals was important as many did not understand the flashing do not walk interval (NJTPA,2011;Chen,2010; Jeng and Fallat, 2003). This was critical in determining the crossing behaviour.

Further, in order to establish pedestrians' overall view on implementation of pedestrian safety rules using the mean values, the study found that the distribution was negatively skewed (Skewness = -.36), with a mean of 4.0150 and SD=.5811.There was a statistically positive significant correlation between pedestrian demographic factors and implementation of pedestrian safety rules at p $0.001<0.05$ meaning that a change in pedestrian demographic factors was associated with a corresponding change in implementation of pedestrian safety rules. In general, pedestrians' view of implementation of pedestrian safety rules was therefore above average, with the majority of pedestrians holding a positive view about implementation of pedestrian safety rules in the City of Kisumu.

On testing the influence of pedestrian demographic factors on implementation of pedestrian safety rules in the City of Kisumu which was HypothesisH_4. (H_0: There is no significant relationship between pedestrian demographic factors and implementation of

pedestrian safety rules), it was concluded that there was a statistically significant relationship between pedestrian demographic factors and implementation of pedestrian safety rules (p=0.001; p<0.05).This was statistically significant indicating a relationship between pedestrian demographic factors and implementation of pedestrian safety rules.

5.3.5 Attitude of Pedestrians on the Relationship between Road Infrastructure Interventions and Implementation of Pedestrian Safety Rules

In order to test if attitude of pedestrians moderated the relationship between public education on road safety and implementation of pedestrian safety rules, it was necessary to use public education, attitude of pedestrians and their interaction term as independent variables in a linear regression model, with implementation of pedestrian safety rules as the dependent variable. The analysis produced R square value of .092.This suggests that the three independent variables explained 9.2% (Soole, 2013) of the variance in the dependent variable. Using linear regression model to test moderating effect of attitude of pedestrians on the relationship between public education and implementation of safety rules, the analysis found that the interaction term was not statistically significant, given that (t=.835, p= .405 >.05). Therefore, attitude of pedestrians did not moderate the relationship between public education on road safety and implementation of pedestrian safety rules. This was contrary to what was earlier hypothesized.

In order to test whether attitude of pedestrians moderated the relationship between enforcement of traffic laws and implementation of pedestrian safety rules, enforcement of traffic laws, attitude of pedestrians and their interaction term were used as independent variables in a linear regression model, with implementation of pedestrian safety rules as the dependent variable. The analysis produced an R square value of .133.This suggests that the three independent variables explained 13.3% of the variance in the dependent variable (Soole, 2013). Therefore, the interaction effect of enforcement of traffic laws and attitude of pedestrians was statistically significant (t=-2.051, p = $.019$ <.05).Attitude of pedestrians therefore moderated the relationship between implementation of pedestrian safety rules and enforcement of traffic laws as hypothesized.

In testing whether attitude of pedestrians moderated the relationship between pedestrian demographic factors and implementation of pedestrian safety rules, three variables were

used in a linear regression model namely pedestrian demographic factors, attitude of pedestrians and their interaction term, attitude of pedestrians and pedestrian demographic factors as independent variables, with implementation of pedestrian safety rules as the dependent variable. The analysis produced an R square value of .22.This implies that the three independent variables explained 22.0% of the variance in the dependent variable. Generating a linear regression model involving the four variables showed that attitude of pedestrians failed to moderate the relationship between implementation of pedestrian safety rules and pedestrian demographic factors as the interaction term turned out not to be statistically significant (t=-.582, p<.05). This was contrary to the initial hypothesis.

5.4 Conclusions of the Study

Having analyzed and interpreted the findings obtained from the data collected, based on objective one which was the extent to which public education on road safety influence implementation of pedestrian safety rules in the City of Kisumu, it was concluded that public education on road safety was inadequate as far as the pedestrians were concerned. The correlation between public education on road safety and implementation of pedestrian safety rules was statistically significant at p = 0.013<0.05.This means that, as public education on road safety improved, implementation of pedestrian safety rules also increased. It was therefore concluded that public education on road safety was an ideal intervention for pedestrians in implementing pedestrian safey rules.

On objective two which was on how road engineering designs influence implementation of pedestrian safety rules, it was concluded that there was no statistically significant relationship between road engineering designs and implementation of pedestrian safety rules in the City of Kisumu, Kenya. The correlation between road engineering designs and implementation of pedestrian safety rules was not statistically significant at p = 0.186>0.05. This means that as road engineering design increased implementation of pedestrian safety rules in this study decreased. It may be concluded that implementation of pedestrian safety rules was not dependent on road engineering designs.Although the result showed no statistically significant relationship between road engineering designs and implementation of pedestrian safety rules, pedestrian rating of road engineering design was on the average range.Pedestrians view during observations from the walkability checklist however indicated observable relationships between adequate use of sidewalks,

zebra crossing and pavement and enhanced implementation of pedestrian safety rules. This was further supported by documentary analysis through literature review as cited by Asingo and Mitullah (2014) who reported that when pedestrians failed to keep to their side of the road or ignored safe means for road crossing on a zebra crossing their non compliance was high which indicated serious risk of injury or death. Hence, there was a tendency of the relationship between road engineering design and implementation of pedestrian safety rules was likely to improve with adequate provision and adequate use of pedestrian facilities Odera, Khayesi and Heda (2014) in agreement confirmed that without zebra crossing, sidewalks or quality pavement, pedestrians were likely to be killed in urban roads. However, in this study, if any relationship existed between road engineering designs and implementation of pedestrian safety rules, it could have been due to chance or any other cause outside the scope of this study.There was therefore need to do a further investigation on why the relationship registered a statistically negative relationship in the City of Kisumu.

On objective three which was on the extent to which enforcement of traffic laws influence implementation of pedestrian safety rules, it was concluded that pedestrian rating of enforcement of traffic laws was above average. The correlation between enforcement of traffic laws and implementation of pedestrian safety rules was statistically significant at $p= 0.001<0.05$ meaning that as enforcement of traffic laws improves, implementation of pedestrian safety rules also improved.There was a significant relationship between implementation of pedestrian safety rules and enforcement of traffic laws.Thus, enforcement of traffic laws enhanced implementation of pedestrian safety rules.

On objective four which sought to establish how pedestrian demographic factors influenced implementation of pedestrian safety rules. Majority of pedestrians viewed their demographic factors as being associated with implementation of pedestrian safety rules. The correlation between pedestrian demographic factors and implementation of pedestrian safety rules was statistically significant at $p\ 0.001<0.05$ meaning that a change in pedestrian demographic factors was associated with a corresponding change in implementation of pedestrian safety rules. It may be concluded that implementation of pedestrian safety rules was dependant on pedestrian demographic factors. This suggests

that pedestrian attributes of age, gender and educational level were likely to significantly improve implementation of pedestrian safety rules in the City of Kisumu.

The fifth objective which sought to establish the extent to which the combined road infrastructure interventions influenced implementation of pedestrian safety rules in the City of Kisumu, it was concluded that the combined road infrastructure interventions accounted for 25.4% of the variance in the dependent variable (implementation of pedestrian safety rules). The results indicated that only the constant term ($p=0.001$), the coefficient of enforcement of traffic laws (Coulson,Fox, Lawlor and Trayers, 2011) ($p=0.001$) and coefficient of pedestrian demographic factors ($p=0.001$) were statistically significant ($p<0.05$).Public Education ($p=0.313$) and Road Engineering Designs ($p=0.102$) were not statistically significant. Enforcement of traffic laws and pedestrian demographic factors which registered positive influence on implementation of pedestrian safety rules needed to be enhanced while public education on road safety and road engineering designs which negatively influenced implementation of pedestrian safety rules required improvement to benefit pedestrians and drivers in urban roads in the City of Kisumu.

On the sixth objective which was on the moderating influence of attitude of pedestrians on the relationship between selected road infrastructure interventions and implementation of pedestrian safety rules, it was concluded that on attitude of pedestrians as a moderator between public education on road safety and implementation of pedestrian safety rules, the analysis produced $R^2= .092$ suggesting the three independent variables explained 9.2% of the variance in the dependent variable. On regression, the interaction term was not statistically significant ($t=.835$ $p>.05$). Therefore, attitude of pedestrians did not moderate the relationship between public education on road safety and implementation of pedestrian safety rules which was contrary to what was earlier hypothesized. Despite the unexpected results, positive pedestrian attitude and improved public education on road safety would encourage implementation of pedestrian safety rules and responsible sharing of the road space.

On attitude of pedestrians as a moderator between enforcement of traffic laws and implementation of pedestrian safety rules, the analysis produced R^2 of .133 suggesting that the three independent variables explained 13.3% of the variance in the dependent variable.

On regression, the interaction term was statistically significant (t=-2.369, p>.05). Therefore, attitude of pedestrians moderated the relationship between enforcement of traffic laws and implementation of pedestrian safety rules as hypothesized. Thus enforced traffic laws combined with a positive pedestrian attitude would lead to effective implementation of pedestrian safety rules in the City of Kisumu.

On attitude of pedestrians as a moderator between pedestrian demographic factors and implementation of pedestrian safety rules, the analysis produced R^2 of .22. This suggests that the three independent variables explained 22.0% of the variance in the dependent variable. On regression, the interaction term was not statistically significant (t=.582, p>.05). Therefore, attitude of pedestrians failed to moderate the relationship between pedestrian demographic factors and implementation of pedestrian safety rules contrary to what was initially hypothesized. Overall, it can be concluded that the attitude of pedestrians towards implementation of pedestrian safety rules was above average and therefore positive. Since the pedestrians were positive in implementing pedestrian safety rules, this would be a springboard to ensuring the best of their demographic characteristics drawn from age, gender and pedestrian education level is reinforced in ensuring better implementation of road safety rules in Kisumu.

Multiple regression models were used to establish the combined moderating influence of attitude of pedestrians on relationship between road infrastructure interventions and implementation of pedestrian safety rules. The multiple R was .538, and the R^2 explained 28.9% of the variation with the adjusted R square explaining 25.6% of the variance. The results of the ANOVA showed an F-value of 8.594 df (9, 190) and p-value 0.001 ($p<0.05$) which was statistically significant. On regression, a relationship between the predictor variables combined with attitude of pedestrians and implementation of pedestrian safety rules was established. The standardized coefficient for attitude of pedestrians was 2.096 which indicated for a unit increase of this particular moderator and road infrastructure interventions; implementation of pedestrian safety rules increased by 2.096. The multiple regression linear model was therefore $Y = 1.477X_3 + 2.096M - .376\ X_3M$.

The results therefore indicate that positive attitude of pedestrians and road infrastructure interventions are likely to boost implementation of pedestrian safety rules in the City of Kisumu. Pedestrians' view on implementation of pedestrian safety rules (the dependent variable) was above average, with the majority of pedestrians holding a positive view about implementation of pedestrian safety rules in the City of Kisumu. Thus implementation of pedestrian safety rules could therefore be managed effectively from a safe systems approach which involved responsible sharing of the road by all road users.

5.5 Contribution of the Study to the Body of Knowledge

Objectives of the study	Contribution to knowledge
1. To establish the extent to which public education on road safety influence implementation of pedestrian safety rules.	1. Although public education on road safety was inadequate, increased road safety awareness, knowledge of the traffic act and availability of the children's traffic park improved implementation of pedestrian safety rules.
2. Examine how road engineering designs influence implementation of pedestrian safety rules.	2. Observations and interviews on adequacy of sidewalks, zebra crossing and pavements revealed the need to apply the safe systems approach theory. Road engineering designs and implementation of pedestrian safety rules was not statistically significant in this study however integration of both engineering interventions and behavioral interventions was found to be a possible more sustainable solution.
3. To assess the extent to which enforcement of traffic laws influence implementation of pedestrian safety rules.	3. Enforcement of traffic laws indicated by presence of police, corruption, sanctions and fines was applied pragmatically. *Ex post facto* design allowed the study of implementation of pedestrian safety rules to be done retrospectively and allowed application of ethical considerations.
4. To determine how pedestrian demographic factors influence implementation of pedestrian safety rules.	4. Pedestrian demographic factors influenced a proactive and responsible sharing of the road space and implementation of pedestrian safety rules treated as an outcome variable.
5. To assess the moderating influence of attitude of pedestrian on the relationship between road infrastructure interventions and implementation of pedestrian safety	5. Attitude of pedestrians measured as a behaviour component moderated the relationship between road infrastructure interventions (enforcement of traffic laws) on implementation of pedestrian safety rules.

5.6 Recommendations of the Study

Considering the study findings and conclusions, the following recommendations were made: that Public education on road safety in terms of road safety awareness, knowledge of the traffic Act and availability of the children's traffic park were low on their influence on implementation of pedestrian safety rules. The Traffic Act should therefore contribute to policy and practice, research and theory to assist the Kenya Government in enhancing pedestrian safety.An integrated non-motorized policy targeting pedestrians would reinforce the government's responsibility for providing high quality road infrastructure interventions for pedestrians. The study found the number of Children's traffic parks inadequate as a source of public education for pedestrians,the study recommends that the number of children's traffic parks should be increased to educate child pedestrians in the City of Kisumu.

Road engineering designs influence on implementation of pedestrian safety rules was not statistically significant. Practitioners in the Ministry of Roads and Transport authorities and road safety councils should strategize and attain acceptable levels of implementation of pedestrian safety rules through integration of both engineering and behavioral interventions on road infrastructure.The pedestrian facilities highlighted in this study such as zebra crossing,sidewalks and pavement should be adequately provised for and effectively used by all road users especially pedestrians to enhance road safety.

Enforcement of traffic laws on implementation of pedestrian safety rules was found to be statistically significant. Further research on implementation of pedestrian safety rules and enforcement of traffic laws could be approached from a project planning and management perspective to provide useful information to pedestrians in the City of Kisumu and traffic law enforcers to adopt a multidisciplinary and proactive approach in addressing pedestrian safety rules.Provideuseful reference material to researchers and scholars to enable road users to make decisions on proper road use from facts based on research. This study acts as a starting point for further studies on responsible sharing of space, proactive approach to addressing pedestrian safety issues and adapting the safe systems approach theory for all road users.

Knowledge on pedestrian safety from pedestrian demographic factors would persuade political leaders to develop, implement and support pedestrian safety measures, with their

political good will.This will in the long run encourage the pedestrians to prefer walking to other modes of road transport which is beneficial to their health,environmental benefits and for social interactions in Livable Cities like the upcoming and fast growing City of Kisumu.

5.7 Suggestions for Further Research

For further research, the study suggests the following:-

1. This study was delimited to the City of Kisumu alone. A study can be replicated in other cities in Kenya to explain the possibilities of other environmental factors thereby improving generalizability of the findings.
2. The study only focused on road infrastructure interventions and attitude of pedestrians on implementation of pedestrian safety rules. There is therefore need for an investigation of other variables which may produce different results. Implementation of pedestrian safety rules in this study was used as an outcome variable. Another study could measure the level of implementation of pedestrian safety rules.
3. The study integrated engineer and behaviour change interventions to measure road infrastructure interventions on implementation of pedestrian safety rules. Other researchers could use either engineering or behaviour change interventions separately.
4. A study can be carried out with attitude of pedestrians as the dependent variable, implementation of pedestrian safety rules as independent variable and road infrastructure interventions as moderating variable to see the outcome of the change in results.
5. This study was carried out on ten selected urban roads in the City of Kisumu. Another study could be based on the other remaining urban roads for wider generalizability.
6. Attitude of pedestrians focused on behavioural component of attitude specifically behaviour of pedestrians while walking along or across the road. Other studies could focus on other components like the cognitive and affective components of attitude on implementation of pedestrian safety rules.
7. The safe systems approach theory was used to anchor the current study on urban roads. Another study could use the same theory but on implementation of pedestrian safety on rural roads.
8. All the beneficiaries in this study should be incorporated to ensure integrated implementation of pedestrian safety rules especially targeting motor cyclists who have proved to be a menace in most roads to pedestrians and motorists.

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APPENDICES

AppendixI: Letter of Transmittal

JESSICA AKINYI OGOMBE
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2ND JUNE, 2015

TO WHOM IT MAY CONCERN

I am a Doctor of Philosophy candidate at the University of Nairobi. As part of the requirement of the Doctoral degree in project planning and management, I am conducting research as a prerequisite for the course in project planning and management on **influence of road infrastructure interventions on implementation of pedestrian safety rules in the city of Kisumu, Kenya** this will lead to improvement of pedestrian safety rules in theCity of Kisumu.

To enable me collect data for the research, you have been selected as one of the participants of the study. Kindly complete the data collection instruments such as the questionnaire and interview guide attached. The research is for academic purposes only and thus your identity will be kept confidential. You are requested to give your response as honestly as possible.

Thank you in advance for participating in this research.

Yours Sincerely,

Jessica Akinyi Ogombe
Student, School of Continuing and Distance Education
Department of Extra-Mural Studies
University of Nairobi

Appendix II: Questionnaire for Pedestrians

This questionnaire attempts to ask questions related to Road Infrastructure Interventions and Attitude of Pedestrians on Implementation of Pedestrian Safety Rules. Kindly answer the questions as honestly as possible. The instructions and room for responses isprovided beside the questions.

	T101: SURVEY QUESTIONNAIRE		
	QUESTIONS	***RESPONSES***	***INSTRUCTIONS***
1.0	**INTRODUCTION**		
1.1	Date of interview	_____ /_____/ 2015	*DD/MM/YY*
1.2	Interviewer ID		*INDICATE A-TWO-DIGIT CODE*
1.3	Administrative Region	City of Kisumu	*CIRCLE THE MOST APPROPRIATE*
1.4	Name of the urban road.		*Type the name of the road network*
2.0	**SOCIO-DEMOGRAPHIC FACTORS**		
2.1	Which age bracket do you belong?	Below 20 years ……..1 Between20 and29……..2 Between30 and 39……..3 Between40 and 49……..4 Between50 and 59……..5 Over 60 years,,,,,,……..6	*CIRCLE THE MOST APPROPRIATE*
2.2	My age as a pedestrian hinders my use of the road.	Strongly Agree.....5 Agree.....4 Neutral.....3 Disagree.....2 Strongly disagree.....1	*CIRCLE THE MOST APP ROPRIATE*
2.3	Please specify your gender	FEMALE……..1 MALE……2	*CIRCLE THE MOST APPROPRIATE*
2.4	My gender determines my use of the road as a pedestrian	Strongly Agree……..5 Agree…….. ….4 Neutral……..3 Disagree…… ..2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
2.5	State your highest educational level?	NONE……..1 PRIMARY……..2 SECONDARY ……..3 TERTIARY……4 UNIVERSITY……5	*CIRCLE THE MOST APPROPRIATE*
2.6	Where do you live?	Rural.....1 Peri -urban.....2 Core urban.....3	*CIRCLE THE MOST APPROPRIATE*
2.7	I consider walking my most preferred mode of transport.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
2.8	It is unsafe to walk on urban roads in the city of Kisumu	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE ANY THE MOST APPROPRIATE*
2.9	I sometimes get annoyed with other pedestrians while walking on the roads in the city of Kisumu.	Strongly Agree.....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*

3.0	**PUBLIC EDUCATION ON ROAD SAFETY AND IMPLEMENTATION OF PEDESTRIAN SAFETY RULES**		
3.1	Publicity and advertising about pedestrian safety in the city of Kisumu should be increased	Strongly Agree.....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
3.2	Pedestrian safety awareness is created in the daily newspapers as a source of public education.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
3.3	Pedestrians knowledge of the Traffic Act should be increased.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
3.4	Visiting the childrens traffic park benefits child pedestrians.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
3.5	The number of childrens traffic parks in the city of Kisumu hinders accessibility.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
3.6	Availability of the integrated non motorized transport policy for pedestrians should be improved in the city of Kisumu	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
4.0	**ROAD ENGINEERING DESIGNS ON IMPLEMENTATION OF PEDESTRIAN SAFETY RULES**		
4.1	The quality of pavement in the city of Kisumu is good	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....4 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
4.2	The width of the sidewalk makes it suitable for pedestrian use	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
4.3	The white and black design of a Zebra crossing for pedestrians is	Very good.....5 Good.....4 Average .....3 Poor.....2 Very poor 1	*CIRCLE THE MOST APPROPRIATE*
4.4	As a pedestrian, most motorists yield to me when I walk across a zebra crossing.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
4.5	A driver who does not yield to pedestrians walking legally at a zebra crossing should be punished.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
4.6	Sidewalks in the city of Kisumu are inadequately provided for.	Strongly Agree.....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
4.7	I sometimes feel nervous while crossing a road in the city of Kisumu?	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*

5.0	**ENFORCEMENT OF TRAFFIC LAWS AND IMPLEMENTATION OF PEDESTRIAN SAFETY RULES**		
5.1	Iconsider myself to be law –abiding pedestrian within the city of Kisumu.	Strongly Agree.....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
5.2	Pedestrian safety enforcement in the city of Kisumu should	Be increased .....3 Remain unchanged.....2 Be decreased 1	*CIRCLE THE MOST APPROPRIATE*
5.3	Penalties for breaking pedestrian safety laws in the city of Kisumu should	Be increased .....3 Remain changed.....2 Be decreased 1	*CIRCLE THE MOST APPROPRIATE*
5.4	Absence of traffic police on the road reduces compliances to traffic rules	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
5.5	Accidents are mainly caused by risky pedestrian behaviour	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
5.6	Drivers should be fined for causing risky behaviour towards pedestrians.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
6.0	**PEDESTRIAN DEMOGRAPHIC FACTORS AND IMPLEMENTATION OF PEDESTRIAN SAFETY RULES.**		
6.1	Walking on roads in the city of Kisumu is safe for children	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
6.2	Elderly pedestrians find it unsafe to use a sidewalk in the city of Kisumu	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
6.3	My age as a pedestrian makes it easy for me to use a pedestrian crossing	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
6.4	Male pedestrians are more comfortable walking on a sidewalk.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
6.5	There is no difference between male and female in use of the pavement.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
6.6	Female pedestrians are more careful when using a zebra crossing	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
6.7	Ones level of education determines how they make decisions while using the road	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
6.8	Walking does not need one to be educated just need your foot	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*

7.0	**ATTITUDE OF PEDESTRIANS TO IMPLEMENTATION OF PEDES TRIAN SAFETY RULES.**		
7.1	I don't assume vehicles will stop when I want to cross the road	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
7.2	I always walk on the sidewalk where there is one	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
7.3	Istand clear of buses, hedges, parked cars, or obstacles before crossing the road.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
7.4	I feel safer crossing the street in a well-lit area at night.	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
7.5	I carry a flash light when walking at night	Never.....4 Rarely.....3 Often.....2 Very often 1	*CIRCLE THE MOST APPROPRIATE*
7.6	I wear bright /coloured clothing and reflective materials when walking on or near a road.	Never.....4 Rarely.....3 Often .....2 Very often 1	*CIRCLE THE MOST APPROPRIATE*
7.7	I stay sober when walking near or crossing a road.	Never.....4 Rarely.....3 Often .....2 Very often 1	*CIRCLE THE MOST APPROPRIATE*
7.8	I normally look before I cross without relying solely on pedestrian signals	Never.....4 Rarely.....3 Often .....2 Very often 1	*CIRCLE THE MOST APPROPRIATE*
7.9	Icross streets at marked crosswalks	Never .....4 Rarely.....3 Often .....2 Very often 1	*CIRCLE THE MOST APPROPRIATE*
7.10	I look right,left,and right again before crossing a street	Never.....4 Rarely.....3 Often.....2 Veryoften.....1	*CIRCLE THE MOST APPROPRIATE*
7.11	I wear headphones while crossing a road	Never.....4 Rarely.....3 Often .....2 Very often 1	*CIRCLE THE MOST APPROPRIATE*
7.12	I use a mobile phone while crossing a road	Never.....4 Rarely.....3 Often .....2 Very often 1	*CIRCLE THE MOST APPROPRIATE*
7.13	Dangerous roads to walk in are those with high pedestrian activity	Strongly Agree .....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
7.14	The safest roads to walk in have a high pedestrian activity.	Strongly Agree.....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
	IMPLEMENTATION OF PEDESTRIAN SAFETY RULES		
8.0	I obey traffic rules when walking along the road	Strongly Agree.....5 Agree.....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*

8.1	It's the responsibility of the police to ensure obedience to traffic laws	Strongly Agree ..... 5 Agree ..... 4 Neutral ..... 3 Disagree ..... 2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
8.2	Pedestrians do not have regulations relating to safe road use	Strongly Agree ..... 5 Agree ..... 4 Neutral ..... 3 Disagree ..... 2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
8.3	The engineers should ensure safety is inbuilt on the roads for pedestrian use	Strongly Agree ..... 5 Agree ..... 4 Neutral ..... 3 Disagree ..... 2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
8.4	The level of road safety awareness improves implementation of pedestrian safety rules	Strongly Agree ..... 5 Agree ..... 4 Neutral ..... 3 Disagree ..... 2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
8.5	Age is critical in implementing pedestrian safety rules	Strongly Agree ..... 5 Agree ..... 4 Neutral ..... 3 Disagree ..... 2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
8.6	Males are not keen on implementing pedestrian safety rules	Strongly Agree ..... 5 Agree ..... 4 Neutral ..... 3 Disagree ..... 2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
8.7	Female pedestrians follow regulations relating to implementation of pedestrian safety rules always	Strongly Agree ..... 5 Agree ..... 4 Neutral ..... 3 Disagree ..... 2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
THANK YOU FOR YOUR COOPERATION			

AppendixIII: Questionnaire for Drivers'

This questionnaire attempts to ask questions related to Road infrastructure interventions and attitude of pedestrians on implementation of pedestrian safety rules. Kindly answer the questions as honestly as possible. The instructions and room for responses is provided beside the questions.

DEMOGRAPHIC FACTORS			
1.0	Which age bracket do you belong?	Below 20 years ……..……1 Between20 and 29……..……....2 Between30 and 39……..……....3 Between40 and 49……..……....4 Between50 and 59……..……....5 Over 60 years…… ……..…….....6	*CIRCLE THE MOST APPROPRIATE*
1.1	Please specify your gender?	Female .....1 Male 2	*CIRCLE THE MOST APPROPRIATE*
1.2	State your highest educational level?	University .....5 Tertiary .....4 Secondary .....3 Primary .....2 None 1	*CIRCLE THE MOST APPROPRIATE*
1.3	Where do you live?	Core urban .....4 Peri-urban .....3 Rural.....2 Others (please specify) 1	*CIRCLE THE MOST APPROPRIATE*
1.4	How many years have you driven a motor vehicle?	.....	*CIRCLE THE MOST APPROPRIATE*
1.5	In the past 12 months,name any month(s) that you didn't drive?	.....	*CIRCLE THE MOST APPROPRIATE*
1.6	During the months you drove, which day of the week did you drive the least?	.....	*CIRCLE THE MOST APPROPRIATE*
PUBLIC EDUCATION ON ROAD SAFETY AND IMPLEMENTATION OF PEDESTRIAN SAFETY RULES			
2.**0 How often do you think the following factors contribute to increasing number of pedestrian accidents in the city of Kisumu? (*Please circle for each of the 11 items as follows)***			
2.1	Driving when too tired	Very often .....5 Often .....4 Sometimes .....3 Rarely .....2 Never 1	*CIRCLE THE MOST APPROPRIATE*
2.2	Driving car when drunk	Very often .....5 Often .....4 Sometimes .....3 Rarely .....2 Never 1	CIRCLE THE MOST APPROPRIATE
2.3	Driving too close to a pedestrian who is walking infront.	Very often .....5 Often .....4 Sometimes .....3 Rarely .....2 Never 1	*CIRCLE THE MOST APPROPRIATE*
2.4	Breaking speed limit of 30km/hr on urban roads	Very often .....5 Often .....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
2.5	Driving after taking of a drug or medicine which impairs driving ability.	Very often .....5 Often .....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*

2.6	Quality of pavement surface	Very often.....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
2.7	Bad weather condition leading to poor visibility for pedestrians.	Very often .....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
2.8	Driving defective motor vehicle	Very often .....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
2.9	Driver's poor vision	Very often .....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
2.10	Bad road signboard	Very often .....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
3.0 ENFORCEMENT OF TRAFFIC LAWS ON IMPLEMENTATION OF PEDESTRIAN SAFETY RULES			
To what extent do you agree or disagree with the following statements regarding road usage in the city of Kisumu? (*Please circle one answer for each of the 4 items as follows:*)			
3.1	Other drivers who break traffic rules make me angry while am driving	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
3.2	Iam worried when one of my family members is driving.	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree .....`.1	*CIRCLE THE MOST APPROPRIATE*
3.3	There is need to have more enforcement of traffic laws	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
3.4	Pedestrian violate traffic rules more than drivers	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
4.0What is your opinion regarding thefollowing issues about roads in the city of Kisumu? (*Please circle one answer for each of the 4 items as follows*)			
4.1	Driver's traffic behaviour	Excellent……...5 Good……..…4 Fair……..…3 Bad……..2 Very bad……..…1	*CIRCLE THE MOST APPROPRIATE*
4.2	Pedestrians' behaviour	Excellent……..……..5 Good……..……4 Fair……..3 Bad……..2 Very bad……..…1	*CIRCLE THE MOST APPROPRIATE*
4.3	Traffic control	Excellent……..…..5 Good……..……4 Fair……..……3 Bad……..2 Very bad……..1	*CIRCLE THE MOST APPROPRIATE*
4.4	Behaviour of traffic police	Excellent……..5 Good……...…4 Fair……...…3 Bad……...…2 Very bad……..……...….1	*CIRCLE THE MOST APPROPRIATE*

5.0 **What is your opinion regarding the following issuesabout drivers in the city of Kisumu?** (***Please circle one answer for each of the 3 items as follows***)			
5.1	Drivers' ability to drive safely	Excellent……...5 Good……..….4 Fair……..…3 Bad……...2 Very bad……1	*CIRCLE THE MOST APPROPRIATE*
5.2	Drivers' knowledge about traffic rules	Excellent……..5 Good……4 Fair……...……3 Bad……..……2 Very bad……1	*CIRCLE THE MOST APPROPRIATE*
5.3	Quality of drivers training Education?	Excellent……5 Good……4 Fair……...3 Bad……..……2 Very bad……1	*CIRCLE THE MOST APPROPRIATE*
6.0 **How much do you agree or disagree with the following statements about traffic police in the city of Kisumu?** (***Please circle one answer for each of the 5 items as follows:***)			
6.1	They work well	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
6.2	They are too few to be effective on roads	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
6.3	They discriminate	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
6.4	Their behaviour is good	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
6.5	They are corrupt	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree 1	*CIRCLE THE MOST APPROPRIATE*
7.0 ROAD ENGINEERING DESIGN AND IMPLEMENTATION OF PEDESTRIAN SAFETYRULES:			
To what extent do you agree or disagree with the following statements regarding roads in theCity of Kisumu? (***Please circle one answer for each of the 5 choices as follows***			
7.1	It is important to improve the road conditions in the city of Kisumu	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
7.2	It is not necessay to improve crosswalks (e.g. zebra crossings) and sidewalks in the city of Kisumu	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
7.3	There is need to improve road lighting in the city of Kisumu	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*
7.4	It is necessary to construct underground passages and bridges for pedestrians in the city of Kisumu	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree..... 1	*CIRCLE THE MOST APPROPRIATE*
7.5	It is not necessary to have bicycle roads in the city of Kisumu	Strongly Agree .....5 Agree .....4 Neutral .....3 Disagree .....2 Strongly disagree.....1	*CIRCLE THE MOST APPROPRIATE*

8.0 What is your opinion regarding the following issues about roads in City of Kisumu? (*Please circle one answer for each of the 5 items as follows*:			
8,1	Pavement quality	Excellent……..…5 Good……4 Fair……3 Bad……2 Very bad……1	*CIRCLE THE MOST APPROPRIATE*
8.2	Pedestrian facilities	Excellent……..…5 Good……4 Fair……3 Bad……2 Very bad……1	*CIRCLE THE MOST APPROPRIATE*
8.3	Road width, roundabout circumference and street lighting	Excellent……..…5 Good……4 Fair……3 Bad……2 Very bad……1	*CIRCLE THE MOST APPROPRIATE*
8.4	Adequacy of sidewalks	Excellent……..…5 Good……4 Fair……3 Bad……2 Very bad……1	*CIRCLE THE MOST APPROPRIATE*
8.5	Traffic lines and traffic signs	Excellent……..…5 Good……4 Fair……3 Bad……2 Very bad……1	*CIRCLE THE MOST APPROPRIATE*
8.6	Do you talk on the phone while you are driving?	Yes☐ No☐	*Please tick ' Yes' or 'No'*
8.7	(If "No" skip next question)		
8.8	If "Yes", approximately how many times do you talk on the phone in a day?	……	
8.9	Have you ever had any accidents in the last 12 months?	Yes☐ No☐	*Please tick ' Yes' or 'No'*
8.10	If "No" skip next question)		
8.11	If "Yes" how many times in the last 12 months?	……	
8.12	Name three dangerous intersections within the city of Kisumuwhere one is likely to have an accident?	…… …… ……	
8.13	Name the safest three roads in the city of Kisumu?	…… …… ……	
9.0PUBLIC EDUCATION (KNOWLEDGE) ON PEDESTRIAN SAFETY AND IMPLEMENTATION OF PEDESTRIAN SAFETY RULES			
9.1	When you are driving, what is the legal limit for alcohol?	Not exceeding 0.2 mg/ml……..1 Not exceeding 0.6 mg/ml……..2 Not exceeding 0.8 mg/ml……..…..…....3 I don't know……..4	(*Please circle one choice*)
9.2	Overlapping, obstruction, driving on pavement or through a petrol station to avoid traffic is not a traffic offence?	Yes☐ No☐	*Please tick "Yes" or "No")*
9.3	When you overspeed, you risk a fine of Kshs 10,000 or 3 months imprisonment or both. (Please tick "Yes" or "No")	Yes☐ No☐	*Please tick ' Yes' or 'No'*
9.4	. Careless driving causing death to pedestrians is treated like murder.	Yes☐ No☐	*Please tick ' Yes' or 'No'*
9.5	Driving under influence of alcohol is an offence.	Yes☐ No☐	*Please tick ' Yes' or 'No'*
9.6	Eye test is not mandatory for licensed drivers.	Yes☐ No☐	

10.0 **IMPLEMENTATION OF PEDESTRIAN SAFETY RULES**			
10.1	Driving too close to a pedestrian who is walking infront.	Very often.....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
10.2	If "yes" how many times?	……	*INDICATE THE MOST APPROPRIATE*
How often do you the following actions when driving?(Please circle one answer for each of the seven items as follows			
10.3	Driving car when you are too tired	Very often.....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
10.4	Driving car when you are drunk	Very often.....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
10.5	Driving too close to a car which is behind or in front	Very often.....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
10.6	Breaking the speed limit	Very often.....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
10.7	Driving after taking drug or medicine which influences mental behaviour	Very often.....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
10.8	Talking on phone (by holding it in your hand,while driving)	Very often.....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
10.9	Driving defective motor vehicle	Very often.....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
10.10	Traffic mix on an urban road with high pedestrian activity from 2.7	Very often.....5 Often.....4 Sometimes .....3 Rarely .....2 Never.....1	*CIRCLE THE MOST APPROPRIATE*
10.11	Have you ever done drunk – driving in the last 3 months?	Yes☐ No☐	*Please tick ' Yes' or 'No'*

11. **In your opinion, how often do other drivers make the following offences? (*Please circle one answer for each of the five items as follows***			
11.0	Going against traffic	Very often ……5 Often ……4 Sometimes……3 Rarely……..……..2 Never ……..1	*CIRCLE THE MOST APPROPRIATE*
11.1	Breaking speed limits	Very often ……5 Often ……..4 Sometimes……3 Rarely……..……2 Never ……..1	*CIRCLE THE MOST APPROPRIATE*
11.2	Not stopping on line at intersection	Very often ……5 Often ……4 Sometimes……..3 Rarely……..……..2 Never ……..1	*CIRCLE THE MOST APPROPRIATE*
11.3	Driving in a criss-cross manner	Very often ……5 Often ……...4 Sometimes……..3 Rarely……..……2 Never ……..1	*CIRCLE THE MOST APPROPRIATE*
11.4	Not allowing pedestrians to cross the road at designated points	Very often ……5 Often ……...4 Sometimes……..3 Rarely……..……..2 Never ……..1	*CIRCLE THE MOST APPROPRIATE*
12.0	**How often do you do the following actions? (*Please circle one answer for each of the five items as follows*:**		
12.1	Yielding to pedestrians at a pedestrian crossings	Very often ……5 Often ……4 Sometimes……3 Rarely……..……2 Never ……1	*CIRCLE THE MOST APPROPRIATE*
12.2	Talking on the phone while driving	Very often ……5 Often ……4 Sometimes……3 Rarely……..……2 Never ……1	*CIRCLE THE MOST APPROPRIATE*
12.3	Driving after taking drug or medicine which influences mental behaviour	Very often ……5 Often ……4 Sometimes……3 Rarely……..……2 Never ……1	*CIRCLE THE MOST APPROPRIATE*
12.4	Parking temporarily in forbidden place	Very often ……5 Often ……4 Sometimes……3 Rarely……..……2 Never ……1	*CIRCLE THE MOST APPROPRIATE*
12.5	In the past 12 months have you been found with a traffic violation	Yes☐ No☐	*Please tick ' Yes' or 'No'*
12.6	What was the nature of the traffic violation?	Breaking speed limits……5 Using alcohol……..4 Not fastening seat belt……3 Causing an accident……..……..2 Others(please specify)……..…….1	*CIRCLE THE MOST APPROPRIATE*
12.7	Name three roads considerd dangerous to walk in the city of Kisumu	…… …….. …….....	*CIRCLE THE MOST APPROPRIATE*
12.8	Name three roads considered safe to walk in the city of Kisumu	…… …… …… ….	*CIRCLE THE MOST APPROPRIATE*
	THANK YOU FOR YOUR COOPERATION		

Appendix IV: Interview Guide forEngineers, City Planners, Law Enforcement Officers, Educators and Parents

You are kindly requested to participate in this interview. Your responses will be very useful in studying the influence of attitude of pedestrians on the relationship between road infrastructure interventions on implementation ofpedestrian safety rulesin the City of Kisumu. Your participation will therefore be highly appreciated. Whatever information you give in this interview will be confidential and only used for purposes of study.

1) a) In your opinion, how safe are the roads in the City of Kisumu for all road users? b)Are the roads safe for pedestrians?c) Which are the 3 safest and the 3 least safe roads for pedestrian use in the city of Kisumu?
2) How rampant are road accidents in the City of Kisumu? And why? b)Are pedestrian accidents equally rampart?c) Who is responsible for the road accidents? (d)In your opinion, what can be done to solve the problem?
3) a)Are pedestrian facilities adequately provided for in the city of Kisumu?b) What is your view about road safety campaigns as public education on road safety?c)How often are road safety campaigns conducted in the city of Kisumu ?d) where are the road safety campaigns conducted?
4) What is your opinion of public education on pedestrian safety on the roads in this city?
5) What are the challenges facing law enforcement agencies regarding pedestrian safety in the city?
6) a)Are you aware of the traffic act in Kenya?b) Where can you find one?c)Have you read it?
7) How do you perceive safety while using the road?
8) In your opinion do road traffic laws reduce pedestrian accidents?
9) a) To what extent does age and gender of pedestrians influence how they use the road? b) How do pedestrians behave along or across the road?
10) Does speed limit of 30km/h influence how pedestrian use the road?

THANK YOU FOR YOUR COOPERATION.

Appendix V: Observation Walkability Checklist

Please tick (v) the boxes using the rating scale below to identify the adequacy of pedestrian facilitieson the ten sampled urban roads in City of Kisumu.

Location of walk

1	2	3	4	5	6
Awful	Many problems	Some problems	Good	Very good	Excellent

Rating scale

1) On adequacy of pedestrian facilities, answer the question to rate the sidewalk location on this road for implementation of pedestrian safety rules

☐Sidewalks are not continuous - they start and stop abruptly

☐Sidewalks are not properly maintained they are broken, cracked or potholed

☐Sidewalks are blocked with utility poles, road signs

☐No sidewalks, paths or shoulders are provided

☐The traffic volume is high on the sidewalk

Something else specify……..

Rating: (circle one) Locations of problems

1 2 3 4 5 6 _____

2) On adequacy of Zebra crossing facility to assess the level of implementation of pedestrian safety program?

☐The road is too wide for pedestrians to cross easily hence they made detours

☐Traffic signals are missing to control the crossing time, hence haphazard crossing away from facility

☐Needed striped black and white markings on crosswalk to cross with ease?

☐Parked cars blocked view of pedestrian traffic

☐Trees or plants blocked view of pedestrian traffic

☐Needed well maintained curb ramps for ease of crossing

Something else specify……..

Rating :(circle one) Locations of problems

1 2 3 4 5 6 _____

3) Do drivers behave well towards pedestrians to enhance implementation of pedestrian safety rules?

☐Drivers backed out of driveways without looking out for pedestrians

☐Drivers did not yield to pedestrians crossing the street

☐Drivers turned into pedestrians crossing the street

☐Drivers drove too fast past pedestrians without regard for safety

☐Driver speed up to make it through traffic lights or drove through traffic lights without regard for pedestrians

Something else specify……

Rating: (circle one) Locations of problems

1 2 3 4 5 6 _____

4) Was it easy to implement pedestrian safety rules while using this road?

☐Crossed at crosswalks or where you could see and be seen by drivers.

☐Stopped to look left, right and then left again before crossing streets.

☐Walked on sidewalks.

☐Crossed without the lights giving the go ahead to cross.

Something else not specified above……..

Rating: (circle one) Locations of problems

1 2 3 4 5 6 _____

5) Was your walk made pleasant by presence of traffic police on road environment?

☐Needed more police presence to feel safe as a pedestrian on the roadside?

☐Interference by other road users without police intervention

makes the road environment unpleasant

☐Road not well lit hence police presence not respected by road users

☐Air pollution from automobile exhaust affects air quality and

implementation of pedestrian safety rules

☐Something else not specified above…….

Rating: (circle one) Locations of problems

1 2 3 4 5 6 _____

Please use the rating scale below to find out how your road network influences implementation of pedestrian safety rules?

Add up your ratings and decide.

1 _____	26 - 30 Pedestrian safety intervention - good for walking
2 _____	21 - 25Pedestrian safety intervention - pretty good
3 _____	16 - 20Pedestrian safety intervention - but needs work
4 _____	11 - 15Pedestrian safety interventions- still needs a lot of work
5 _____	5 - 10 Pedestrian safety interventions- isdisaster for walking

THANK YOU FOR YOUR COOPERATION

Appendix VI: List of Urban Roads underKURAin the City of Kisumu

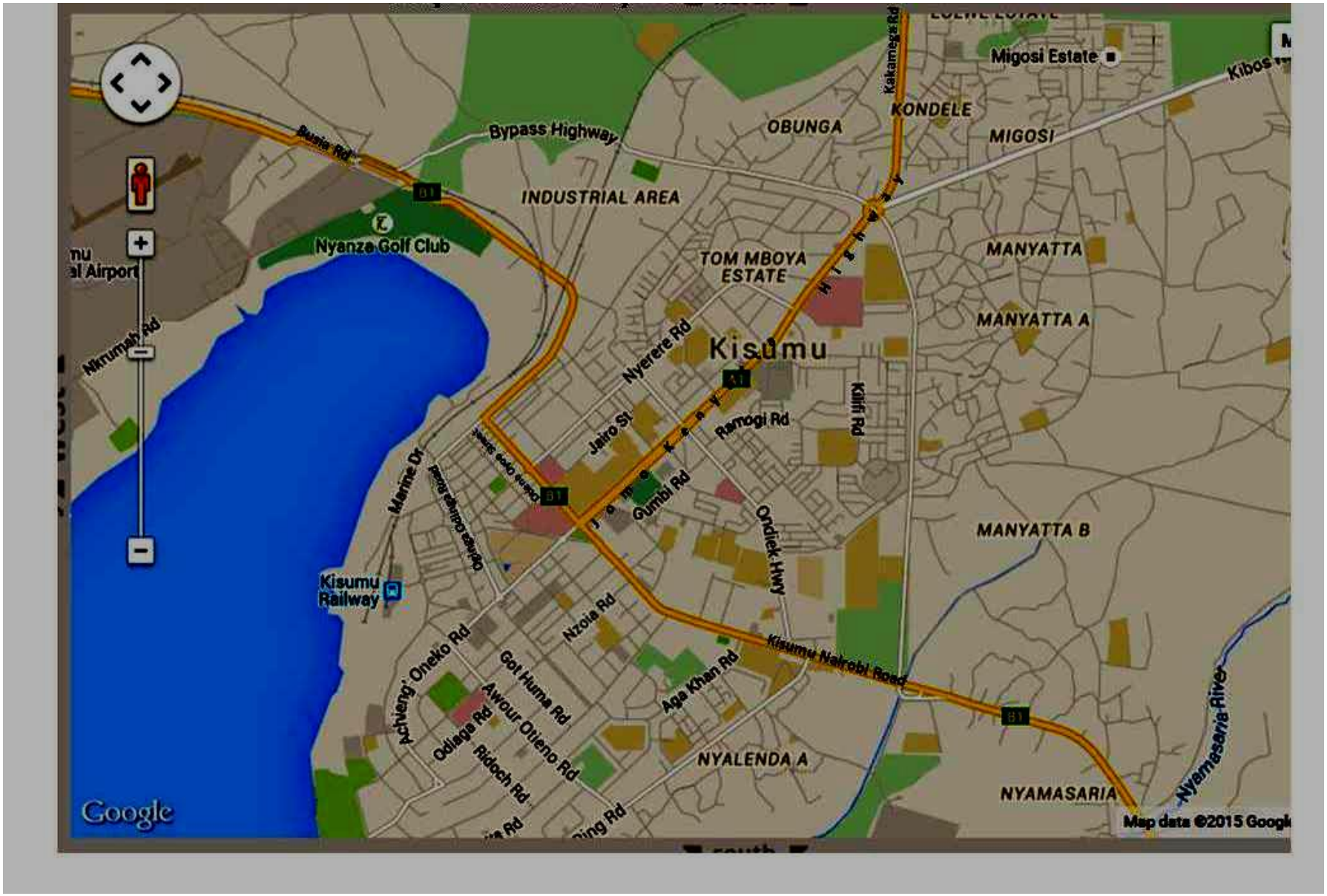
NO	NAME OF ROAD	SURFACE TYPE	LENGTH (KM)	WIDTH (M)
01	RING ROAD (NYALENDA)-**J4**	BITUMEN	3.5	7.2
02	NERHU ROAD**(L19)**	BITUMEN	2.2	6
03	TOM MBOYA DRIVE**(L20)**	BITUMEN	1	6.5
04	AWUOR OTIENDE - GREAT LAKE UNIVERSITY**(L21)**	GRAVEL	O.8	6
05	CARE KENYA-TOM MBOYA DRIVE	GRAVEL	0.5	6
06	LOOP TO INTERNATIONAL SCHOOL OF MEDICINE-MILIMANI	GRAVEL	0.4	6
07	AWUOR OTIENO ROAD**(K5)**	BITUMEN	1.4	6.1
08	OJIJO OTEKO ROAD	BITUMEN	1.3	6
09	**ACHIENG ONEKO(J1)**	**BITUMEN**	**1.4**	**6**
10	**OGINGA ODINGA(M1)**	**BITUMEN**	**0.95**	**16**
11	OBOTE ROAD**(M1)**	BITUMEN	1.5	16
12	CARWASH-KENYA RE	BITUMEN	0.5	6
13	EZRA GUMBE	BITUMEN	1.4	5
14	**KENYA RE-KAKAMEGA**	**BITUMEN**	**1.1**	**7.2**
15	**ACHIENG ONEKO ROAD (J1)**	**BITUMEN**	**3.3**	**12**
16	ODIAGA ROAD **(K4)**	BITUMEN	1	6
17	NZOIA **(K3)**	BITUMEN	0.6	6
18	BUTERE ROAD(OFF NZOIA) **(L9)**	BITUMEN	0.3	8
19	**AGHAKHAN ROAD (L11)**	**PAVED**	**0.8**	
20	JALARAM ACADEMY- NERHU ROAD	BITUMEN	0.4	6
21	KPLC YARD MILIMANI - AWUORI ROAD	EARTH	0.4	
22	AWUORI- JALARAM ACADEMY	EARTH	0.4	6
23	MISSING LINK (AWUORI-JALARAM ACADEMY)	EARTH	0.2	6
24	OKORE ROAD(L6)	BITUMEN	0.65	5
25	GOT HUMA ROAD	BITUMEN	0.6	6
26	RIDOCH	BITUMEN	0.7	6.2
27	RING ROAD - FROM OJIJO OTEKO TO GOT HUMA JUNCTION	BITUMEN	1.5	5
28	OMOLO AGER	BITUMEN	1.25	6
29	LODRWAR STREET	BITUMEN	0.6	6
30	BONYO	BITUMEN	0.4	6
31	ISHMAIEL NOO OORO	BITUMEN	0.47	6
32	**ONDIEK HIGHWAY**	**BITUMEN**	**1.5**	**6**
33	**MAMBOLEO-RIAT-B1 JUNCTION (BUSIA ROAD)**	**EARTH**	**5.9**	**6**
34	APUT LANE	BITUMEN	0.2	5.6
35	IMPALLA WALK	BITUMEN	0.55	5.6
36	LOLWE DRIVE	BITUMEN	1.2	5.4
37	HARAMBEE	BITUMEN	0.3	6
38	IMPALLA CLUB- DUNGA BEACH	EARTH	2.8	6
39	DUNGA BEACH-NYALENDA RING ROAD	EARTH	2	5.4
40	JOEL OMINO SEC,SCHOOL/NYALENDA RING ROAD JUNCTION - AUJI RIVER	EARTH	1.2	6
41	TOM MBOYA LABOUR/COLLEGE AND JOEL OMINO SEC	EARTH	0.35	6

42	JOBITA ONDITI	BITUMEN	0.3	6.8
43	LINK (JOBITA ONDITI-BUTERE)	BITUMEN	0.3	8.5
44	OMINO CRESCENT	BITUMEN	0.4	6
45	SIMBA -KILO(NYALENDA)	EARTH	0.1	6
46	SABUNI ROAD	BITUMEN	0.86	7.2
47	PAMBA ROAD	BITUMEN	0.2	7.7
48	BREWERIES -OBUNGA ESTATE	EARTH	0.5	7.6
49	**NYERERE**	**BITUMEN**	**2.6**	**5.7**
50	KAMPALA STREET	BITUMEN/EARTH	0.3	8M/4.5
51	SWAN CENTRE/OGINGA ODINGA ST. JUNCTION - KENYA RAILWAYS PORT	BITUMEN/EARTH	0.6	9.6
52	OLD STATION ROAD	BITUMEN	0.7	4.8
53	NEW STATION ROAD	BITUMEN	0.4	8
54	ACCRA STREET	BITUMEN	0.4	9
55	MAKASEMBO	BITUMEN	1.17	7.6
56	BREWERIES	BITUMEN	0.8	6
57	KARUME	BITUMEN	0.7	6.3
58	OBOTE-MAKASEMBO/PADAMA ENG. WORKS JUNCTION	EARTH	0.1	6
59	JOAN OUKO A&B	BITUMEN	0.8	6.1
60	PAUL MBOYA ROAD	BITUMEN	0.6	9.6
61	GOR MAHIA	BITUMEN	0.5	9.6
62	AGHAKHAN HOSPITAL-FIRE STATION	BITUMEN	0.3	6
63	APINDI STREET	BITUMEN	0.3	8.6
64	MARINE DRIVE	BITUMEN	0.3	9.9
65	ACCRA STREET (M5)	BITUMEN	0,5	10
66	ODERA STREET(M6)	BITUMEN	0.4	10
67	TEMPLE	BITUMEN	0,2	7.2
68	ANGAWA AVENUE (K1)	BITUMEN	0.7	15
69	NYAMLURI BACK STREET	BITUMEN	0.1	5.4
70	JAIRO OWINO STREET(N1)	BITUMEN	0.8	6
71	LINK “A” (JAIRO OWINO -NYERERE)	BITUMEN	0.1	6
72	LINK “B” (JAIRO OWINO -NYERERE)	BITUMEN	0.1	6
73	NYERERE-PRIDE INDUSTRIES TO MAKASEMBO	EARTH	0.4	6
74	OHURU	BITUMEN	0.4	6.6
75	**JOMO KENYATTA H/W (SPORTS GROUND)-MOSATA PLAZA**	**EARTH**	**0.08**	
76	BONYO -ISHMAEL NOO OORO-COCACOLA CUSTOMS EXCISE FACTORY	EARTH	0.25	6
77	GUMBI **(P8)**	BITUMEN	0.7	6
78	RAMOGI **(L35)**	BITUMEN	1.3	6
79	OCHIENG AVENUE **(L2)**	BITUMEN	0.7	6
80	LUMUMBA ROAD **(N3)**	BITUMEN	0.55	7
81	CELTEL **(L40)**	GRAVEL	0.4	4.5
82	KILIFI ROAD **(K6)/K7**	BITUMEN	1.5	5
83	KIBUYE - ARINA (KILIFI RD JUNCTION)	GRAVEL	0.2	4.5
84	**FROM KONDELE - MANYATTA RING RD - NAIROBI ROAD**	**EATRH**	**2.7**	**6**
85	**KIBOS ROAD**	**BITUMEN**	**5**	**7**

86	KIBOS - OUKO – NYAMASARIA	EARTH/	7.3	5
87	GUMBI- NASELICA HOTEL	EARTH	0.1	6
88	OMINO CRESCENT - OCHIENG AVENUE **(P8)**	BITUMEN	0.15	7
89	KALOLENI ROAD **(L36)**	GRAVEL	0.45	3.5
90	WINAM LAW COURT RING RD(KIBUYE) **(N22)**	EATRH	0.3	3.5
91	0LANG **(K6)**	BITUMEN	0.4	6
92	INDUSI **(P27)**	BITUMEN	0.9	6
93	GEORGE MORARA **(L29)**	BITUMEN	0.2	5
94	GEORGE MORARA- DOCTORS PLAZA	BITUMEN	0.2	5
95	MITO JURA	BITUMEN	2.5	6
96	KENYA BREWERIES/JARASHOP-MITI JURA	BITUMEN	0.1	6
97	MILIGAN ROAD	BITUMEN	0.4	6.5
98	KIBUYE MARKET ROAD	EARTH	0.29	3
99	RUSIA HOSPITAL MORTUARY – MORTUARY	BITUMEN	0.5	5
100	OBWOLO- ONGADI	GRAVEL	4.8	6
101	WAITHOREGO-RIVERSIDE		2.5	6
102	GUBA – WATERWORKS	GRAVEL	6.4	5
103	GUBA WATER WORKS RD-WATHOREGO OBWOLO ROAD	EARTH	2.1	4
104	MAMBOLEO-SHOWGROUND	EARTH	2.1	6
105	CARWASH-GUDKA ESTATE-SIJE	GRAVEL	2.1	6
106	TECHNICAL ROAD **(L38)**	PAVED	0.9	6
107	BANK STREET **(M12)**	BITUMEN	0.5	6
108	MAMBA LANE	BITUMEN	0.1	5
109	VICTORIA RAILWAY CLUB	BITUMEN	0.1	5
110	BY-PASS HIGHWAY	BITUMEN	2.7	6

(Source,KURA 2012)

Appendix VII: Map of Roads in the City of Kisumu



Source: Google Maps, 2014

Appendix VIII: Research Permit

CONDITIONS

1. **You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit**
2. **Government Officers will not be interviewed without prior appointment.**
3. **No questionnaire will be used unless it has been approved.**
4. **Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.**
5. **You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.**
6. **The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice**

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A 5848

CONDITIONS: see back page

THIS IS TO CERTIFY THAT:
MS. JESSICA AKINYI OGOMBE
of UNIVERSITY OF NAIROBI, 0-40411 Kisumu,has been permitted to conduct research in *Kisumu County*

on the topic: *INFLUENCE OF ROAD INFRASTRUCTURE INTERVENTIONS ON IMPLEMENTATION OF PEDESTRIAN SAFETY IN THE CITY OF KISUMU*

for the period ending:
30th September,2015

Permit No : NACOSTI/P/15/5765/6386
Date Of Issue : 20th July,2015
Fee Recieved :Ksh 2,000

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

Appendix IX: Research Authorization – National

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No.

Date:
20th July, 2015

NACOSTI/P/15/5765/6386

Jessica Akinyi Ogombe
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Influence of road infrastructure interventions on implementation of pedestrian safety in the city of Kisumu,"*** I am pleased to inform you that you have been authorized to undertake research in **Kisumu County** for a period ending **30th September, 2015.**

You are advised to report to **the County Commissioner and the County Director of Education, Kisumu County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. S. K. LANGAT, OGW
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Kisumu County.

COUNTY COMMISSIONER
KISUMU COUNTY
P.O. Box 1912
KISUMU

The County Director of Education
Kisumu County.

Appendix X: Research Authorization - County

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
STATE DEPARTMENT OF EDUCATION

Telegrams:"schooling",Kisumu
Telephone: Kisumu 057 - 2024599
Email: Ckisumu@education.go.ke

When replying please quote

COUNTY DIRECTOR OF EDUCATION
KISUMU COUNTY
PROVINCIAL HEADQUARTERS NYANZA
3RD FLOOR
P.O BOX 575 – 40100
KISUMU

CDE/KSM/GA/19/3A/(105)

28th July 2015

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION
JESSICA AKINYI OGOMBE

The above named is a student at University of Nairobi.

This is to certify that she has been granted authority to carry out research on ***"Influence of road infrastructure interventions on implementation of pedestrian safety in the city of Kisumu."*** for a period ending **30th September 2015.**

Any assistance accorded to her to accomplish the assignment will be highly appreciated.

SILVESTER MULAMBE
COUNTY DIRECTOR OF EDUCATION
KISUMU COUNTY