AN ANALYSIS OF THE CAUSES OF ROAD TRAFFIC ACCIDENTS IN THE CITY OF NAIROBI, KENYA

By

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Student's Declaration

This Research Project is my original work and has not been presented for a degree in any other university.

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Dedication

Dedicated to my wife, Wachuka, and my children Theuri, Wangui and Wakarima for their support and encouragement during the study.

Abstract

This study analysed road traffic accidents in the City Council of Nairobi, with particular reference to the main causes of such accidents and the relationship of driver behaviour to the problem. The research further discussed vulnerability of non-motorized transport users. It aimed at providing recommendations that could be implemented to reduce occurrence and severity of the accidents. The research used both descriptive statistics and linear correlation for analysis. A sample, N, of 30 months (January 2006 to June 2008), with a cumulative frequency of 7811 road traffic accidents was used for analysis. The data set, which was of secondary nature, was availed by the City Council of Nairobi.

The study determined that the main causes of road traffic accidents were human error factors. The top five causes of driver-related accidents were speeding, overtaking carelessly, cutting in, misjudging clearance, and pulling from near side. The results of the Pearson Product Moment Correlation Coefficient and Spearman Correlation Coefficient illustrated that there is a strong positive correlation between driver behaviour and road traffic accidents. For sample $N = 30$, the computed value of $r = 0.855$, while the Spearman correlation, $\rho = 0.804$, thus indicating that the reliability of the sample was high. Further, fatalities of non-motorized transport users (pedestrian and pedal cyclists) were 76.29% of all fatalities, thus their vulnerability. Recommendations made included increased investments for non-motorized transport facilities, traffic control measures, motivation of traffic police officers, use of modern technology in data collection, amendment of the Traffic Act and driver training.

Abbreviations and acronyms

ASL	Above sea level
BAC	Blood alcohol concentration
CBD	Central business district
DALY	Disability-adjusted life years
DVLA	Driver and Vehicle Licensing Agency
ELM	Elaboration likelihood model
HOV	High occupancy vehicle
IPAR	Institute of Policy Analysis and Research
IT	Information technology
KRB	Kenya Roads Board
km/h	Kilometres per hour
m	Metre
NMA	Nairobi Metropolitan Area
NMT	Non-motorized transport
PSV	Public Service vehicle
RMLF	Road Maintenance Levy Fund
RTA	Road Traffic Accidents
SACCO	Savings and Credit Cooperative Organization
TLB	Transport Licensing Board
UK	United Kingdom
UN	United Nations
VTI	Swedish National Road and Transport Research Institute
WHO	World Health Organization

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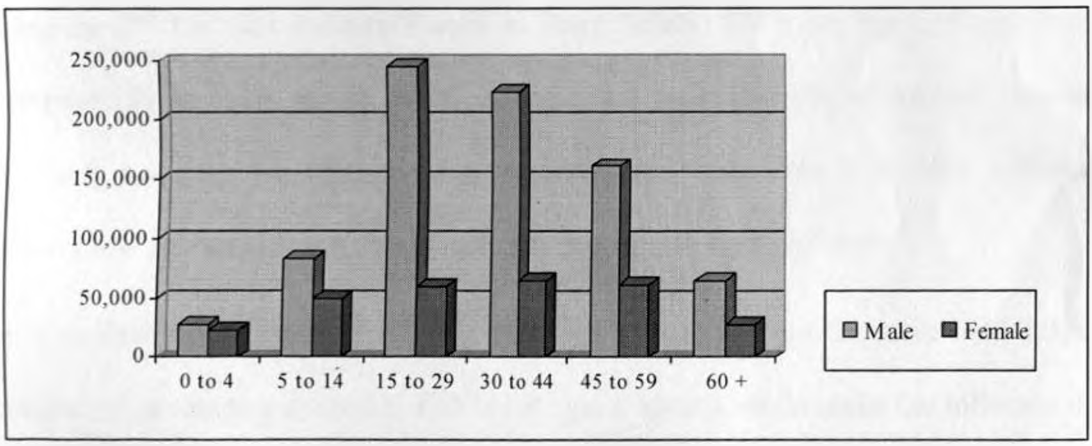
CHAPTER ONE
INTRODUCTION

1.1.Background of the study

Road traffic accidents are the leading cause of death by injury and the tenth-leading cause of all deaths globally. An estimated 1.2 million people are killed in road traffic accidents each year, and as many as 50 million are injured, occupying 30 percent to 70 percent of orthopedic beds in developing countries hospitals, (World Health Organization, 2002, in Worley, 2008). Developing countries bear a large share of the burden, accounting for 85 percent of annual deaths and 90 percent of the disability-adjusted life years (DALYs) lost because of road traffic injury. Road traffic injuries affect mainly males (73 percent of deaths) and those between 15 and 44 years old. This burden, therefore, creates enormous economic hardship due to the loss of family breadwinners (see Figure 1-1).

Figure 1-1: Road Traffic Deaths Worldwide by Sex and Age Group, 2002



Source: WHO Global Burden of Disease Project, Version 1 (2002), in Worley, (2008)

In developed countries, road traffic death rates have decreased since the 1960s because of successful interventions such as seat belt safety laws, enforcement of speed limits, warnings about the dangers of mixing alcohol consumption with driving, safer design and use of roads and vehicles. As an example, road traffic fatalities declined by 27 percent in the United States of America and by 63 percent in Canada from 1975 to 1988. But traffic fatalities increased in developing countries during the same period - by 44 percent in Malaysia and 243 percent in China, for instance (World Health Organization, 2002, in Worley, 2008).

The World Bank estimates that road traffic injuries cost 1 percent to 2 percent of the gross national product (GNP) of developing countries, or twice the total amount of development aid received worldwide by developing countries. The World Bank work of Koptis and Cropper, 2003, (in International Road Assessment Programme, 2008), predicts that road fatalities are zero for countries with less than US$200 GDP per head rising to a peak of 14 – 16 per 100,000 at around US$5-6,000 GDP per head and falling to 5 per 100,000 at US$30,000 per head and above. This prediction is however significantly lower than the World Health Organization (WHO's) annual estimates. During the 2nd UN Stakeholders Forum on Road Safety, 2007, (in International Road Assessment Programme, 2008), WHO assessed that typically 50% of hospital beds in developing countries are taken by road accident casualties. This is at odds with the relatively low percentage of fatalities officially reported as road accidents.

Just as in developed countries, driver impairment is an important factor in road traffic accidents for developing countries. Driving at excess speeds, while under the influence of alcohol or drugs, while sleepy or fatigued, when visibility is compromised, or without protective gear for all vehicle occupants are major factors in road traffic accidents, deaths, and serious injuries. In general, non-motorized transport (NMT) users are the most vulnerable road users as well as the heaviest users of roads in poor countries. In developing countries, most people who use public transportation, bicycles, or who habitually walk are poor, illuminating the higher risk borne by those that are less privileged (Worley, 2008). Table 1-1 shows the higher proportion of deaths among these groups in developing countries.

Table 1-1: Proportion of road users killed in various modes of transport as a percent of all fatalities, selected countries

Country	Pedestrians	Bicyclists	Motorized vehicles		Others
			Two-wheeled	Four-wheeled	
Thailand (1987)	47	6	36	12	--
Malaysia (1994)	15	6	57	19	3
United States (1995)	13	2	5	79	1

Source: Dinesh Mohan, (2002), in Worley, (2008).

1.1.1. Trend of road traffic accidents and injuries in developing countries

According to Museru, Mcharo, and Leshabari, (2002), between 1990 and 2000 the number of road traffic accidents in Tanzania rose by 44% from a total of 10,107, the number of associated injuries increased by more than 44%, and that of death by more than 64%. A total of 56% of the injured were passengers, followed by pedestrians (25%). Inappropriate road use behaviours by different road users were reported to be the major cause of accidents with driver's inappropriate behaviour contributing 52%.

Statistics from many developing countries confirm these changes. In Mexico for example, as deaths from infectious diseases declined from 43% to 17%, deaths from injuries rose from 4% to 11% of all deaths, with road traffic accidents contributing most of the deaths. The situation in Africa shows a similar trend. Nigeria, with one of the highest road traffic accident rates, recorded an increase of 43% in road traffic accidents with 110% increase in deaths rates, between 1977 and 1983. The corresponding population increase during the same period was only 2.7%. Similar trends have been reported from East Africa. Road traffic related fatalities in Kenya increased by 578% and non-fatal casualties by 506% between 1962 and 1992. In Tanzania road traffic accidents accounted for 56% of all patients admitted to Muhimbili Medical Centre due to injuries (Museru, Mcharo, and Leshabari, 2002).

In analyzing the common causes of road traffic accidents, the Tanzanian police attributed 51.6% of the accidents to reckless /dangerous driving. Defective motor vehicles account for 15% of all accidents. However of more interest is that almost 7% of the accidents have been attributed to careless pedestrians, 3% careless motorcyclists and another 7% careless pedal cyclists. This probably is a tendency for victim blaming as the Ghanaian saying of "the dead are always wrong" seem to imply. Most of the roads do not have side pavements for pedestrians or cyclists and sometimes all road users have to crowd on the road. Similarly there are few crossing signs on the streets and the drivers routinely ignore those present for lack of enforcement and awareness (Museru, Mcharo, and Leshabari, 2002).

Interestingly, alcohol abuse as a cause of accident has been attributed only to about 1%. However it is an open secret that drivers drink and drive with impunity. Not uncommonly, most of the accident victims including drivers, passengers and pedestrians are admitted in gross intoxicated alcohol situation levels. However, the Tanzanian Police, and in deed most developing countries, have no mechanism for measuring blood alcohol concentration (BAC). The few breath analyzers are routinely underutilized and this could be a source of under-reporting. In Zambia, it was found that 30% of killed drivers, pedestrians and cyclists had unacceptable level of BAC. This could represent a more appropriate number than the 1% given by the Tanzanian Police.

1.1.2. The Kenyan road network

Kenya has an extensive road network of 62,573km of classified roads and a further 87,700km of unclassified roads. Although having a national average density of 0.29km/km^2 of total surface area (Ministry of Roads & Public Works, Kenya, 2004), there is a very considerable variation around Nairobi, where there are high economic activities; with those areas having a well developed road system.. The roads as a mode of transport within the transport sector occupy a more significant position than any other mode of transport when evaluated in terms of their reach and extent, the volume of freight and passengers carried, and service to the communities.

1.1.3. The road network situation in Nairobi

The surface transport network in the Nairobi metropolitan area comprises more than 2,000km of roads ranging from national highways linking Nairobi to other parts of the country to unpaved earth tracks providing access to individual properties. The network for the City Council of Nairobi alone is however 1,500km as shown in table 1-2, (Katahira & Engineers International and RECS International Inc., 2006).

Table 1-2: Road Network for the City Council of Nairobi

	Description	Paved Roads (km)	Unpaved roads (km)	Total (km)
1	Classified	265	Nil	265
2	Adopted	665	85	750
3	Non-adopted	Nil	465	465
4	Other	20	Nil	20
	Total	950	550	1500

Source: Katahira & Engineers International and RECS International Inc., 2006

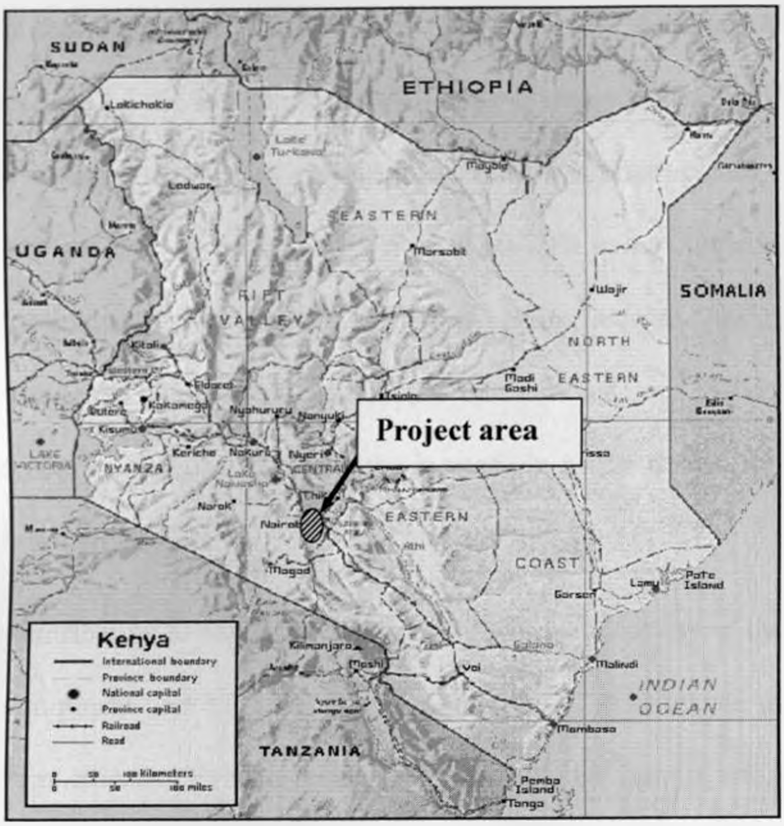


Figure 1-2: Location map of Nairobi

1.1.4. Traffic accidents in the City of Nairobi

The city's population was 2.143 million as per the 1999 census. It is projected to grow to 3.478 million by 2010, (The World Bank Institute, 2005*)*. Activities in the central business district have been on the increase in recent years and the traffic situation is getting worse due to concentration of business and commercial development there. As a result of these developments, traffic accidents have continued to soar.

The main source of road traffic accident data is the Traffic Police Department. The City Council of Nairobi, on the other hand, keeps records on traffic accidents occurring within its jurisdiction. Several factors contribute to road traffic accidents including: a) driver-related factors such as age, training and behaviour; b) over-exposure of pedestrians and other vulnerable groups owing to lack of non-motorized transport facilities and c) lack of appreciation by transport planners that walking is an important mode of transport. This is clearly demonstrated by the fact that half of all trips in major African cities are entirely on foot. Public transport trips also involve significant walking from places of residence to the terminus. The share of all-walking trips is up to 60-70% in medium and smaller cities and walking dominates for shorter trips, (The World Bank Institute, 2005). According to Katahira & Engineers International and RECS International Inc., 2006, "The present supply to transport is inadequate to meet the increase in traffic demand, in particular in the Nairobi Metropolitan Area.

Other factors contributing to road traffic accidents include incapacity of the traffic police arising from equipment and staff limitations, low morale, indifference of, and lack of cooperation from citizens. Vehicle-related and road-related factors are also important aspects leading to traffic accidents. In this respect, vehicle-related factors have to do with the extent to which vehicles are maintained in a roadworthy condition; while road-related aspects have to do with both the design as well as maintenance. The occurrence of black spots as a result of poor design cannot be gainsaid.

Lastly, a weak legal framework that does not allow for stiff and deterrent penalties for flouting traffic rules can also be seen as a cause of accidents. While this does not directly affect vehicles, drivers and other key players are not strongly motivated to obey the rules, thus resulting in increased accidents.

1.1.5. Measures necessary to reduce road traffic accidents in Nairobi

The City Council of Nairobi has continued to institute measures to improve its road network. This has been done through development of new roads, instituting traffic calming measures including installation of traffic signals and improvement of junctions and other facilities. All bottlenecks to NMT movements including illegal structures within road reserves, blocked alleys between buildings, and hoarded walkways under canopies of existing buildings and those under construction should be removed. Further, it is necessary to have routine maintenance of existing roads and enforcement of the Traffic Act and City Council of Nairobi by-laws relating to road traffic management. Had there been an autonomous traffic police unit specifically in charge of traffic within the city of Nairobi, it would work with the CCN law-enforcement personnel to facilitate sustenance of order. This unit would also be in charge of ensuring security and safety of PSV commuters and NMT users, (Provincial Commissioner, Nairobi Province, 2003).

1.1.6. Effect of the environs on traffic situation in the City of Nairobi

The City of Council of Nairobi and its environs are referred to as the Nairobi Metropolitan Area. The area comprises the City Council of Nairobi and the following urban centres surrounding it: Municipal Councils of Kiambu, Limuru, Ruiru and Thika; Town Councils of Kikuyu and Tala-Kangundo and the market centres of Ongata Rongai, Kiserian and Ngong in the County Council of Ol-Kejuado (Katahira & Engineers International and RECS International Inc., 2006). These centres act as dormitory towns for the City Council of Nairobi, thus exerting considerable pressure on the roads leading to Nairobi, in the morning and in the evening as residents report to work and go back home respectively. Vehicular traffic is therefore heavy on the major routes into and out of the Central Business District (CBD), where a majority of the residents either work or end up for business or leisure trips. As a result of increased traffic volume over a fixed road space, road traffic accidents continue to soar with time.

1.2. Statement of the problem

Despite the efforts to improve the road transport infrastructure, road traffic accidents have continued to occur, almost with alacrity, within the jurisdiction of the City Council of Nairobi, even with the introduction of speed controlling devices and other reforms in the transport sector. It is therefore apparent that there are other factors contributing to accidents besides condition of vehicles, road environment and enforcement of the law.

Besides the vehicle and the road, chief among the other factors contributing to road traffic accidents is the driver. Certain aspects of the driver contribute to road traffic accidents namely: - behaviour and attitude; the many new drivers as a result of increase in the number of vehicles on the network without a corresponding increase in the road space. A majority of the drivers are poorly taught, young and are evolving their skills and attitudes in a traffic environment. In this respect, the use of high occupancy vehicles (HOV) for mass public transport as opposed to small vehicles is desirable as a means to utilizing the available road capacity optimally, (Saturday Nation, 12th May 2007).

The adoption of HOV could reduce occurrence of road traffic accidents because public transport operators tend to employ older (and more experienced) drivers for such vehicles. The factors contributing to road traffic accidents could be summarised by the death reducing model illustrated in figure 1-3. This model was presented by Mumford, the International Director of International Road Assessment Programme (*i*RAP), at the launch of the *i*RAP - Kenya at Utalii Hotel, Nairobi, Kenya on 6th June 2008.

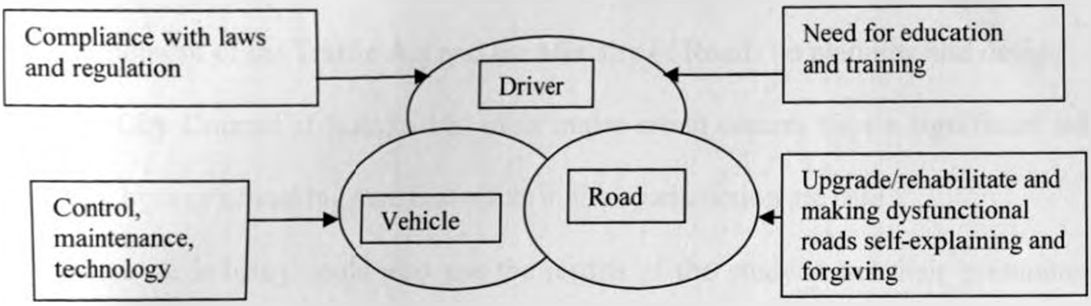
From the above, it has been established that certain characteristics related to driver behaviour are suspected to contribute to road traffic accidents. It is desirable, therefore, to establish the extent to which these characteristics contribute to road traffic accidents, and whether there are other factors that play a role to exacerbate the problem. A large number of studies in developed countries have demonstrated the size of the problem of underreporting of road traffic accidents. The problem in developed countries is limited to property damage or slight injury accident data; however the problem is beyond this level in developing countries. In Sri Lanka for example, it was found that 23 percent of fatalities, 20 percent of all injuries and 65 percent of child injuries are not reported for the period 1977 to 1981. In developed nations, the percentage of unreported accident data varies from one country to another and from time to time. In Sweden, it was estimated that about 85 percent of all accidents that occurred in 1964 were not reported to the police while in the UK this percentage was 28 percent for 1974-1976. Therefore, in the UK, police headquarters took a further step to improve the accident reporting system by assigning a permanent police representative to each hospital.

From a meta-analysis of 49 studies of road traffic accidents reporting in official accident statistics in 13 countries, it is concluded that reporting of injuries is incomplete at all levels of injury severity. In rounded values, the mean reporting level in the countries included was found to be 95% for fatal injuries according to the 30-day rule, 70% for serious injuries (admitted to hospital), 25% for slight injuries (treated as outpatients), and 10% for very slight injuries (treated outside hospitals). Reporting levels vary substantially among countries, ranging from 21 to 88% for hospital-treated injuries. Reporting is highest for car occupants and lowest for cyclists, (Elvik and Mysen, 1999).

Arising from findings of the various studies analysed, the rule of thumb, and considering urban nature of the area under study, the reported accidents could safely be taken to be

60%. The balance of 40% could mainly be attributed to non-injury and minor accidents. This study was therefore an analysis of causes of road traffic accidents in the City Council of Nairobi. Kenya (United Nations Centre for Regional Development, Africa Office. 2004).

Figure 1-3: Death reducing model



Source: International Road Assessment Programme (*i*RAP), 2008

1.3.Purpose of the study

Occurrence of traffic accidents and their effects is one of the major challenges facing the transport sector in Kenya today. As a factor impacting negatively on effective traffic management, road traffic accidents in the City Council of Nairobi have been a cause of concern not only for the city authorities, but in deed the central government. This study, therefore, aims at determining the correlation between driver behaviour and traffic accidents with a view to recommending measures to reduce the occurrence of accidents within the jurisdictional area of the City Council of Nairobi.

1.4.Significance of the study

The future of development of Nairobi's transport system must be premised on at least partial restoration of balance between the distributions of investment by mode with the actual travel behaviour of the population. Arising from the findings of the study, the modes with the majority of person-trips will then have to be given high priority. The main challenge to grapple with is the need to be able to circulate safely at the main corridors. Various groups of actors will therefore use the results of the study to realise these challenges as follows:

(i) The central government has to ensure that roads are safe. For that reason, the findings of the study will inform the Ministry of Transport on policy matters like the amendment of the Traffic Act and the Ministry of Roads on planning and design.

(ii) The City Council of Nairobi and other major urban centres have a significant role to play by way of making sure that roads in their jurisdiction are safe.

(iii) Insurance industry could also use the results of the study to set their premiums for various insurance covers. When the main causes of road traffic accidents are known from a scientific study, then the industry will be able to adjust provisions rationally.

(iv) Businesses dealing in passenger and goods transport would use results of the study to make informed choices when they engage in such ventures.

(v) Businesses in road safety would use the findings to design road furniture that would assist in reducing occurrences and severity of accidents.

(vi) Owing to their vulnerability to road traffic accidents (RTA) commuters would also be interested to know what the main causes of traffic accidents are.

(vii) Research cannot be exhaustive and thus the results of the study may be used by other researchers in the future.

1.5.Scope of the study

The study area covers roads within the jurisdictional area of the City Council of Nairobi. The study covered the traffic accidents occurring during the period from 1st January 2005

2.18.5. Driver training and monitoring

There is need for an integrated well-developed driver education that enables newly trained drivers to handle different critical situations. Training for professional drivers can also be judgmental as opposed to skill-oriented. This notwithstanding, the continuous monitoring of young drivers in particular will also need to be given due consideration to reduce accidents.

2.18.6. Need for a user-centred design perspective

The field of human factors addresses the interaction of devices or systems and their human users as these users engage in various tasks. Design for good human factors requires an understanding of the characteristics of the users and the tasks in which they are engaged. Standard road signs and other information technology (IT) devices and systems, should be designed in a manner consistent with the capabilities and behaviour of the range of people that are intended to use them. The user-centered design philosophy is that an effective, safe, and accepted product is designed around the user. It takes into account not only physical and perceptual capabilities (such as reaction time or visual acuity) but also behaviour, knowledge, motivations, and attitudes. A good overview of the application of human factors in highway and vehicle applications is necessary in studying the occurrence and reduction of road traffic accidents.

The behaviour of roadway users is often complex and difficult to predict. They may not always respond to a road sign or IT information in the manner in which the designer intended that information to be used. Proper responding by road users therefore, requires that they: notice the display, in a reliable and timely manner; process the information being presented; comprehend the intended message and all of its implications; accept the

(v) Which strategies are necessary for the implementation of the selected options?

1.8. Hypotheses

The following hypotheses were tested:

(i) That there is a relationship between driver behaviour and road traffic accidents occurring in the City Council of Nairobi.

(ii) That non-motorized transport users are more vulnerable to road traffic accidents than motorized transport users in the City Council of Nairobi.

1.9. Definition of terms

Attitude: An attitude is a state of mind about something. It is the way someone feels or thinks about a person, a thing, an action or an idea, (Carlin, D. P. & Payne, J., 1995).

Classified Roads: These are public roads that are part of the national road network. The classification is based on the category of roads from international highways to the minor access roads. They are categorized from Class 'A' to 'E' as follows:

1. Class 'A': International roads, e.g. Mombasa-Nairobi-Busia Road.
2. Class 'B': National roads joining major towns, e.g. Machakos-Kitui
3. Class 'C': Roads joining district headquarters and other towns.
4. Classes 'D' and 'E': Minor access roads.
5. Special purpose roads: Roads leading to government installations, agricultural areas, forests, mining areas and private properties.

Driver behaviour: The way in which a driver responds to a given situation, or stimulus on the road or within the traffic environment. For purposes of this research, driver behaviour is studied in the context of, and in relation to; errors, lapses and violations, memory loss, culpability, acuity, and any other factors or parameters.

Matatu: Small to medium-size public transport vehicle carrying 14 to 29 passengers, (Government of Kenya, 1993).

Road Traffic accident: It is an unfortunate incident (involving vehicles on a road) that happens unexpectedly and unintentionally (derived from *Concise Oxford English Dictionary* 10th ed., 2001).

Unclassified Roads: - Public roads within local authorities as defined in the Local Government Act (Chapter 265 of the Laws of Kenya), i.e. those roads that are not classified and are within the jurisdictional area of cities, municipal councils, town councils and county councils.

CHAPTER TWO

LITERATURE REVIEW

2.1.Introduction

This chapter covers the various aspects of road traffic accidents including causes, severity, effect on the economy, and how they affect the day to day life of different categories of road users. The trends in various developed and developing countries have been presented, giving a comparative picture with the Kenyan situation. Urban mobility and accessibility for non-motorized transport users have been covered in detail. Further, the effect of road condition on road traffic accidents was also presented under the chapter. Of a lot of interest, the review indicated that persons killed through road accidents mainly die in their prime age, thus dealing a blow to their dependents as well as the economies where they come from.

Various theories and concepts on attitude and behaviour were also reviewed and have been presented in detail. The ABC model (affect, behavioural change and cognition), the Elaboration Likelihood model (ELM) have been reviewed and presented in relation to the driver. The theories explain the various factors affecting attitude change and behaviour. The issue of personality type in relation to the driver was also reviewed. Human failings as factors in road traffic accidents were presented in the chapter; where various errors, effect of drinking, and deliberate offences, in relation to social context were covered.

The review also covered information handling with respect to data collection as well as road safety. The use of information to improve expectancies and put risk perception into context is also covered.

Finally, the possible solutions to the problem of road traffic accidents was reviewed under the chapter through proposals on designing for safety, prioritization for non-motorized transport users, driver training, and setting and following safety rules.

2.2.The global trend in road traffic accident severity

Forty-nine thousand three hundred people were killed in the United States in motor-vehicle accidents in 1990. This is approximately the same number as those killed during the Vietnam War. Every 11 minutes, someone dies from a motor-vehicle accident in the United States of America. That is 130 people each day. In California some 5,173 people were killed in 1990 due to motor vehicle traffic causes. Someone, therefore, dies every 102 minutes from a motor-vehicle accident; the motor-vehicle accident is number four in cause for death over heart attacks, cancer and smoking according to Bach (1992).

With respect to injuries, United States of America has the highest number of persons injured in road accidents: 10.21 persons out of 1000 people were injured in road traffic accidents between 2001 and 2003. Canada had a relatively high number as well: 7.18. On the other hand, Denmark had the least number of people injured in traffic accidents, 1.59 persons; almost 6.5 times lower than in the US. This was followed by Finland, at 1.64. On average, 4.39 people out of 1000 population were injured during the period 2001 to 2003 due to road accidents, (Organization for Economic Cooperation and Development (OECD) 2007).

Kenya recorded the 5th highest number of accidents per licensed vehicles out of 29 selected countries worldwide according to a research carried out by the UK Transport Research Laboratory (TRRL) in 1986. The reported accidents continued to rise from

10,300 recorded in 1990 to 13,900 in 2000 representing an average growth rate of 3% per annum. During the same period, vehicle population grew by an average of 0.8% from 350,000 to 530,000. The number of fatalities from road traffic accidents rose from 1,850 in 1990 to 2,830 in 2000 comprising: pedestrians, 40 percent; passengers, 40 percent; drivers, motorcyclists and bicyclists, 20 percent (Ministry of Transport, (2007).

2.3.Urban mobility situation in Kenya

Data on the road network in Kenya are limited. Comprehensive information on the condition of the network does not exist and the data, which are normally included in reports, are derived from partial surveys undertaken in 1990s. Generally, approximately 5% of urban roads are in good condition, 36% fair and 59% in poor condition. In a survey carried out in 1993, 70.6% of roads in Nairobi were in good condition, 2.4% in fair and 27% in poor condition, (Wilbur Smith Associates in Association with Otieno Odongo & Partners, 1993). The situation has since changed, but no available statistics to support this change.

According to Zuriga (1997), "Reduced mobility and limited accessibility have become a major problem for the Arequipa Metropolitan region and its urban transport system. The problems are exacerbated by inefficient traffic management and poor driving behaviour, aside from the lack of adequate transport facilities and related infrastructure." This quote shows the situation in which many urban areas all over the world are: diminishing mobility and accessibility, lack of transport facilities, poor planning and traffic management and neglect of multi-modal transport systems. This situation notwithstanding, walking remains an important mode of transport in an integral transport system.

The case of Africa shows that in Nairobi and Dar es Salaam for instance, nearly half of the trips are entirely made on foot, whereas for the remaining share, a combination is made of public transport and walking. Just only 10% rely on private motorized transport, (The significance of Non-Motorized Transport for Developing Countries: Strategies for Policy Development, 2005). Walking accounted for 32% of distances travelled in Temeke and over 50% in Morogoro in Tanzania. Impediments to walking include loss of sidewalks to commercial encroachment, vulnerability to motorized traffic, failure to provide for road crossings, traffic management and enforcement not directed to pedestrian movement, (The World Bank Institute, 2005).

The matter of mobility in urban areas is faced with many problems including firstly, a negative perception amongst policy makers of all modes of transport, except the private car. Secondly, the absence of low-cost urban mobility, and integrated transport policies and thirdly, lack of financial resources to invest in pro-poor transport, (Sub-Saharan Africa Transport Policy Programme, 2000).

Each year, traffic accidents still kill about 120,000 people (a third of them aged under 25 years), and cause some 2.5 million injuries. In an attempt to reverse the trend, European Commission has been raising public awareness of sustainable urban mobility by supporting European Mobility Week and Car Free Day. In Argentina, Taiwan, Canada, Mexico and Brazil cities organise the Mobility Week and the Car Free Day based on the European experience, (City Mayors: Transport, 2003). Table 2-1 illustrates the fatalities as a result to road traffic accidents in relation to a wide range of parameters for selected countries in Africa. The statistics for Kenya were seen to be relatively high compared to other Countries with similar numbers of registered motor vehicles in Africa.

Table 2-1: Road accident fatalities in relation to other parameters: Selected African Countries

Country	Year	Fatalities	Injuries	MV in use 1996	Deaths per 10,000 vehicles	Population 1996 ('000)	Deaths per 100,000 population	Motorization Level	GNP (US$ 1997) Per Capita
Algeria	1993	3,678	35,717	1,505,000	24.4	28,734	12.8	52.4	1529.0
Cameroon	1993	840	5,312	162,000	51.9	13,676	6.1	11.8	630.0
Cape Verde	1993	46	670	4,100	112.2	389	11.8	10.5	1121.0
Chad	1993	22	427	29,640	7.4	6,611	0.3	4.5	246.0
Gabon	1993	116	964	41,000	28.3	1,125	10.3	36.4	4224.0
Guinea	1993	423	3,906	35,000	120.9	6,759	6.3	5.2	567.0
Kenya	**1993**	**2,516**	**21,824**	**391,000**	**64.3**	**27,364**	**9.2**	**14.3**	**353.0**
Lesotho	1993	326	1,650	37,620	86.7	2,023	16.1	18.6	676.0
Nigeria	1993	8,958	22,882	1,379,000	65.0	114,568	7.8	12.0	291.0

Source: WHO Global Burden of Disease Project, Version 1 (2002), in Worley, (2008)

2.3.Theoretical and conceptual framework on attitude and behaviour

This study was premised on the basis of attitudinal and behavioural characteristics of road users. More particularly, the characteristics of drivers were being examined as a major determinant of causes of road traffic accidents. Various models have been used to understand attitude as well as behaviour and some are described below in detail.

2.3.1. ABC model (affect, behavioural change and cognition)

Attitude is a hypothetical construct that represents an individual's like or dislike for an item. Attitudes are positive, negative or neutral views of an "attitude object": i.e. a person, behaviour or event. People can also be "ambivalent" towards a target, meaning that they simultaneously possess a positive and a negative bias towards the attitude in question. Attitudes are composed from various forms of judgments. They develop on the ABC model (affect, behavioural change and cognition). The affective response is a physiological response that expresses an individual's preference for an entity. The behavioural intention is a verbal indication of the intention of an individual. The cognitive response is a cognitive evaluation of the entity to form an attitude. Most attitudes in individuals are a result of observational learning from their environment. (Petty & Cacioppo, 1986).

The above narrative explains how road users appear to have similar tendencies with respect to their attitudes and behaviour on issues of mobility. It will be observed that drivers on particular routes will exude the same type of behaviour irrespective of whether they are familiar to one another. The solution to this problem will include the alteration of the traffic environment in a way that will affect the patterns of behaviour of target road users.

2.3.2. Elaboration Likelihood Model (ELM)

The Elaboration Likelihood Model (ELM) of persuasion (Petty & Cacioppo, 1986) is a model of how attitudes are formed and changed. Central to this model is the "elaboration continuum", which ranges from low elaboration (low thought) to high elaboration (high thought). The ELM distinguishes between two routes to persuasion: the central route and the peripheral route.

2.3.2.1. Central route

Central route processes are those that require a great deal of thought, and therefore are likely to predominate under conditions that promote high elaboration. Central route processes involve careful scrutiny of a persuasive communication (e.g. a speech or an advertisement) to determine the merits of the arguments. Under these conditions, a person's unique cognitive responses to the message determine the persuasive outcome (i.e. the direction and magnitude of attitude change). So, if favourable thoughts are a result of the elaboration process, the message will most likely be accepted (i.e., an attitude congruent with the messages position will emerge), and if unfavourable thoughts are generated while considering the merits of presented arguments, the message will most likely be rejected (Petty & Cacioppo, 1986). In order for the message to be centrally processed, a person must have the motivation and ability to do so.

The two key elements in this argument are motivation and ability. For communication of whatever form to be effective, the receiver must be able to process and correctly interpret it within the predetermined tolerance. Additionally, there has to be a motivation to positively receive, process and use the displayed message. Nonetheless, the intended recipients must have a certain minimum level of education. Under the Traffic Act however, there is no requirement for drivers to have a particular level of education, thus giving rise to situations where levels of communication with respect to road use will vary. The resultant of this is to have situations where drivers do not comprehend messages intended for their consumption, thus increasing occurrence of road traffic accidents.

2.3.2.2. Peripheral route

Peripheral route processes, on the other hand, do not involve elaboration of the message through extensive cognitive processing of the merits of the actual argument presented. These processes often rely on environmental characteristics of the message, like the perceived credibility of the source, quality of the way in which it is presented, the attractiveness of the source, or the catchy slogan that contains the message (Petty & Cacioppo, 1986).

The peripheral route assumes that the time to process the message is limited. It also takes into consideration the fact that the receiver of the message may have other limitations, e.g. ability to interpret more complicated messages. In this respect, drivers, and more so those most prone to road traffic accidents, are more likely to adopt this route, reason being that they have limitations in terms of perception arising from the traffic environment within which they operate. The effectiveness of this route in affecting attitude and behaviour change is however limited.

2.3.2.3. Choice of route

The two factors that most influence the route an individual will take in a persuasive situation are motivation (strong desire to process the message) and ability (actually being capable of critical evaluation). Which route is taken is determined by the extent of elaboration. Both motivational and ability factors determine elaboration. Motivational factors include (among others) the personal relevance of the message topic, accountability, and a person's "need for cognition" (their innate desire to enjoy thinking). Ability factors include the availability of cognitive resources (e.g., the presence or absence of time pressures or distractions) or relevant knowledge needed to carefully scrutinize the arguments. Under conditions of moderate elaboration, a mixture of central and peripheral route processes will guide information processing.

More recent adaptations of the ELM have added an additional role that variables can serve. They can affect the extent to which a person has confidence in, and thus trusts, their own thoughts in response to a message (self-validation role). In keeping with the general view of source expertise, a person may feel that "if an expert presented this information, it is probably correct, and thus I can trust that my reactions to it are informative with respect to my attitude". This role, because of its metacognitive nature, only occurs under conditions that promote high elaboration.

2.4. Factors that affect attitudes change

Attitudes can be changed through persuasion. The celebrated work of Carl Iver Hovland, who was a sterling professor of psychology at Yale University until his death in 1961, helped to advance knowledge of persuasion. In Hovland's view, attitude change should be understood as a response to communication, (Shepard, 1997). He researched into the factors that can affect the persuasiveness of a message as follows:

(i) Target Characteristics: These are characteristics that refer to the person who receives and processes a message. One such trait is intelligence - it seems that more intelligent people are less easily persuaded by one-sided messages. Another variable that has been studied in this category is self-esteem. Although it is sometimes thought that those higher in self-esteem are less easily persuaded, there is some evidence that the relationship between self-esteem and persuasibility is actually curvilinear, with people of moderate self-esteem being more easily persuaded than both those of high and low self-esteem levels (Rhodes & Woods, 1992, in Shepard, 1997). The mind frame and mood of the target also plays a role in this process.

(ii) Source Characteristics: The major source characteristics are expertise, trustworthiness and interpersonal attraction or attractiveness. The credibility of a perceived message has been found to be a key variable here; if one reads a report about health and believes it came from a professional medical journal, one may be more easily persuaded than if one believes it is from a popular newspaper. Some psychologists have debated whether this is a long-lasting effect and Hovland found the effect of telling people that a message came from a credible source disappeared after several weeks (the so-called "sleeper effect"). Whether there is a sleeper effect is controversial. Received wisdom is that if people are informed of the source of a message before hearing it, there is less likelihood of a sleeper effect than if they are told a message and then told its source.

(iii) Message Characteristics: The nature of the message plays a role in persuasion. Sometimes presenting both sides of a story is useful to help change attitudes.

(iv) Cognitive Routes: A message can appeal to an individual's cognitive evaluation to help change an attitude. In the *central route* to persuasion the individual is presented with the data and motivated to evaluate the data and arrive at an attitude changing conclusion. In the *peripheral route* to attitude change, the individual is encouraged to not look at the content but at the source. This is commonly seen in modern advertisements that feature celebrities. In some cases, physician, doctors or experts are used. In other cases film stars are used for their attractiveness.

2.5.Emotion and attitude change

Emotion is a common component in persuasion, social influence, and attitude change. Emotion works hand-in-hand with the cognitive process, or the way we think, about an issue or situation. Taking into consideration current attitude research, attitudes can be described as "mental and neural representations, organized through experience, exerting a directive or dynamic influence on behavior". Attitudes and attitude objects are functions of cognitive, affective and conative components. Attitudes are part of the brain's associative networks, the spider-like structures residing in long term memory that consist of affective and cognitive nodes linked through associative pathways. These nodes contain affective, cognitive, and behavioral components.

2.6. Personality types and driver types

Drivers can be described as either "aggressive" or "defensive" arising from personality development and social influences contributing to the two cases. The aggressive driver label may have been derived from the well-known "Type A" personality label. The influence of this view is apparent by the similarity of many characteristics typical of "Type A" personality. The "Type A" person is commonly known in the public view as one who is highly stressed, often late, under tight deadlines and having high blood pressure and coronary problems as a result of their "pressurized" lifestyle. An aggressive driver may display some of these same characteristics.

On an opposite end of the spectrum, the characteristics of the well-known "Type B" personality are apparent in the defensive driver. The defensive driver is calm, cool and collected. He or she handles stress well and seems to enjoy life more than the aggressive driver. The defensive/"Type B" seems to handle potentially stressful situations with a methodology which is proven, consistent and predictable. In addition, a defensive driver may also feel good about actions taken and is concerned with the well being of others involved.

Aggressive is defined as "inclined to move or act in a hostile, control-seeking manner." An aggressive driver is one who drives and takes actions which are apparently hostile, controlling and overly blunt. Defensive, on the other hand, is defined as "intended or appropriate for protection; displaying an attitude of protection and defense." A defensive driver is what may be called a "preventative" driver who seeks to avoid potential accidents, hazards or miscommunication.

In studying driver behaviour, there are three elements of the highway transportation system that need to be taken into focus i.e. road; human and vehicle. According to statistics, the three top causes of fatalities are: pedestrian violations; speeding and running red lights. Further, one of the causes of road traffic accidents between cars and pedestrians is that the pedestrian is not paying attention when crossing. Fault will often be placed on the driver, due to "right of way" laws, (Bach, 1992).

In the words of Bach (1992), "Vietnam, my friends is over. I've learned about The War in history classes, from superiors, from the supermarket, and by thinking about it. Introspection does have benefits. From similar sources, I have also learned, changed and hopefully, successfully communicated my views of driver attitude and behavior. Unfortunately, the war of driver-related death is still raging. We've been losing battle after battle, year after year. As was heard in Driver's Education class during my sophomore year of high school, "Don't become another statistic." Investigate your driver attitude."

2.7.Speed behaviour and drivers' attitudes to speeding

"Is school transport in Sweden a safe and secure way for the children to travel to and from school? The answer depends on whom you ask. Almost everyone agrees that the driver has a key role", (Nordic Road and Transport Research, 2003). This quotation confirms what is widely believed to be a key factor in causes of traffic accidents. Even as the above question is being posed, the problem that one is faced with is whether there is such a thing as an accident involvement that is unrelated to the driver's behaviour. This is a daunting issue that has so far not been solved, (Wåhlberg, A. E., Kline, T., 2002). It presents an *ad hominem* argument with respect to drivers. The findings of a study undertaken at the Monash University Accident Research Centre point to a number of potential countermeasures against speeding according to Fildes, (1991) as presented below:

Driver age: - Younger drivers (those aged less than 34 years) were more likely to exceed the speed limit and be excessively fast drivers at all locations. Older drivers (those aged 45 years or more) were more likely to be below the speed limit and to be excessively slow motorists.

Number of occupants: - Vehicles with single occupants (driver only) were more likely to exceed the speed limit and be excessively fast vehicles, while those with two occupants were less likely to exceed the speed limit. This was consistent for urban and rural settings and for straight and curved sections of roadway.

Safe & dangerous speed: - Estimates of what constituted a safe travel speed were positively correlated with observed speed and own speed estimates at all locations. There was also a significant negative correlation between travel speed and what the driver nominated as a dangerous speed at the urban sites.

Excessively fast speed: - A substantial number of motorists interviewed believed it was not dangerous to exceed the posted speed limit by 30km/h at both rural and urban locations (the rates were higher for straight than curved road settings). A surprising proportion of those travelling at excessively slow speeds (up to 30%) also did not believe travelling 30km/h above the speed limit to be dangerous.

Driver attitude change: - Driver attitudes towards what constituted a safe travel speed were related to speeding behaviour, although not as strongly as driver age and accident history. This is further evidence of the need for an educational campaign aimed at changing this attitude. Previous experience suggests that achieving a change in attitude may require a long-term programme of measures using a multi-facet approach.

2.8. Human failings as an important factor in road accidents

Most road traffic accidents are due to a combination of factors relating to human failings, road deficiencies and vehicle defects. In depth multi-disciplinary studies have shown that the human factors contribute in 95% of accidents in urban areas, road factors in about 20% and vehicle factors in 1%. The interaction between human failings and road features has important implications for applications in remedial measures to aid and influence road users, (The Institution of Highways and Transport, 1997).

2.8.1. Effect of driver errors on road traffic accidents

The category of road users most affected by the interaction between human failings and road features is drivers. In this regard, drivers' reaction time increases as a function of decision complexity and the amount of information to be processed, i.e. the longer the reaction time, the greater the chance of error. A common characteristic of many high accident locations is that they place large or unusual demands on the information-processing capabilities of drivers. Inefficient operation and accidents usually occur where the driver's chances for information-handling errors are high. Many driving errors are caused by deficiencies in a driver's capabilities or temporary states, which, in conjunction with inappropriate designs or difficult traffic situations, may produce a failure in judgment.

Adverse psychophysiological states also lead to driver failures. These include decreased performance caused by alcohol and drugs, for which a link to crashes has been clearly established. Drivers must see the road directly in front of their vehicles and far enough in advance to perceive with a high degree of accuracy the alignment, profile gradeline, and related aspects of the roadway, (American Association of State Highway and Transportation Officials, 2001). Further, a road user need not die for making a mistake while using the roadway. This calls for self-explaining and forgiving road designs, (International Road Assessment Programme, 2008). Such designs include removal of obstacles within the reach of vehicles if they veer off the carriageway, segregating non-motorized transport facilities from the carriageway, safety considerations in geometric design, road junctions that generally prevent vehicles colliding head-on or at right angles, use of appropriate drainage systems and road signage. Further, information displayed must generally be understood by all road users.

2.8.2. Effects of drinking and driving

In 2003, the use of alcoholmeters to check the amount of alcohol in drivers' breath was introduced on Kenyan roads. No sooner than this was done, however, the action was fought in court by a victim of the gadget and within a few months, the equipment was withdrawn for what the court termed lack of provision in the Traffic Act. When the gadget was in use, drivers had started being used to taking not more than two beers if they had to drink and drive. Others had sought to employ drivers to take them home if they had to stay on and drink. The effect of this was to reduce drink-driving related road traffic accidents. While this gadget had gained popularity among many road users, a section of them felt that it was unhygienic for the manner in which it was being applied.

A driver was required to blow into it, whereupon it gave either a green or a red light, depending on whether or not the blood alcohol content (BAC) in the breaths had the acceptable limit. In Nordic countries, drink-driving is a serious matter and it can make a driver lose the license for periods ranging from a few months to lifetime suspension, depending on the seriousness of the accident caused.

In January 2001, Norway reduced the legal limit of BAC for drivers from 0.05 to 0.02 percent. The percentage that would not drink at all before driving increased from 82 percent to 91 percent and the already strict social norms against alcohol and driving seemed to be strengthened, according to a survey carried out by The Institute of Transport Economics. However, the likelihood of driving with a BAC below or above the old limit of 0.05 percent has surprisingly not changed. It is a well established fact that consumption of alcohol before driving a motor vehicle increases the accident risk. However, the importance of rather low blood alcohol concentrations for accident risk is still discussed. Norwegian studies find that drivers involved in fatal, alcohol-related road traffic accidents have on the average quite high BAC, above 0.1 percent.

Drinking and driving is most reliably measured by roadside surveys. Such surveys are however, rather costly, and therefore the Norwegian authorities did not want roadside survey to monitor the changes in drinking and driving brought about by the reduced BAC limit, (Nordic Road & Transport Research, 2002).

2.8.3. Deliberate offences in traffic

For public service vehicles and other commercial vehicles, the speed limit is set at 80 km/h and 50 km/h beyond Nairobi city boundaries and within the precincts of the city respectively. The limits for private cars are 110 km/h and 50 km/h beyond and within the city boundaries respectively. At the lower limits, accidents would be kept at a minimum. Inappropriate speed for prevailing conditions is a major cause of road accidents and better compliance with speed limits has been shown to reduce accidents significantly.

The police, who are responsible for enforcing speed limits, use a variety of enforcement methods. A number of technical aids are also employed and generic systems have been approved by the Home office as providing reliable evidence for prosecution purposes, (The Institution of Highways and Transport, 1997). Besides speed concerns, some public service vehicle drivers use hard drugs while on the wheel. Some of the reported accidents have been as a result of driving under the influence of drugs. On observation, most public service vehicles have little formal education, a fact that contributes to their erratic behaviour.

Traffic safety research previously focused on describing the cause of accidents with reference to various types of shortcomings of the driver, which has resulted in attempts to improve driving ability and to change the traffic environment. In recent years, researchers have begun to understand that the solution to the problem does not always lie in what the driver can or cannot do, but in what he/she actually intends to do. Human errors are of three types: firstly, deliberate offences such as speeding, drinking while driving; secondly, mistakes such as erroneous assessment of their own or others' speed, and defective sight conditions; and thirdly routine offences that are due to carelessness or forgetfulness.

As regards traffic accidents, it has been found that it is deliberate offences which are the principal cause, rather than mistakes or routine offences. Deliberate offences have been described as a deliberate departure from routines which, in the usual case, can protect the individual from danger. Research has shown that people who commit deliberate offences often think that they are better drivers than others, which means that they feel traffic rules need not apply to them.

The typical characteristics of a person who deliberately takes risks in traffic include: an overweening belief in his/her capacity as a driver and believes that he/she can handle the car even in a difficult situation; overestimates the advantages and underestimates the risks; and the person has difficulty in controlling his/her behaviour. Further, he/she overestimates the inclination of other drivers to commit deliberate offences and does not feel that his/her behaviour is anything to be ashamed of. Increased knowledge of what induces a driver to commit deliberate offences may form the basis for various measures that aim to change his/her behaviour.

The longest lasting effect is achieved when the internal motivation is modified, i.e. the individual's assessment of his/her behaviour is changed. Measures addressed to target groups are preferable, but campaigns directed at all citizens have also had good effect. It is possible to change people's behaviour, but this requires good knowledge of the target group, which, in turn, is also a help in formulating the message. This work demands well thought-out methods and patience. A behaviour that has taken years to form cannot be changed in one day, (Variable Message Signs - A Literature Review, 2007).

2.9.Speed as a function of the traffic environment

As mentioned above, urban areas in Kenya have 50 km/h as the upper speed limit. This falls to even lower than 20 km/h in areas where traffic is too congested and driving at higher speeds would be dangerous to other road users. In normal traffic situations, however, drivers tend to forget the speed limits and get pulled along by those ahead of them, thus almost always driving beyond the limits.

Even elsewhere, drivers do not bother too much about speed limits; it is the traffic environment that determines speed. Studies carried out in Sweden gave an indication of the effect of traffic environment on speed. The variation in speed between the traffic environments can to the greatest extent be explained by the variation in traffic environments and, to a considerably lesser extent, by the variation between drivers. Factors that influenced the speed chosen by drivers were road width, visibility and the amount of traffic. The results of this particular study are relevant for, and bring to the fore, the issue of more flexible speed limits within towns and built-up areas, (Swedish National Road and Transport Research Institute (VTI), 2007).

2.10. Personality predictors of driving accidents

Young Canadian automobile drivers (16–29 years) were involved in a survey to explore the relationship between personality constructs and car-driving behaviour. Subjects with driving violations were not necessarily more involved in driving accidents *per se* than those without any violations (convictions), but there was a moderate correlation between driving accidents and violations. Drivers without driving violations preferred lower levels of arousal (arousal avoidance), were lower on tension risk-taking behaviour, thrill and adventure seeking, and were more inhibited (avoid socially stimulating situations) when compared with 'violators'. Accident involvement was unrelated to age, or estimated overall kilometres travelled, but was significantly positively correlated with time since passing one's driving test (length of driving experience). The personality traits that discriminated accident-free and accident-involved drivers revealed that the non-accident group, who displayed more pleasure in organising and anticipating goals rather than immediate sensations, expressed a higher need for personal control, were significantly less risk-taking in their behaviour, more conforming and inclined to avoid novel sensations and socially-stimulating situations, (Personality Predictors of Driving Accidents, 1996).

2.11. Sleepiness behind the wheel: knowledge and action

Driver fatigue or falling asleep is recognized to be among the most important causative factors in road crashes, next to alcohol, speeding and inattention. A Norwegian survey among private and professional drivers indicate that drivers in general have a good knowledge of the risk of falling asleep at the wheel, and the most important measure to prevent it: To stop the car and take a nap. In spite of their knowledge, most of the drivers continue driving when recognizing sleepiness while driving. The professional drivers argue that time schedules and pressure from management are important factors for ignoring their sleepiness.

Research has shown that the probability to fall asleep among professional drivers decreases with higher age and with more work experience, a result that indicates that driving experience or/and falling asleep while driving improves the professional drivers' conduct (i.e. taking the right measures to prevent sleep) regarding sleepiness and fatigue behind the wheel. (Nordic Road & Transport Research, 2004).

2.12. Driver behaviour and attitudes: The Kenyan experience

Characteristics of traffic accidents in recent years include a rapid increase in driver/passenger fatalities in accidents involving moving vehicles, increase in night-time accidents, and a sharp rise in the deaths of senior citizens. To cope with this situation, efforts are being made to reinforce the improvement of traffic safety facilities and other activities based on the development plan, (Ministry of Transport, 1993).

With the persistence of lawlessness in passenger transport in Kenya, the Government reaches out to Savings and Credit Cooperative Organizations (SACCOs) formed by passenger service vehicle (PSV) owners to help enforce traffic rules through self-regulation. The Transport Licensing Board (TLB), the state-run organization that oversees road transport, says it has not given up on enforcing the traffic rules. In 2004, the Government of Kenya made it mandatory for PSVs to install speed governors, seat belts, and the crew to be in uniform while on duty, among other regulation. The number of people killed in road accidents dropped by 25% in 2004 to 2,264 from 3,004 in 2003, (Public Transport: SACCOs keeping PSV business on track, 2007).

Nordic countries have been working towards reduction of road accidents, particularly fatal ones, so as to make road use more appealing to the many categories of users. In this respect, Norway sought to revise the existing traffic manual with the aim of achieving this feat. The reason for the revision of the existing manual is, among other factors, Vision Zero – a vision of a future situation where nobody is killed or seriously injured in road accidents and the need for more self-explanatory and forgiving roads. In Norway approximately 300 persons are killed and 1,200 are seriously injured in road accidents per year. The new manual distinguishes clearly between roads and streets. Streets are being formed by the town structure, available area and the wish for low speed. Consequently the streets will get completely different shape and dimensions than the roads, (Nordic Road and Transport Research, 2007).

2.13. Judgement and skill in driver training

Observation of driver training in the city of Nairobi indicates that the content is mainly concentrated on skill. The basic minimum period that a driver under instruction should handle a vehicle on the road "practical training" before testing is ten (10) hours. Training on traffic signs and other features on the road "theory" is done intermittently between the "practical training". The time allowed for the entire training session up to testing is hardly adequate to give a driver confidence on the road. Another challenge is the competence of driver instructors, whose qualifications, in training and experience are not at all regulated for standardization. Many institutions offering driving lessons are merely commercial entities whose primary goal is to make profit. For this reason, many young registered drivers are being sent out to the job market without proper appreciation of the enormity of the driving profession as a calling, particularly when handling public transport or commercial vehicles.

During the 1990s, there was a gradual shift in driver training in Sweden from a "skill oriented" content in which the focus is on improving driving skill to handle critical situations, towards a "judgment oriented" content in which the focus is placed on the avoidance of critical situations through a driving style with large safety margins. There are some studies indicating that traditional skill oriented driver training does not yield any positive traffic safety effects, or that its effect may sometimes be negative. This suggests that a judgment oriented driver training would be preferable from a traffic safety perspective, but there is no evidence for this as regards effects on actual driving behaviour, (Nordic Road & Transport Research, 2002).

2.14. Mobility requirements for women, children, physically challenged and cyclists

As is the case in other sectors, stakeholder participation is crucial in the preparation and implementation of sound and equitable policies, strategies, programmes, plans, and projects. National and local governments are urged to credibly involve, as a major group of stakeholders, pedestrians and cyclists in any decision-making process, which directly and indirectly relate to their mobility and traffic safety requirements. In doing this, they should pay particular attention to the mobility needs of women, the physically challenged, and children, which are particularly affected by inappropriate urban transport solutions. Further, there is need to involve PSV operators for enhancement of safety on the roads. It has been observed that SACCOs based on public service vehicle routes have assisted the relevant authorities in enforcing rules by ensuring compliance among members, ("Public Transport: SACCOs keeping PSV business on track," 2007).

On average, bicyclists ride against red lights in one out of three cases. A majority think that those who ride against red lights are law abiding in other areas and that the best countermeasure is to better arrange for bicycling in general. This was found out in a study carried out in Netherlands, but it applies even in Nairobi, where bicyclists do not wait for lights to go green, thus risking being hit by vehicles from other approaches. The only difference in Nairobi is that there are fewer bicycles, (Cycling against red light - extent and causes, 2006).

2.15. Information handling as an important factor in traffic accidents

Several aspects of handling information should be noted. These include coping with the information load, integrating information sources, and the timing of information needs. Motorists often have to cope with a great deal of information while they are driving. These include formal driving-related, information from signs, signals, markings, and other features on the roadway. Processing this information, i.e. sorting it, attending to it, and interpreting it takes time and effort. A road user must have sufficient time to process and respond to the information in whatever form, be it manual or IT-related, under the real-world information environment in which it occurs. When motorists receive more information than they can process in the time available, various things can happen: They may decelerate severely or drive too slowly, make late or erratic maneuvers, take an improper route alternative, ignore crucial information, fail to monitor other traffic, or have excessive episodes of eyes-off-the-road time. Information overload is a joint product of the demands of the information and the time available for dealing with it. Another aspect of information handling is the road user's integration of all sources of information.

2.16. Data collection methods

This study takes into consideration the fact that self reports have repeatedly been shown to be of dubious validity, (Wåhlberg and Kline, 2002). In that respect, therefore, the study heavily relied on secondary data of historical nature, collected from police records.

According to Gupta, S. C. and Gupta, I. (2005), "In using the secondary data it is best to obtain the data from the primary source as far as possible. By doing so, we would at least save ourselves from the errors of transcription (if any) which might have inadvertently crept in the secondary source."

2.16.1. Data collection on traffic accidents in the City of Nairobi

The Traffic Police collect all road traffic accident data for the purpose of legal prosecution and insurance claims. The accident data forms (coded P41) filled at police stations are collated and forwarded to the City Council of Nairobi for further processing and analysis. The Transportation Unit of the Council analyses the information in order to determine: The number and severity of injuries; cause of accident and classification of black spots as determined based on number of fatalities, (Ministry of Transport, 2007). Enforcement of the act is faced with shortcomings including staffing, equipment capability and the road infrastructure environment.

From the police records, the data is classified by the City Council of Nairobi in the following forms: a) Number of accidents within the period covered; b) Type of accident (whether involving vehicle to vehicle, vehicle to pedestrian, vehicle to hand cart, vehicle to pedal cycle, vehicle to motor cycle, vehicle to obstacle, other type); c) Classification of injury (whether fatal, serious injury, slight injury, non-injury); d) Sex of casualties; e) Location of accident; f) Type of vehicle (whether public service, private car or other); g) Time of the accident; h) Possible cause of accident entered as a code by the police; and i) the source of data.

2.16.2. Generic methods used in data collection on speed

The police, who are responsible for enforcing speed limits, use a variety of enforcement methods. A number of technical aids are also employed and generic systems have been approved by the Home Office as providing reliable evidence for prosecution purposes. Examples are: hand-held radar: - a self-contained radar device which directs a radar beam at approaching vehicles and calculates their speed from the reflected signal; 35mm cameras – used at mobile or permanent sites on the roadside, which measure vehicle speeds using radar or piezometric tubes and automatically photograph vehicles exceeding the speed limit. Offending vehicles are identified so that owners, and thence drivers, are traced through DVLA records, although this involves a significant amount of administrative work; and video cameras - which photograph a traffic stream continuously and which are linked to a speed detector. The speed detector identifies speeding vehicles and the camera 'reads' the relevant registration numbers of offending vehicles on downstream variable message signs. Video cameras can also be mounted on police vehicles and on motor bikes, (The Institution of Highways and Transport, 1997).

The use of generic systems as a way of controlling speed limits in Kenya is possibly limited to hand-held speed guns, a facility that, while recognized in the Traffic Act, does not give evidence provable in a court of law. The use of other systems has largely been hampered by several factors, chief among them the imitations of the Traffic Act; limited resources to procure such systems; inadequate capacity to remedy black spots; and insecurity in the accident-prone areas, thus making it inappropriate and expensive to control speeds at night.

2.17. Other important factors influencing road safety

This study takes into consideration the fact that there are several factors that influence road traffic accidents and road safety in general. While the main ones have been mentioned above, there are others that play an important role in road safety and some are mentioned below, (Nordic Road and Transport Research, 2006).

2.17.1. Importance of expectancies in improving road safety

People do not only respond to what is physically present at the moment, but also to what they expect the situation to be. Expectancies are based on long-term general experience, long-term specific experience (e.g., what a driver has encountered at a particular situation in the past, what a driver has encountered from a particular device in the past), and short-term experience (e.g., characteristics of the road the driver has just been operating over). When the actual situation is consistent with the road user's expectancy, the way the road user responds tends to be quick and accurate. When a road user's expectancy is inaccurate, the way the road user responds tends to be slow and error-prone. The implications of this are that the road designer should try to create the proper expectancy in the road user: design the system to be compatible with likely road user expectancies; and where inaccurate user expectancy is likely to occur, take additional measures to overcome this.

2.17.2. Risk perception and risk management

Road users base their actions on their perceived risk, which is not necessarily an accurate reflection of actual risk. Furthermore, the road user's goal is typically not to minimize personal risk but rather to optimize all personal benefits, based on their personal criteria; safety is only one element of this equation. Another important aspect of risk behaviour is that people often adapt their behaviour to some potential safety benefit in a way that lets them take more risk. This phenomenon is termed risk compensation.

2.17.3. Effect of the social context on drivers

Although driving is an individual activity, road use does occur in a social context. The presence of other people can facilitate or inhibit various kinds of behaviour in road users. For example, if vehicles queue up behind a driver at highway/railway intersection, the driver may feel pressured to cross the tracks, even if he or she is unsure of the safety of the situation. If a driver prefers to slow adequately to search for trains while other vehicles do not, the driver may be made to feel overly cautious or as if he or she is a traffic obstruction. When one road user violates a traffic rule (e.g. going around a bump or a barrier), this may facilitate or encourage similar behaviour by subsequent road users. In some cases, local norms of behaviour emerge (e.g., everyone knows you do not really stop at that particular crossing). Public service vehicle drivers overlap queues in urban roads, causing other drivers to adopt similar behaviour. Impatient drivers hoot at slow drivers, thus pressuring them change their speeds, even when knowing it is unsafe to do so, or make other unsafe manoeuvres against their will.

2.17.4. Effect of attention and distraction on the driving task

A person's ability to simultaneously pay attention to different features of the environment is limited. This is a concern for all types of road users, although the problem is most acute for motor vehicle drivers because of their higher travel speeds and greater stopping requirements. Different aspects of the driving task and various sources of information may compete for the driver's limited attention. The allocation of attention to different activities may be influenced by the momentary demands of the driving task, the timeliness and urgency of the information, and personal motivations. Drivers are often not fully attentive to the driving task itself. There are many different categories of potentially distracting activities such as eating, drinking, using a cell phone, and attending to things inside the vehicle. (Nordic Road and Transport Research, 2006).

2.17.5. Range of driver and vehicle capabilities

Road users represent an extremely diverse population. First, the mode of transport varies, from pedestrians to bicyclists, motorcyclists, passenger vehicle drivers, and operators of large vehicles, such as buses and tractor trailers. These different classes of road user vary drastically in travel speed, stopping ability, acceleration, viewer's eye position, visibility of the roadway, noise environment, and driving task demands. Second, within any of these groups, people will differ radically in terms of capabilities, knowledge, and experience.

2.18. Possible solutions to the problems associated with traffic accidents

The World Bank and the World Health Organization (WHO) advocate a "systems approach" to road traffic safety that emphasizes involvement at all levels of the road traffic system - from road providers and enforcers (vehicle manufacturers, road traffic planners, road safety engineers, police, educators, health professionals, and insurers) to road users. (Worley, 2008). Urban areas particularly are associated with high traffic volumes in comparison to rural areas. In that regard, there is need to address the issue of road safety with a view to reducing accidents occurring within these areas. While there are several methods that could be applied to redress the situation, some simple and relatively inexpensive techniques can be used with notable success. Prevention interventions fall into several broad categories:

2.18.1. Managing risk exposure with land-use

In developing countries, exposure to potential road traffic injury has increased largely because of rapid motorization, coupled with poor road conditions, rapid population growth, lack of safety features in cars, crowded roads, poor road maintenance, and lack of police enforcement. For example, in Vietnam, the number of motorcycles grew by 29 percent in 2001, with an associated increase of 37 percent in the number of road traffic deaths. Promoting efficient patterns of land use and providing shorter, safer routes for vulnerable road users can reduce their exposure. Studies in Brazil, Mexico, and Uganda have found that pedestrians would rather cross a dangerous road than go out of their way to take a pedestrian bridge, even though such preferences increased their exposure to injury risk. Improving public transportation systems can also reduce exposure. People in cars are between 8 and 20 times less likely to be killed in a road accident than walkers, bicyclists, or motorized two-wheeler users. (Worley, 2008).

2.18.2. Planning and designing roads for safety

In almost all countries, road networks are designed from the perspective of the motor vehicle user. But developing countries can take lessons from safety conscious road design in countries such as the Netherlands and Denmark, where roads are built to suit their function (high speed, rural, transitional between high speed and rural, and residential) and account for the safety of pedestrians and cyclists. Studies in Denmark showed that providing segregated bicycle lanes alongside urban roads reduced deaths among cyclists by 35 percent. This study found that some distracting activity was going on nearly one-third of the time while the vehicle was in motion. (Nordic Road and Transport Research, 2006). About one-half of this distracted time was attributed to conversation with a passenger, while the rest was distributed across many types of distractions. Nonetheless, this study indicates how common overtly observable behaviour with distraction potential, unrelated to driving, occurs during typical travel. Of course, unobservable distractions (such as daydreaming or thinking about personal concerns) also occur and would add to this distracted time.

2.18.3. Traffic calming measures

Traffic calming in urban streets improves the living environment and welfare of residents and other users. Traffic calming may come in conflict with the needs for regular deliveries and car parking in shopping streets. These conflicts may be difficult but necessary to solve, (Nordic Road and Transport Research, 2006).

Whenever possible, traffic schemes should be designed to minimize the need for enforcement, since the enforcement of traffic regulations takes up resources. Measures which are self-enforcing are therefore more likely to be both operationally efficient and cost-effective. Traffic schemes should aim to 'design out' both the ability and inclination of drivers to commit traffic offences. Examples of such designs include traffic calming schemes such as speed humps, speed tables, and rubble strips, which make it difficult and uncomfortable to drive at excessive speed. Further, the installation of traffic islands and kerb realignment bollards and other road furniture could be designed to prevent or deter prohibited movements.

The use of milled rumble strips in the centre of a two-lane road is also probably an excellent measure to reduce the number of head-on collisions that occur because tired and inattentive drivers inadvertently leave their own lanes. Intermittent rubble strips on the edge of the road also play the same role, and have been shown to reduce occurrences of drivers veering off the road due to sleepiness out of fatigue. Further, there is need to ensure that streets in urban areas are well lit at night to avoid conflicts, (Swedish National Road and Transport Research Institute (VTI), 2000).

2.18.4. Prioritization of non-motorized transport modes

The infrastructure support environment consists of factors that enable people to walk or cycle. It includes an NMT network with facilities which can be safely and efficiently used, other facilities such as at the work place, stations, public transport, etc, not necessarily part of an NMT network.

As walking and cycling are an important part of the wider urban transport systems, they have to be treated as such. For this reason, national and local governments should be urged to include these modes into mainstream urban transport policies, strategies, programmes, plans and infrastructure investment projects.

The general approach to safety is: to minimize the encounters between NMT and (high volumes of) speeding motorized transport. This can be achieved by segregation of modes, or by traffic calming.

2.18.5. Driver training and monitoring

There is need for an integrated well-developed driver education that enables newly trained drivers to handle different critical situations. Training for professional drivers can also be judgmental as opposed to skill-oriented. This notwithstanding, the continuous monitoring of young drivers in particular will also need to be given due consideration to reduce accidents.

2.18.6. Need for a user-centred design perspective

The field of human factors addresses the interaction of devices or systems and their human users as these users engage in various tasks. Design for good human factors requires an understanding of the characteristics of the users and the tasks in which they are engaged. Standard road signs and other information technology (IT) devices and systems, should be designed in a manner consistent with the capabilities and behaviour of the range of people that are intended to use them. The user-centered design philosophy is that an effective, safe, and accepted product is designed around the user. It takes into account not only physical and perceptual capabilities (such as reaction time or visual acuity) but also behaviour, knowledge, motivations, and attitudes. A good overview of the application of human factors in highway and vehicle applications is necessary in studying the occurrence and reduction of road traffic accidents.

The behaviour of roadway users is often complex and difficult to predict. They may not always respond to a road sign or IT information in the manner in which the designer intended that information to be used. Proper responding by road users therefore, requires that they: notice the display, in a reliable and timely manner; process the information being presented; comprehend the intended message and all of its implications; accept the validity and personal relevance of the message; choose to respond to the message, given the full range of (sometimes conflicting) tasks and motivations with which they are dealing; and have the ability to execute the desired behaviour in a safe and timely manner.

This list of required steps is not meant to imply that the mental process underlying road user behaviour necessarily runs off in this sequence. Real human cognition is much more complex and this is not intended to represent a model of road user cognition. The point is that each of the requirements above must be accomplished for the road user to ultimately act in the desired manner. The designer of a standard sign or an IT device or system needs some understanding of the road users who will be encountering the sign or IT display. Fundamental human attributes in perception and cognition that are relevant for the design of any display may be found in basic human factors and are reflected in the driving guidance manuals or the Highway Code, (Variable Message Signs-A literature Review, 2007).

2.18.7. Providing visible, crashworthy, and smart vehicles

Designing motorized vehicles that are more crashworthy is an important intervention in those developing countries where automobile safety regulations are more lax than in developed countries. One study showed that in developing countries, buses and trucks are involved in a much greater proportion of road traffic accidents, yet lack relevant safety standards. Improving vehicular visibility is also important. In Thailand, hospital records showed that 75 percent to 80 percent of road traffic injuries were among users of motorized two-wheeled vehicles, which are not easily visible to larger vehicle drivers. Improving the visibility of drivers in other instances (such as at night or during fog) can reduce injuries. Daytime running lights and high-mounted stop lamps have improved road traffic accidents in these cases, as have reflectors and colorful clothing, (Worley, 2008).

2.18.8. Setting safety rules and improving compliance and transport policy

Setting and enforcing speed and blood alcohol concentration limits have proven to be perhaps the most successful interventions contributing to the decrease in injury in developed countries. Speed limiting devices on vehicles, limits on engine power, and non-vehicular traffic-calming measures hold the greatest promise in developing countries, (Worley, 2008). One survey of studies found that, in developing countries, blood alcohol was present in 33 percent to 69 percent of fatally injured drivers. Because blood alcohol tolerances vary across countries, comparison studies are difficult, and to date, no study has provided the evidence to benchmark the tolerance level at which reductions in accidents can occur in developing countries.

Finally, although mandatory seat-belt-use laws have reduced traffic injuries in developed countries by 40 percent to 50 percent, such laws must be tailored to the local situation: In developing countries, car occupants constitute less than 10 percent to 20 percent of traffic fatalities. These countries also need to improve helmet safety and use among two- and three-wheel vehicle operators as well as to enforce the appropriate number of passengers for these vehicles, (Worley, 2008).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter covers in detail the explanation of the procedure used in undertaking the research. This study, which was an historical research, used the mixed mode research approach. Qualitative as well as quantitative researches were used to explain the relationships analysed in the study. In qualitative research, the fundamental concern was the degree of confidence in the data used to reach conclusions. Perspectives of the researcher were checked using triangulation, i.e. by considering different instruments for enhancement of validity. Specifically, various theories on behaviour and attitude were analysed with respect to the driver. Further, the data set available for the period of the study was checked for consistency, accuracy and validity using the Spearman-Brown formula. The chapter further gives in detail the research design, target population and its relationship to the sample used, treatment of sampling errors, data collection procedures, analysis and hypotheses testing.

3.2. Research design

Firstly, the study applied the linear correlational research analysis method for determining the relationship between driver behaviour (independent variable), and road traffic accidents (dependent variable). Secondly, descriptive statistics and two theories were used to explain the various causes of road traffic accidents. Driver behaviour as a variable would not have been measurable, thus it was necessary to device a method to measure the same. Road traffic accidents in the data set availed from the police were classified into various categories specific to their causes and presented in codes. Driver-related causes are coded from 1 to 30c (Appendix 1). The number of road traffic accidents recorded as being caused by the driver was assumed to be related to the behaviour of the driver. This assumption is based on the premise that human factors contribute in 95 percent of accidents in urban areas, (The Institution of Highways and Transport, 1997).

The data used helped to inform the research on understanding the main causes of road traffic accidents. The study was further used to guide in understanding the various options that could be implemented to reduce road traffic accidents in the City of Nairobi. The study involved the studying, recording and analyzing past data in historical perspectives (United Nations Centre for Regional Development, 2004). Choice of the type of study used was dependent on the knowledge already available about the problem and the resources available, as well as the limited time to carry out the study and the budgetary constraint.

3.3. Target Population

The target population was the number of all traffic accidents occurring in the City of Nairobi during the period 1st January 2005 to 30th June 2008. Not all the accidents for that period, however, have been recorded in the City Council of Nairobi's database. In that respect, this population was not available. The accessible population considered in the study, therefore, was the total number of accidents occurring in the City's jurisdictional area for the study period, *as recorded by the traffic police*. While appreciating the proximity of police stations to the main roads and fear of reprisals for motorists for not reporting traffic accidents as required by law as motivation to record road traffic accidents, studies show that underreporting of road traffic accident data is an international phenomenon. Reporting of accidents in developing countries is known to be low due to various shortcomings. (Djebarni and Naji, 1999).

3.4. Sampling design

Whether or not a sample will produce results that are sufficiently representative of the whole aggregate depends primarily on whether the errors introduced by the sampling process are sufficiently negligible to the extent that they cannot invalidate the results for the purposes for which they are required. In order to reduce the sampling errors, a sufficiently large sample size needs to be used, (United Nations Centre for Regional Development, Africa Office (UNCRD), 2004).

Using the rule of thumb and consideration of the target population, the data available from police records for the entire period of the study was used as the sample, constituting approximately 60% of the population as noted above. The sample for the study therefore used the non-probability sampling procedure and the sample is a purposive one. In this kind of sampling, the judgement of the researcher played an important role to ensure that bias was either minimized or eliminated (Kothari, 2004). The researcher's assumptions when using the sample size took into consideration the budget, time, personnel and other limitations, (Barlett, Kotrlik, and Higgins, 2001).

3.4.1. Procedure of treating errors in sampling

Estimates derived from sample surveys are subject to two types of errors – sampling and non-sampling errors. Sampling errors occur when estimates are derived from a sample rather than a census of the population. Sampling errors relate to surveys, where it is possible to have several samples for the same study, from probability sampling procedures. Sampling errors did not apply to this study, for the reason that a non-probability sampling procedure was used, and only one sample was possible under the circumstances.

3.3.2. Non-sampling errors

Arising from the above, it is noted that the possibility of having more than one sample was remote, since the data set could only originate from one primary source, i.e. the traffic police. This therefore eliminates sampling errors, thus only leaving non-sampling errors to be taken care of. Further still, a census of the population of interest produces estimates subject to error. While these are called non-sampling errors, estimates from samples still contain errors of this type. Common sources of these errors are imperfect coverage, non-response, response errors and differences, and processing errors, (Canada's National Statistical Agency, 2006). Further, non-sampling errors can be attributed to other sources, such as definitional difficulties, differing respondent interpretations, and respondent inability to recall information.

Non-sampling error is also attributable to such causes as errors made in recording, coding, and errors made in imputing values for missing data. Explicit measures of the effects of non-sampling error are not available. The relative standard error indicates the magnitude of the sampling error; it does not measure non-sampling error, which includes biases in the data. Several edit and quality-control procedures were therefore used to reduce non-sampling error. For example, the data set was checked for consistency, (National Science Foundation, Division of Science Resources Statistics, 2005).

3.3.3. Analysis of data and hypotheses testing

The data described above are time-related in that they have been collected on daily basis over a period of time. For that matter, the analysis of the data could have been the method of time series. However, there were several variables in the study, and thus bringing in a different dimension to the analysis.

In this regard therefore, the analysis of the data was based on both simple descriptive statistics and elaborate associative techniques, i.e. linear correlation. The simple statistics were restricted to the frequency in which the road traffic accidents occurred over the period of the study. The associative techniques applied linear correlation, which aimed at investigating whether there existed a relationship or association between driver behaviour (measured numerically by the number of driver-related road traffic accidents) and the total road traffic accidents. According to Lucey, (2002), when the value of one variable is related to another, they are said to be correlated. The analysis aimed at determining the Pearson Product Moment Correlation Coefficient denoted by **r**, which gives an indication of the strength of the linear relationship between two variables. The quantity **r** is defined in equation 3-1 as:

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{n\sum x^2 - (\sum x)^2} \times \sqrt{n\sum y^2 - (\sum y)^2}} \qquad \textbf{(Equation 3-1)}$$

where **x** and **y** the number of driver-related accidents and total accidents, respectively, and **n** is the sample size.

It is a fact that, all other factors being held constant, a bigger sample will probably be more reliable than a smaller one. The Spearman-Brown prophecy formula was developed to estimate the change in reliability for different numbers of items. The Spearman's ρ (*Rho)* is the measure of reliability is defined in equation 3-2 as:

$$reliability = \frac{n \times r}{1 + (n-1)r} \qquad \textbf{(Equation 3-2)}$$

where n is the sample size and r the Pearson Product Moment Correlation Coefficient. Further, the driver-related accidents were analyzed with respect to each cause code as per Appendix 1 to determine which among the thirty three causes associated with the driver were the main causes of road traffic accidents.

3.3.4. Data collection methods

Data collection method was mainly quantitative, with the strategy being the application of record-keeping and studying the causes of road traffic accidents occurring in the city of Nairobi with the aim of carrying out an analysis for the purpose of making recommendations. Owing to time limitations, financial resources at the disposal of the researcher, methodology of collection and the precision required in the study, it was not feasible to collect primary data. The data to be used in the study therefore is secondary data collected from the City Council of Nairobi, which collaborates with the Traffic Police Department in matters relating to road traffic accidents within the jurisdiction of the City Council. City Council officials collect data from the traffic police in its raw form. compiled in standard forms (archive source accident data), thus qualifying the council to be considered a primary source.

While all care was taken in handling the data, incidents of biases like over-reporting and selective under-reporting, particularly in self-reported accidents may have gone undetected. Three classes of injury severity were recorded namely: slight injury; serious injury; and fatal injury. The police forms used for recording the information indicate the following labels: year, month, region, police jurisdiction, identity of the police officer, vehicle type, manner of collision, age bracket of victims, accident cause code, time of day, and the output injury severity. Traffic police carry out the exercise of data collection through reports from victims, eye witness reports, observation while on road patrols, telephone and radio communication.

3.3.5. Data collection procedures and techniques

To ensure that all data relating to road traffic accidents are captured, the traffic police find it necessary to use detailed forms that capture all the data enumerated above. This in effect helps eliminating missing important information. The forms also help to build consistency in data collection and recording. This is intended for police officers recording data on accidents to eliminate bias since the forms are standardized.

These data are, as a matter of procedure, recorded by the traffic police as part of their mandate under the Traffic Act, (Government of Kenya, 1993). While collecting these data, the traffic police rely on various methods including a) observations made by police officers while on highway patrols. In cases where the police arrive at the scene of the accident shortly after, the data recorded has a high degree of reliability. In cases where the police are called by victims of the accident or eye witnesses (third parties), then the information may not be as accurate; b) in cases of reports from motorists who have been involved in accidents and/or eye witnesses, police will visit the scene of accident and get whatever other information that can be gathered from the scene and try to confirm the reports by witnesses; and c) other methods, including radio broadcast reports. Some reports may not be easy to verify because by the time police arrive at the scene of accident, the victims of the accident may have been taken to hospital. In cases where the accident is non-injury, drivers may not report them to the police. It is therefore necessary to impress upon drivers the importance of reporting accidents to the police. The need for awareness creation thus arises.

CHAPTER FOUR

DATA ANALYSIS, KEY FINDINGS AND INTERPRETATION

4.1. Introduction

The primary objective of the study was to understand the correlation of driver behaviour and road traffic accidents. In order to make conclusive judgements in this regard, sufficient quantities of data were necessary. Arising from the study objectives, time limitations and financial resources at the disposal of the researcher, it would not have been appropriate or feasible to collect primary data. The data used in the study, therefore, was secondary data, collected from the Kenya Police with assistance from the City Council of Nairobi, which collaborates with the Traffic Police Department in matters relating to road traffic accidents within the jurisdiction of the city. Designated officers of the City Council of Nairobi collect data from Nairobi Area Traffic Police Headquarters located next to Kenyatta National Hospital, approximately 3km from the City Centre (General Post Office). The data is compiled in standard forms (archive source road traffic accident data) and signed by the reporting officers. This therefore qualifies the City Council of Nairobi to be considered a primary source. The data has been presented in tables and bar charts and explained in detail within this chapter.

4.2. Accuracy of reporting and standard report forms

While all care was taken in handling the data, incidents of biases like over-reporting and selective under-reporting, particularly in self-reported accidents may have gone undetected. This was inevitable since the researcher was limited to the data available and further verification would have meant delaying the completion of the study.

Three classes of injury severity were recorded namely: slight injury: serious injury; and fatal injury. The police forms used for recording the information indicate the following labels: year, month, region, police jurisdiction, identity of the police officer, vehicle type, manner of collision, age bracket of victims, accident cause code, time of day, and the output injury severity. Further, the possible cause of accidents is recorded under the relevant codes. The data set considered in the study comprised data for the period 1st January 2005 to 30th June 2008.

4.3. Treatment of data

The data analysis tool used was the Statistical Package for the Social Sciences (SPSS) computer software, where various variables were considered and their relationships sought. Owing to incompleteness of police records, it was not possible to take each accident as a unique case. In coding the data for analysis using the SPSS software, each month was recorded as a case, with the number of accidents in that month being considered as frequencies. This was found to be a serious limitation in that in normal accident reporting, accidents should not be aggregated, since each is unique and needs to be treated as such. Little progress can be made in improving the accident situation until the problem has been clearly defined and an understanding gained on where, why and to whom road accidents are happening. This notwithstanding, road accidents are complex occurrences which make the collection of reliable data difficult. Thus it is important to ensure that data collection is carried out in a systematic and uniform manner, using standardized forms and other instruments to ensure that each *accidents is* treated in the same way. Several variables come to mind, with traffic police taking centre stage. The problem of traffic accidents cannot be taken for granted, since, as noted in chapter one, a substantial amount of the Gross Domestic Product is lost as a result those accidents.

4.4. Tabular presentation of data

The data from police records is presented in full in appendices 3 and 4a to 4j. In the tables below, the same data have been presented in summarized version. The summary of causes is given in table 4-1, with the total number of categories of causes being recorded as ten, namely: driver, pedal cyclists, pedestrians, passengers, animals, obstructions, vehicle defects, road defects, weather and other causes. Accident severity (i.e. fatal, serious injury and slight injury) is presented under table 4-2. This gives a summary of the number of accidents and victims in fatal, serious injury and slight injury accidents for the period under study while tables 4-3 to 4-5 represent the classification of severity by category of victims.

Table 4-1: Summary of causes of accidents: 1st January 2005 to 30th June 2008

Year	Driver	Pedal cyclists	Pedes-trian	Passe-ngers	Anim-als	Obstr-uctions	Vehicle defects	Road defects	Weather	Other causes	Total
2005	1778	207	1268	168	3	12	36	3	2	180	3657
2006	1741	152	1044	137	7	6	38	7	9	192	3333
2007	1552	252	1041	188	0	37	47	15	14	185	3331
2008	512	63	410	70	0	2	3	2	1	84	1147

Source: Transportation Unit of the City Council of Nairobi

Table 4-1 above represents the summary of the number of accidents and the respective causes as reported by the police for the period 1st January 2005 to 30th June 2008. The complete tabulation of the causes is to be found in appendices 4a to 4d. The summary detailing the aggregation of cause codes into the above ten categories of causes is found in appendix 1.

The main cause of road traffic accidents was seen to be drivers, followed by pedestrians. It was also observed that five of the causes, namely; animals, obstructions, vehicle defects, road defects and weather were consistently recording low numbers of accidents in comparison to other categories. Of concern, however, were the reports on 'other causes'; where substantial numbers of accidents appear as having occurred as a result of unknown causes. If accident reporting had been more thorough, then most of those recorded as 'other causes' would have been assigned to any of the other nine causes. The matter of validity of the information as well as the reasons for consistency were explained by the fact that the reports received from the police were authenticated certified by the reporting officers, stamped and dated.

Table 4-2: Road traffic accident severity: 1st January 2005 to 30th June 2008

Year	Fatal accidents		Serious injury accidents		Slight injury accidents		Total annual Accidents
	Total accidents	Victims	Total accidents	Victims	Total accidents	Victims	
2005	525	545	786	1145	2346	3315	3657
2006	573	609	821	1367	1939	2663	3333
2007	579	613	926	1377	1829	3050	3331
2008	274	289	337	630	536	895	1147

Source: Transportation Unit of the City Council of Nairobi

From table 4-2, it was observed that 17% of the total annual accidents were reported as fatal, 25% serious injury and 58% as slight injury accidents. This accounted for 100% of the accidents, thus implying that none of the accidents reported was non-injury, a situation that is not probable, casting doubts on the credibility of the data, and lead to other questions as to whether the issue of under-reporting is ever addressed by the authorities charged with accident data reporting. The study however did not cover the aspect of under-reporting and this is an area that would require further research. The recommendations made, however, took into consideration these observations and the matter of under-reporting was addressed through proposals on enhancement of the traffic police capacity. The other important aspect to consider is the high percentage of fatal accidents. At 17%, the situation was seen to be grim, and thus the need to bring it down.

Table 4-3: Classification of fatal accidents by category of victims

Year	Drivers	Motor cyclists	Pedal Cyclists	Passengers	Pedestrians	Total fatalities	Total fatal accidents	Total annual Accidents
2006	41	8	34	87	439	609	573	3333
2007	54	14	36	74	434	612	579	3331
2008	27	5	17	48	192	289	274	1147

Source: Transportation Unit of the City Council of Nairobi

From table 4-3, it was observed that the biggest share of fatalities is taken by the pedestrian. Fatal accidents accounted for 18.26% of all accidents occurring in the study period. Further, during the same period, pedestrian deaths were 70.53% of all fatalities. When added to the pedal cyclist fatalities, this figure becomes 76.29%, which represents the share of non-motorized transport users dying as a percentage of all road traffic accident deaths. This further indicates how vulnerable the non-motorized transport users are within the road traffic environment. The non motorized transport users were followed by passengers, at 13.84%. In comparison, drivers accounted for 7.95%. While the number of drivers that died for the period may not appear significant (at 128), it is relevant in the sense that each dead driver represents an accident, and thus the need to try to reduce the number. The complete tabulation of monthly statistics is shown in appendices 4f to 4h.

Table 4-4: Classification of serious injury accidents by category of victims

Year	Drivers	Motor cyclists	Pedal Cyclists	Passengers	Pedestrians	Total injuries	Total serious accidents	Total annual Accidents
2006	128	44	440	101	654	1367	821	3333
2007	110	45	82	484	656	1377	926	3331
2008	54	14	25	217	320	630	337	1147

Source: Transportation Unit of the City Council of Nairobi

From table 4-4. it was observed that the share of non-motorized transport users involved in serious injury accidents in comparison to the total serious injuries was 64.52%. Further, serious injury accidents accounted for 26.68% of all accidents. This again gave an indication that the non motorized transport user is pretty much exposed to road traffic accidents. The complete tabulation of monthly statistics is shown in appendices 4f to 4h.

Table 4-5: Classification of slight injury accidents by category of victims

Year	Drivers	Motor cyclists	Pedal Cyclists	Passengers	Pedestrians	Total injuries	Total slight accidents	Total annual Accidents
2006	225	70	1255	129	984	2663	1939	3333
2007	233	86	180	1453	1099	3051	1829	3331
2008	83	22	45	413	332	895	536	1147

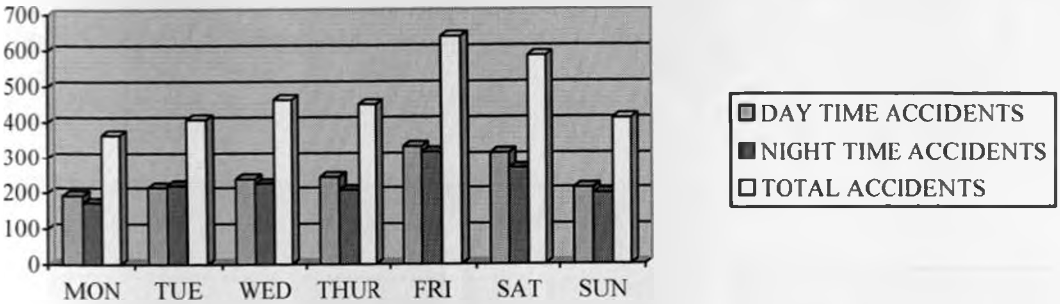
Source: Transportation Unit of the City Council of Nairobi

From table 4-5, it was observed that the total slight injury accidents accounted for 55.10% of all accidents in the period under consideration. Further, the share of non-motorized transport users involved in slight injury accidents in comparison to the total slight injuries was 58.93%. While the figure is still more than 50%, and thus restating the vulnerability of this group of road users, the reduction tended to indicate that non-motorized transport users had more chances of evading slight injury accidents than fatal and serious injury ones. This would lead to the assumption that the speeds involved would be generally lower in this respect. From the above narrative, it was apparent that fatal, serious injury and slight injury accidents accounted for 18.24%, 26.66% and 55.10% respectively (Refer also to appendices 4f to 4h).

4.5.Graphical presentation of data

Data on daily accidents showing day time and night time accidents is presented in figures 4-1 to 4-3. Class of victims for the period 1st January 2006 to 30th June 2008 comprising drivers, motor cyclists, pedal cyclists, passengers and pedestrians are presented in figure 4-4 to 4-6. The summary of causes for the period 1st January 2005 to 30th June 2008 is again illustrated in figures 4-7 to 4-10.

These presentations illustrating data in bar charts gave a simple way of interpretation, thus making it easy to make conclusions at a glance. Further, the objectives of the study



were to determine the main causes of accidents, which was made easy use of charts.

Figure 4-1: Number of accidents in Nairobi on daily basis: 2006

Source: Transportation Unit of the City Council of Nairobi.

Based on the 2006 data presented in figure 4-1, it is clear that day time and night time accidents are almost the same in number, with the day time ones being marginally higher. The aggregate figures for Tuesdays however showed that night time accidents were more than day time ones. It was however observed that accidents were lowest on Monday, rising steadily to the highest on Friday, and falling again.

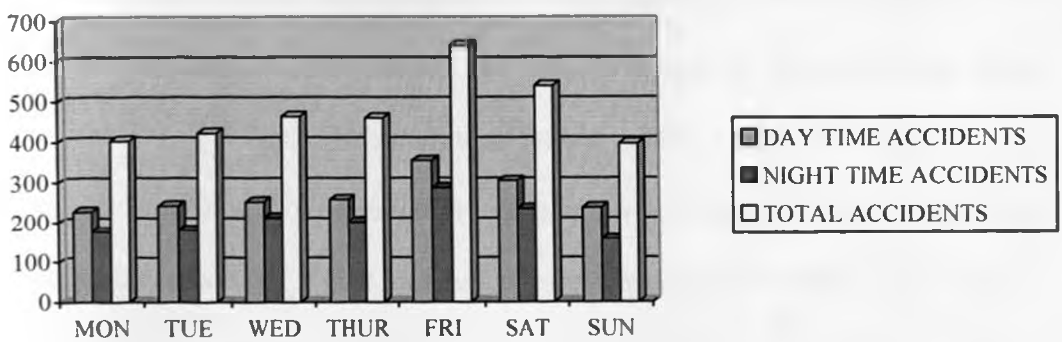


Figure 4-2: Number of accidents in Nairobi on daily basis: 2007

Source: Transportation Unit of the City Council of Nairobi.

Based on the 2007 data presented in figure 4-2, it is clear that day time and night time accidents are almost the same in number, with the day time ones being marginally higher. It was further observed that accidents were lowest on Sunday, rising steadily to the highest on Friday, and falling again.

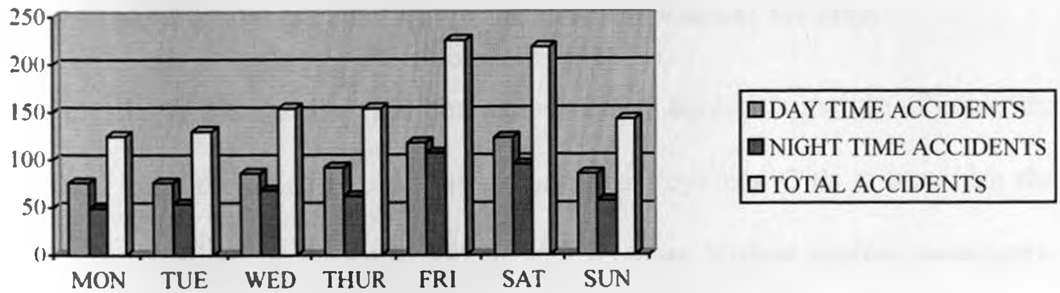


Figure 4-3: Number of accidents in Nairobi on daily basis: Jan to June 2008

Source: Transportation Unit of the City Council of Nairobi.

Based on the 2008 data presented in figure 4-3, it is clear that day time and night time accidents are almost the same, with the day time ones being marginally more. Further, it was observed that accidents were lowest on Monday, rising to the highest on Friday.

The illustration on figures 4-1, 4-2, and 4-3 tend to tell a story about occurrence of accidents in relation to time of day as well as day of week. The story is worrying because there appears to be an affinity for accidents for Friday. There is need to appreciate two issues: (a) that the data is time-related, and can be analysed using the time series procedure, and (b) that there is something unique about Friday that needs to be investigated. Assumptions abound, and a probable one would be that Friday is end of the working week, thus recording higher numbers of merry-makers of the white-collar type.

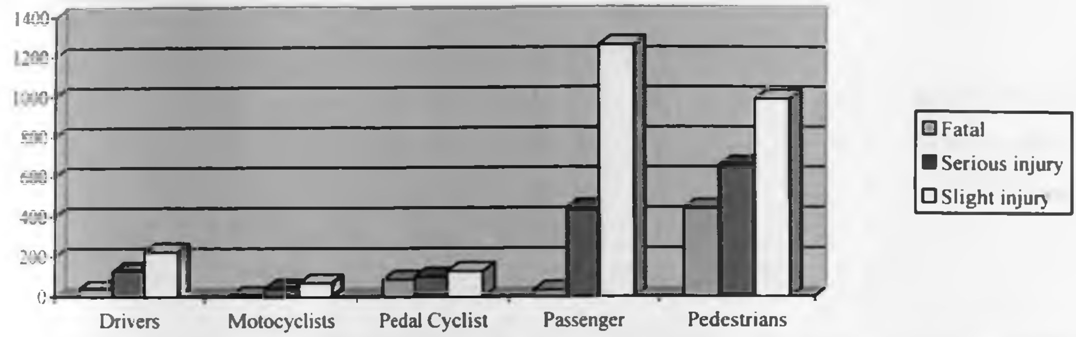


Figure 4-4: Class of victims in road traffic accidents in Nairobi for 2006

Source: Transportation Unit of the City Council of Nairobi.

Figure 4-4 clearly shows that the fatal and serious injury accidents mainly affected the non motorized transport users, i.e. pedestrians and pedal cyclists. This is based on the data for 2006 as reported by the police. Slight injuries were highest against passengers, and this would be due to the large numbers of commuters using public service vehicles in the city. The same information and relationships are represented in Tables 4-3 to 4-5 above.

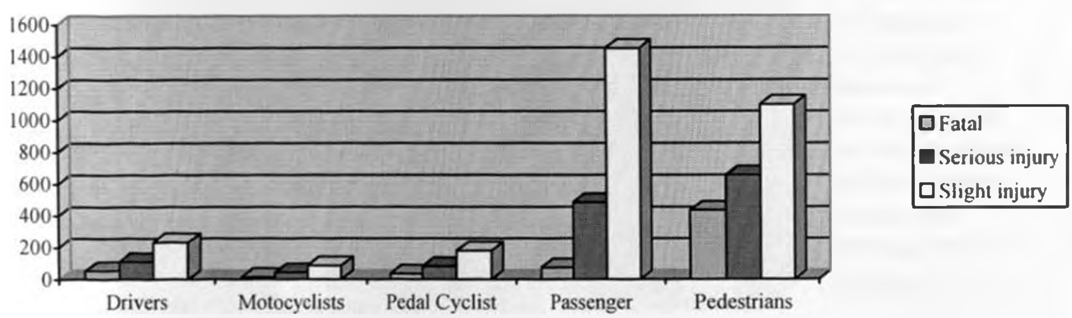


Figure 4-5: Class of victims in road traffic accidents in Nairobi for 2007

Source: Transportation Unit of the City Council of Nairobi.

Figure 4-5 clearly shows that the fatal and serious injury accidents mainly affected the non motorized transport users, i.e. pedestrians and pedal cyclists. This finding is based on the data for 2007. Slight injuries were highest for passengers, and this would be due to the large numbers of commuters using public service vehicles in the city.

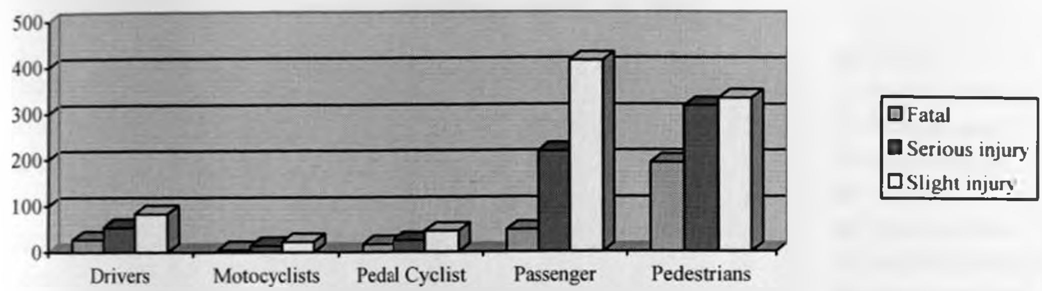


Figure 4-6: Class of victims in road traffic accidents in Nairobi for Jan. to Jun. 2008

Source: Transportation Unit of the City Council of Nairobi.

Figure 4-6 clearly shows that the fatal and serious injury accidents mainly affected the non motorized transport users, i.e. pedestrians and pedal cyclists. This is based on the data for 1st Jan. to 30th June 2008 as reported by the police. Slight injuries were highest against passengers, and this would be due to the large numbers of commuters using public service vehicles in the city. The trend corroborated the results for 2006 and 2007.

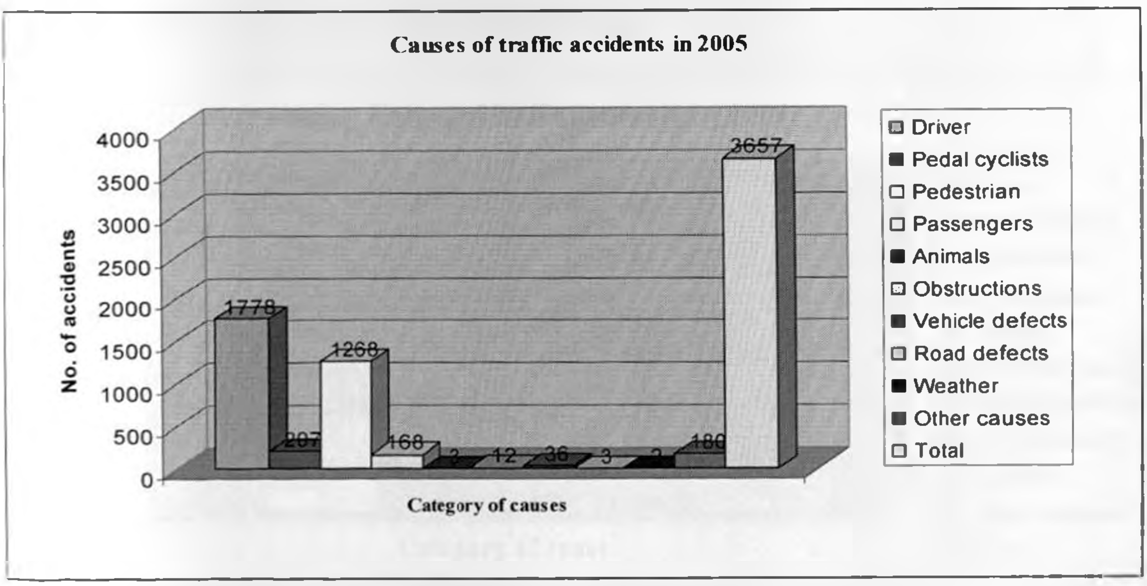


Figure 4-7: Causes of road traffic accidents in 2005

Source: Transportation Unit of the City Council of Nairobi.

From figure 4-7, it is apparent that the main cause of road traffic accidents from the data for 2005 is the driver. This was followed by pedestrians, pedal cyclists and passengers, with the other categories recording very low figures.

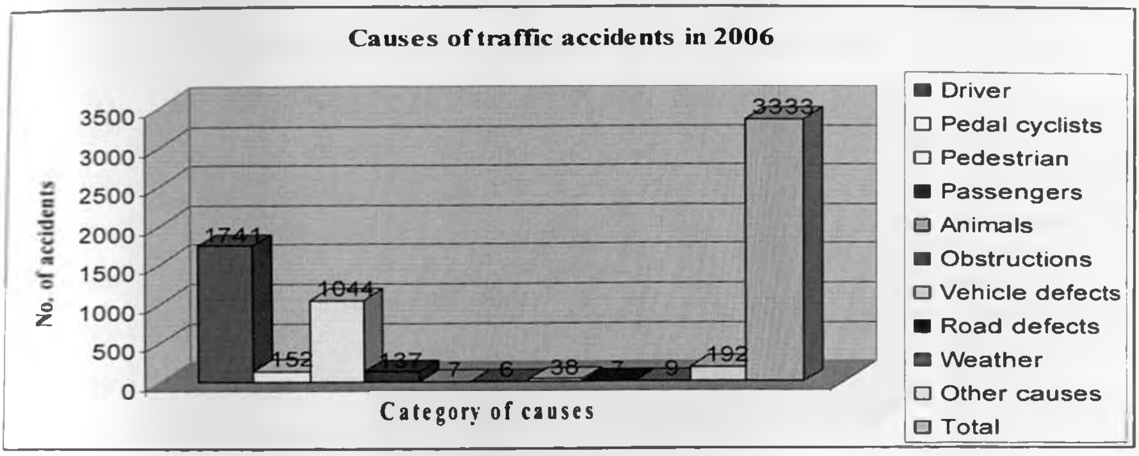


Figure 4-8: Causes of road traffic accidents in 2006

Source: Transportation Unit of the City Council of Nairobi.

From figure 4-8, it is the main cause of road traffic accidents from the data for 2006 is the driver. This was followed by pedestrians, pedal cyclists and passengers, with the other categories recording very low figures. Other causes, while recording 192 cases in the period, aught to have been assigned to specific categories, and their apparent significance would only mean some form of failure in reporting.

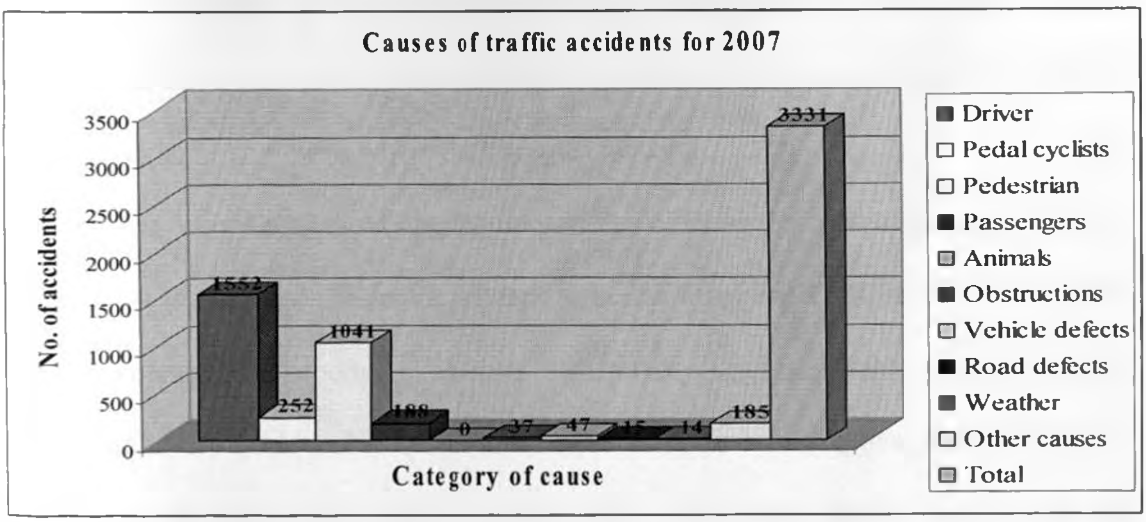


Figure 4-9: Causes of road traffic accidents in 2007

Source: Transportation Unit of the City Council of Nairobi.

From figure 4-9, it is the main cause of road traffic accidents from the data for 2007 is the driver. This was followed by pedestrians, pedal cyclists and passengers, with the other categories recording very low figures.

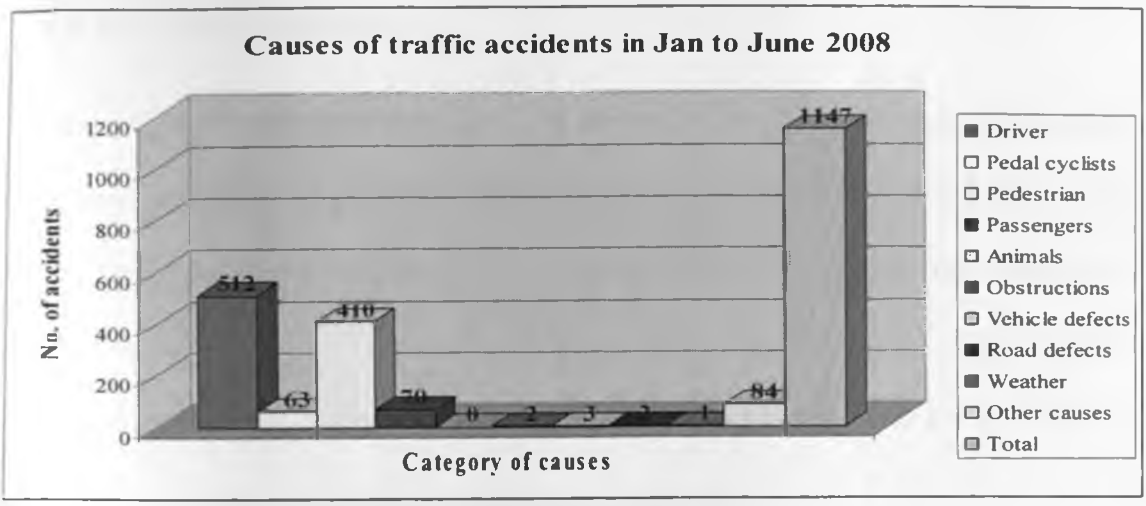


Figure 4-10: Causes of road traffic accidents in 2008

Source: Transportation Unit of the City Council of Nairobi.

From figure 4-10, it is the main cause of road traffic accidents from the data for 2008 is the driver. This was followed by pedestrians, pedal cyclists and passengers, with the other categories recording very low figures.

The irony of the revelation on pedestrians, pedal cyclists and passengers appearing to be the cause of accidents. the driver aught to have been more careful as to be able to avoid the accident. The vulnerable groups of road users tend to be blamed as being the cause of accidents. even in situations where they are just victims.

For the three years under the study. the consistence of causes of road traffic accidents is a cause for worry, in that the driver appears to be the main aspect to be dealt with if the trend is to change. As reported elsewhere in chapter two, human factors account for 95% of all road traffic accidents in urban areas (The Institution of Highways and Transport, 1997). From the above illustrations. human factor would more appropriately be referred to as 'driver factor', thus almost confirming the assertion that there cannot be an accident that has nothing to do with the driver. (Nordic Road and Transport Research, 2003).

4.6. Descriptive statistics

The descriptive statistics from the analysis illustrated in table 4-6 gave a clear indication of the various causes of road traffic accidents. The driver was noted to be the main cause of road traffic accidents from the data set used in the study. Further, the association between various causes of road traffic accidents and the total number of road traffic accidents for the period of the study was analysed and presented in tables 4-7 to 4-26.

Table 4-6: Descriptive statistics on road traffic accidents

Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
Month accident occurred	30	11	1	12	177	5.90	3.458	11.955
Driver-related accidents	30	125	57	182	3805	126.83	32.044	1026.833
Pedal cyclist - related accidents	30	78	2	80	467	15.57	13.464	181.289
Pedestrian -related accidents	30	99	16	115	2495	83.17	20.613	424.902
Passenger - related accidents	30	22	3	25	395	13.17	6.309	39.799
Animal - related accidents	30	3	0	3	7	.23	.774	.599
Obstruction - related accidents	30	11	0	11	45	1.50	2.675	7.155
Vehicle defect - related accidents	30	10	0	10	88	2.93	2.935	8.616
Road defect - related accidents	30	4	0	4	24	.80	1.297	1.683
Weather - related accidents	30	6	0	6	24	.80	1.710	2.924
Accidents related to other causes	30	28	4	32	461	15.37	7.189	51.689
Total annual accidents	30	231	124	355	7811	260.37	47.521	2258.240
Valid N (listwise)	30							

From the above descriptive statistics, it was observed that driver-related accidents presented a monthly mean of 126.83, which was 97.4% of one half of the mean for the total number of road traffic accidents. This was found to be significant because there are nine other possible categories of causes that therefore share the balance. Further, pedestrian-related and pedal cyclist-related accidents were found to follow in quantity, with mean of 83.17 and 15.57 respectively, signifying the seriousness of the problem of road traffic accidents in relation to vulnerable groups.

Table 4-7: Driver-related accidents, Pearson's correlation

Correlations

		Driver-related accidents	Total annual accidents
Driver-related accidents	Pearson Correlation	1	.855**
	Sig. (2-tailed)		.000
	N	30	30
Total annual accidents	Pearson Correlation	.855**	1
	Sig. (2-tailed)	.000	
	N	30	30

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

The result presented in table 4-7 indicates that the Pearson correlation for driver-related accidents is 0.855 ≈ 0.9. From sub-section 5.7.1, this falls within the range +0.7 to +1.0, implying a strong positive correlation between driver-related accidents and the total number of accidents. This fact is further corroborated by the scatter graph illustrated in figure 4-11.

Table 4-8: Driver-related accidents, Spearman's correlation

Correlations

			Driver-related accidents	Total annual accidents
Spearman's rho	Driver-related accidents	Correlation Coefficient	1.000	.804**
		Sig. (2-tailed)	.	.000
		N	30	30
	Total annual accidents	Correlation Coefficient	.804**	1.000
		Sig. (2-tailed)	.000	.
		N	30	30

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

From the Spearman Brown formula illustrated in equation 3-2, it can be concluded that the bigger the sample, the more reliable the results. The value of ρ at 0.804 in table 4-8 above corroborates the strong positive correlation and thus further verifies the hypothesis. This value indicates that the reliability of the sample is high (at 80.4%), which could be attributed to the sampling method used, where the accessible population (60% of the target population) was used as the sample.

Table 4-9: Pedal cyclist-related accidents, Pearson's correlation

Correlations

		Pedal cyclist - related accidents	Total annual accidents
Pedal cyclist - related accidents	Pearson Correlation	1	.336
	Sig. (2-tailed)		.070
	N	30	30
Total annual accidents	Pearson Correlation	.336	1
	Sig. (2-tailed)	.070	
	N	30	30

The result presented in table 4-9 indicates that the Pearson correlation for pedal cyclist-related accidents is 0.336 ≈ 0.3. This falls within the range –0.3 to +0.3, implying that there is little or no correlation between pedal cyclist-related accidents and the total number of accidents. This was anticipated because the main cause of pedal cyclist-related accidents is motorized transport. Further, it is important to note that pedal cyclists fall within the category of vulnerable groups of road users.

Table 4-10: Pedal cyclist-related accidents, Spearman's correlation

Correlations

			Pedal cyclist - related accidents	Total annual accidents
Spearman's rho	Pedal cyclist - related accidents	Correlation Coefficient	1.000	.547**
		Sig. (2-tailed)	.	.002
		N	30	30
	Total annual accidents	Correlation Coefficient	.547**	1.000
		Sig. (2-tailed)	.002	.
		N	30	30

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

The value of ρ at 0.547 in table 4-10 indicates that reliability is moderate at 54.7%, the Spearman's correlation corroborates Pearson's correlation. Compared to driver-related accidents, however, it is apparent that pedal cyclists do not contribute significantly to road traffic accidents. The higher value of Spearman's correlation in relation to Pearson's correlation is due to the data set used being gotten from a large sample.

Table 4-11: Pedestrian-related accidents, Pearson's correlation

Correlations

		Pedestrian -related accidents	Total annual accidents
Pedestrian -related accidents	Pearson Correlation	1	.384*
	Sig. (2-tailed)		.036
	N	30	30
Total annual accidents	Pearson Correlation	.384*	1
	Sig. (2-tailed)	.036	
	N	30	30

*. Correlation is significant at the 0.05 level (2-tailed).

The result presented in table 4-11 above indicates that the Pearson correlation for pedestrian-related accidents is $0.384 \approx 0.4$. This falls within the range +0.3 to +0.7, implying that there is a weak positive correlation between pedestrian-related accidents and the total number of accidents. Pedestrians fall within the category of the vulnerable group of road users and cause accidents due to lack of space to walk along the road corridor. Pedestrian-related accidents are mainly caused by drivers of motorized through the driver.

Table 4-12: Pedestrian-related accidents, Spearman's correlation

Correlations

			Pedestrian -related accidents	Total annual accidents
Spearman's rho	Pedestrian -related accidents	Correlation Coefficient	1.000	.377*
		Sig. (2-tailed)	.	.040
		N	30	30
	Total annual accidents	Correlation Coefficient	.377*	1.000
		Sig. (2-tailed)	.040	.
		N	30	30

*. Correlation is significant at the 0.05 level (2-tailed).

The value of ρ at 0.377 in table 4-12 is quite low, thus indicating that reliability of the sample in relation to pedestrian-related accidents is low. While this appears to contradict the conclusions on the sample size, it definitely corroborates the argument about vulnerable groups. Accidents relating to pedestrians are mainly caused by motorized transport.

Table 4-13: Passenger-related accidents, Pearson's correlation

Correlations

		Passenger - related accidents	Total annual accidents
Passenger - related accidents	Pearson Correlation	1	.273
	Sig. (2-tailed)		.145
	N	30	30
Total annual accidents	Pearson Correlation	.273	1
	Sig. (2-tailed)	.145	
	N	30	30

The result presented in table 4-13 indicates that the Pearson correlation for passenger-related accidents is $0.273 \approx 0.3$. This falls within the range -0.3 to $+0.3$, implying little or no correlation between passenger-related accidents and the total number of accidents. This was expected since the main cause of passenger-related accidents is the driver.

Table 4-14: Passenger-related accidents, Spearman's correlation

Correlations

			Passenger - related accidents	Total annual accidents
Spearman's rho	Passenger - related accidents	Correlation Coefficient	1.000	.219
		Sig. (2-tailed)	.	.245
		N	30	30
	Total annual accidents	Correlation Coefficient	.219	1.000
		Sig. (2-tailed)	.245	.
		N	30	30

The value of ρ at 0.219 in table 4-14 is quite low. This means two things: that the reliability of the sample is low (at 21.9%) and there is no relationship between passenger-related accidents and total number of accidents. This result would be expected because passengers cannot possibly be significant in causing road traffic accidents, and their involvement should not be analyzed using linear correlation, thus this outcome.

Table 4-15: Animal-related accidents, Pearson's correlation

Correlations

		Animal - related accidents	Total annual accidents
Animal - related accidents	Pearson Correlation	1	.201
	Sig. (2-tailed)		.287
	N	30	30
Total annual accidents	Pearson Correlation	.201	1
	Sig. (2-tailed)	.287	
	N	30	30

The result presented in table 4-15 indicates that the Pearson correlation for animal-related accidents is 0.201 ≈ 0.2. This falls within the range –0.3 to +0.3, implying little or no correlation between animal-related accidents and the total number of accidents. This was expected since the main cause of animal-related accidents is the driver.

Table 4-16: Animal-related accidents, Spearman's correlation

Correlations

			Animal - related accidents	Total annual accidents
Spearman's rho	Animal - related accidents	Correlation Coefficient	1.000	.232
		Sig. (2-tailed)	.	.216
		N	30	30
	Total annual accidents	Correlation Coefficient	.232	1.000
		Sig. (2-tailed)	.216	.
		N	30	30

The value of ρ at 0.232 in table 4-16 is quite low. This means two things: that the reliability of the sample is low (at 23.2%) and there is no relationship between passenger-related accidents and total number of accidents. This result was expected because animals cannot possibly be significant in causing road traffic accidents.

Table 4-17: Obstruction-related accidents, Pearson's correlation

Correlations

		Obstruction - related accidents	Total annual accidents
Obstruction - related accidents	Pearson Correlation	1	.407*
	Sig. (2-tailed)		.026
	N	30	30
Total annual accidents	Pearson Correlation	.407*	1
	Sig. (2-tailed)	.026	
	N	30	30

*. Correlation is significant at the 0.05 level (2-tailed).

The result presented in table 4-17 indicates that the Pearson correlation for obstruction-related accidents is 0.407 ≈ 0.4. This falls within the range +0.3 to +0.7, implying that there is a weak positive correlation between obstruction-related accidents and the total number of accidents. While this is statistically the case, the correlation could be termed spurious because the cause of accident in this respect is the driver, either due to speeding, inattentiveness, experience or other reasons. Well trained and experienced drivers should be able to avert obstruction-related accidents by safely going round the obstacles, or to stop in time to avoid coming into contact with them.

Table 4-18: Obstruction-related accidents, Spearman's correlation

Correlations

			Obstruction - related accidents	Total annual accidents
Spearman's rho	Obstruction - related accidents	Correlation Coefficient	1.000	.442*
		Sig. (2-tailed)	.	.015
		N	30	30
	Total annual accidents	Correlation Coefficient	.442*	1.000
		Sig. (2-tailed)	.015	.
		N	30	30

* Correlation is significant at the 0.05 level (2-tailed).

From table 4-18, it is noted that only 45 accidents were reported as having been caused by obstructions, representing a mean of 1.5 accidents per month. The value of ρ at 0.442 in table 4-18 implies that reliability is moderate, (at 44.4%). While the result corroborates the Pearson's weak positive correlation between the two variables, the significance of obstructions as a cause of accidents is negligible. Obstructions are inanimate bodies and need not be blamed in road traffic accidents. Drivers play the bigger role in the accidents.

Table 4-19: Vehicle defect-related accidents, Pearson's correlation

Correlations

		Vehicle defect - related accidents	Total annual accidents
Vehicle defect - related accidents	Pearson Correlation	1	.360
	Sig. (2-tailed)		.051
	N	30	30
Total annual accidents	Pearson Correlation	.360	1
	Sig. (2-tailed)	.051	
	N	30	30

The result presented in table 4-19 indicates that the Pearson correlation for vehicle defect-related accidents is $0.360 \approx 0.4$. This falls within the range +0.3 to +0.7, a weak positive correlation between vehicle defect-related accidents and the total number of accidents. Out of the 7811 accidents studied, 88 were recorded as being caused by vehicle defects, which is only 1.13% of all road traffic accidents in the study period. This presented a mean of 2.93 accidents per month. The weak positive correlation is therefore accepted. This argument notwithstanding, the spontaneity of vehicle defects as causes of road traffic accidents must be appreciated. Many factors relating to vehicle maintenance and inspection come to play when considering possibilities of accidents happening due to vehicle mechanical condition. This study, however, did not cover these aspects.

Table 4-20: Vehicle defect-related accidents, Spearman's correlation

Correlations

			Vehicle defect - related accidents	Total annual accidents
Spearman's rho	Vehicle defect - related accidents	Correlation Coefficient	1.000	.361*
		Sig. (2-tailed)	.	.050
		N	30	30
	Total annual accidents	Correlation Coefficient	.361*	1.000
		Sig. (2-tailed)	.050	.
		N	30	30

*. Correlation is significant at the 0.05 level (2-tailed).

From table 4-6, it is noted that 88 accidents were reported as having been caused by vehicle defects, representing a mean of 2.93 accidents per month. The value of ρ at 0.361 in table 4-20 is low, (at 36.1%). The result corroborates the weak positive correlation between the two variables, but the significance of vehicle defects as a cause of accidents is negligible. Occurrence of accidents as a result of this factor can easily be checked if the policy on motor vehicle inspection is changed to cover all vehicles, regardless of size.

Table 4-21: Road defect-related accidents, Pearson's correlation

Correlations

		Road defect - related accidents	Total annual accidents
Road defect - related accidents	Pearson Correlation	1	.398*
	Sig. (2-tailed)		.029
	N	30	30
Total annual accidents	Pearson Correlation	.398*	1
	Sig. (2-tailed)	.029	
	N	30	30

*. Correlation is significant at the 0.05 level (2-tailed).

The result presented in table 4-21 indicates that the Pearson correlation for road defect-related accidents is $0.398 \approx 0.4$. This falls within the range +0.3 to +0.7, implying that there is a weak positive correlation between road defect-related accidents and the total number of accidents. Out of the 7811 accidents studied, 24 were recorded as having been caused by road defects, which is only 0.31% of all road traffic accidents in the study period. This presented a mean of 0.80 accidents per month. Unexpected road defects could be justified as causes of road traffic accidents. Vehicles collide as they avoid potholes or other road defects. In most accidents, however, it may not always be possible to single out those accidents caused specifically by road defects, unless the reporting police officers are also trained in basic road engineering to be able to appreciate the wide ranging road defects. The number of accidents caused by road defects could arguably have been more than those reported. Nevertheless, the weak positive correlation is therefore accepted.

Table 4-22: Road defect-related accidents, Spearman's correlation

Correlations

			Road defect - related accidents	Total annual accidents
Spearman's rho	Road defect - related accidents	Correlation Coefficient	1.000	.527**
		Sig. (2-tailed)	.	.003
		N	30	30
	Total annual accidents	Correlation Coefficient	.527**	1.000
		Sig. (2-tailed)	.003	.
		N	30	30

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

The value of ρ at 0.527 in table 4-22 is moderate, and quite well corroborates the Pearson's correlation. Even with only 24 accidents having been caused by road defects, the reliability is higher than 50%. This serves as a pointer that road maintenance will play a major role in reducing road traffic accidents. The relatively high value of Spearman's correlation is due to the fact that, in most cases, road defects are not easily detectable in time for drivers to avoid them, particularly at relatively high speeds.

Table 4-23: Weather-related accidents, Pearson's correlation

Correlations

		Weather - related accidents	Total annual accidents
Weather - related accidents	Pearson Correlation	1	.402*
	Sig. (2-tailed)		.028
	N	30	30
Total annual accidents	Pearson Correlation	.402*	1
	Sig. (2-tailed)	.028	
	N	30	30

*. Correlation is significant at the 0.05 level (2-tailed).

The result presented in table 4-23 indicates that the Pearson correlation for weather-related accidents is 0.402 ≈ 0.4. This falls within the range +0.3 to +0.7, implying that there is a weak positive correlation between weather-related accidents and the total number of accidents. Out of the 7811 accidents studied, 24 were recorded as having been caused by weather, which is only 0.31% of all road traffic accidents in the study period. This presented a mean of 0.80 accidents per month. Unlike road defects, weather conditions will be apparent to drivers, thus calling for more care while attending to the driving task. Drivers however risks driving at high speeds, without head lights on in fog, at dusk or when it is raining, among other risky manoeuvres. This exposes their vehicles and others to avoidable accidents. The weak positive correlation may be seen as spurious because it is not the weather that causes accidents. More often than not, the weather does not change abruptly, thus the need to examine other factors, chief among them the driver.

Table 4-24: Weather-related accidents, Spearman's correlation

Correlations

			Weather - related accidents	Total annual accidents
Spearman's rho	Weather - related accidents	Correlation Coefficient	1.000	.447*
		Sig. (2-tailed)	.	.013
		N	30	30
	Total annual accidents	Correlation Coefficient	.447*	1.000
		Sig. (2-tailed)	.013	.
		N	30	30

*. Correlation is significant at the 0.05 level (2-tailed).

The value of ρ at 0.447 in table 4-24 corroborates the weak linear correlation between weather-related road traffic accidents and total number of accidents. But this only to the extent that presently. drivers are badly behaved. If drivers were to change their attitudes and behaviour on the wheel so as to be more predictable, weather-related accidents would even be less, and the association would change to negligible or no relationship at all.

Table 4-25: Other causes-related accidents, Pearson's correlation

Correlations

		Accidents related to other causes	Total annual accidents
Accidents related to other causes	Pearson Correlation	1	.343
	Sig. (2-tailed)		.063
	N	30	30
Total annual accidents	Pearson Correlation	.343	1
	Sig. (2-tailed)	.063	
	N	30	30

The result presented in table 4-25 indicates that the Pearson correlation for other causes-related accidents is 0.343 ≈ 0.3. This falls within the range –0.3 to +0.3. implying that there is little or no correlation between pedal cyclist-related accidents and the total number of accidents. The implication of this is that causes of most road traffic accidents are known. Out of the total 7811 accidents in the study period, 461 were as a result of unknown causes, accounting for 5.9%. This presents a monthly mean of 15.37. This mean could be brought down if more care is taken in recording accident data. Police officers should be trained in assigning possible causes to each road traffic accident in order to make analyses more complete.

Table 4-26: Other causes-related accidents, Spearman's correlation

Correlations

			Accidents related to other causes	Total annual accidents
Spearman's rho	Accidents related to other causes	Correlation Coefficient	1.000	.297
		Sig. (2-tailed)	.	.111
		N	30	30
	Total annual accidents	Correlation Coefficient	.297	1.000
		Sig. (2-tailed)	.111	.
		N	30	30

The value of ρ at 0.297 in table 4-26 is accepted, since low reliability in this case would be a desirable result. This is so because these accidents may have been as a result of many different causes, a high value of Spearman correlation would have been spurious.

As noted under the Pearson correlation, thorough reporting would bring down the number of accidents whose causes are unknown.

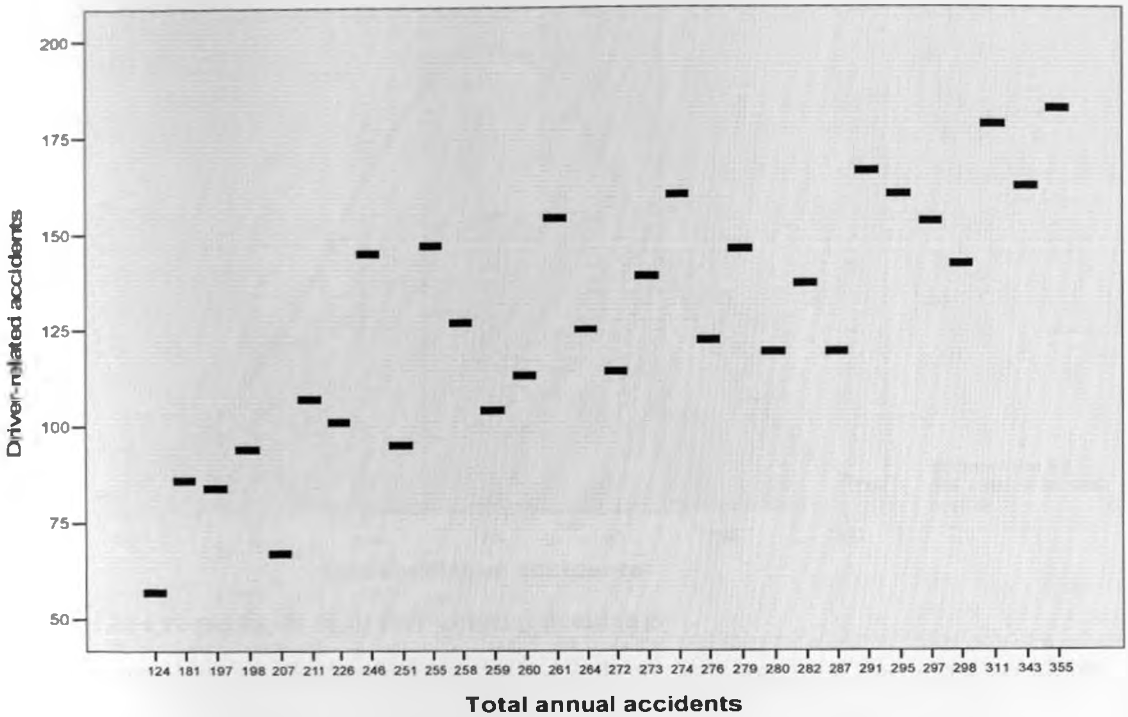


Figure 4-11: Driver-related accidents versus Total annual accidents

The scatter graph presented in figure 4-11 shows that there is a positive correlation between driver – related accidents and the total number of accidents occurring in Nairobi. This fact is confirmed by the Pearson Product Moment Coefficient of Correlation, which further shows that there is almost a perfect correlation between driver-related accidents and the total number of accidents occurring in the City of Nairobi. If a line of fit was to be drawn on the scatter graph, it would confirm that the driver-related accidents increase as the total number of accidents increase. This would mean that the total number of accidents is a function of driver-related accidents, and by definition, a function of driver behaviour.

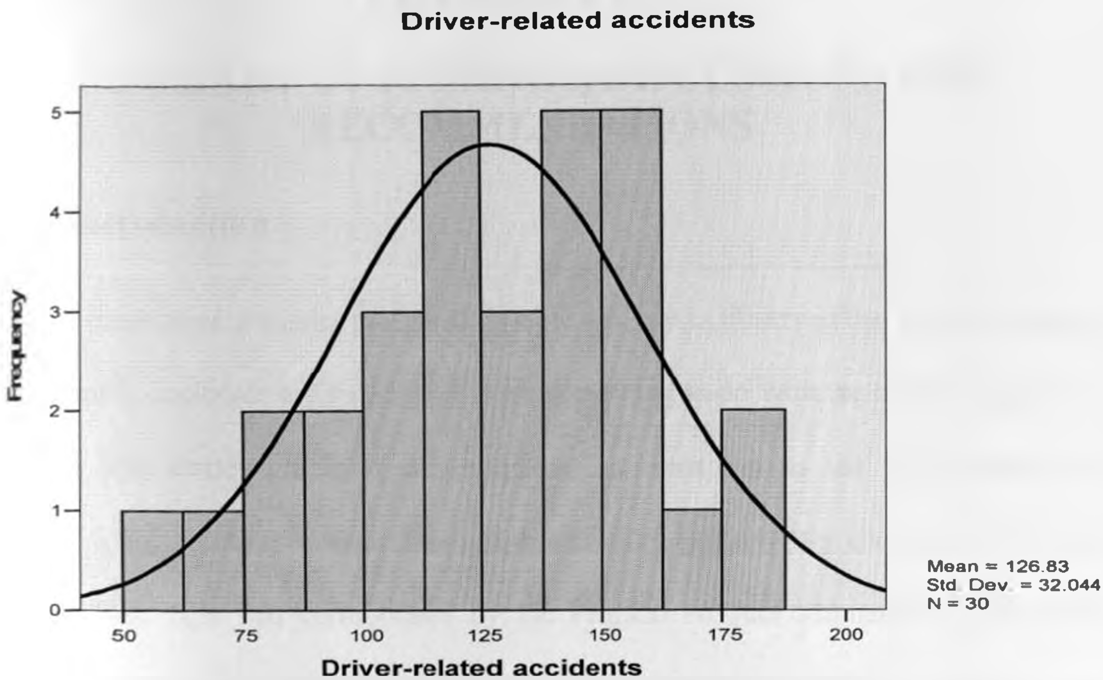


Figure 4-12: Frequencies of driver-related accidents

From the normal curve illustrated in figure 4-12 above, it is apparent that most accidents cluster around the mean, and frequencies for very low (75 and below) or very high (185 and above) are almost negligible. The recommendations of the study have been reached in such a way as to lower the mean by reducing the chances of these accidents occurring.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS AND RECOMMENDATIONS

5.1.Introduction

From the descriptive statistics presented in table 4-6, it was observed that the main causes of road traffic accidents are factors that have something to do with the driver. Figure 5-1 illustrates the scatter graph of driver-related accidents versus the total number of accidents over the study period. This graph showed a positive correlation between the two variables. This was corroborated by the Pearson Product Moment of Correlation Coefficient appearing in table 4-7. Five of the main causes of road traffic accidents were singled out and are presented later in the chapter. Of particular interest in the study is drunk-driving. While not appearing as one of the main causes of road traffic accidents, driving 'under the influence of drink or drug' (cause code 4 in appendix 1) was also analysed to interrogate/illustrate the incompleteness of road traffic accident records as a result of lack of relevant/appropriate legislation to facilitate reining in drunk drivers. Below is an extract showing the summary of road traffic accident cause codes and the reported causes as per the police reporting forms.

Table 5-1: Summary of cause codes and reported causes of accidents

Code	Reported Cause	Code	Reported Cause
1-30c	Drivers	78-89	Vehicle defects
31-58	Pedal cyclists	76-77	Obstructions
59-68	Pedestrians	90-93	Road defects
69-73	Passengers	94-96	Weather
74-75	Animals	97-98	Other causes

Source: Kenya Police

5.2. Major causes of road traffic accidents in the City of Nairobi

The first objective of the research was to determine the main causes of road traffic accidents in the City Council of Nairobi. An analysis was therefore carried out using linear correlation, where the Pearson Product Moment Correlation Coefficient and the Spearman correlation were computed. The findings of the analysis are presented below.

5.2.1. Causing accident due to driving at speeds beyond the allowable limits

From the analysis of the data set, it was observed that speeding is the single most critical cause of road traffic accidents in the City of Nairobi. Out of the 30 months studied, a total of 403 accidents were attributable to 'proceeding at excessive speed without having regard to conditions' – cause code 7; with a mean of 13 accidents per month. This was found to be worrying because in an urban environment, speed is regulated and within the jurisdiction of the City Council of Nairobi, the upper speed limit is 50kph. In built-up areas, speed limits fall to 30kph. The possible explanation would therefore be due to lack of law enforcement on the one part, untoward behaviour and lack of self regulation for motorists on the other.

5.2.2. Causing accident due to overtaking improperly

While overtaking in itself is an acceptable manoeuvre in a road traffic environment, its application in the driving task must be dealt due care to ensure the safety of both the driver and other road users. During the study period, a total of 314 accidents could be attributable to 'overtaking improperly' – cause code 10; with a reported mean of 10 accidents per month. This could be explained by the impatience of drivers, reflecting on their attitude and behaviour. This behaviour may further be attributed to other driver qualities including age, formal education, training and experience, which qualities were not directly covered in this study.

5.2.3. Causing accident by driver cutting in

Just as improper overtaking is largely as a result of impatience on the part of the driver, cutting in could also be attributed to the same. A total of 304 accidents were as a result of driver 'cutting in' – cause code 9; with a mean of 10 accidents per month. An impatient driver will find it hard to have to wait at a side road for the traffic on the main road to clear. The gaps in between vehicles may not be adequate for a vehicle to join in from a side road, but an impatient driver will risk an entry, hoping that the oncoming traffic will slow down. More often than not, the other driver will also hope that the one on the side road will not join the main road until it is clear of traffic. With these kinds of like minds, the two vehicles inevitably crash at the junction. As noted in Chapter 2, the road user's goal is generally not to minimize personal risk but rather to optimize personal benefits, thus resulting in this kind of risk behaviour, (Nordic Road and Transport Research, 2006).

5.2.4. Causing accident by driver misjudging clearance

A total of 301 accidents were recorded as a result of driver 'misjudging clearance, distance, or speed of vehicles or objects' – cause code 29. Just as cutting in has a lot to do with impatience, so does misjudging clearance. A driver needs to give himself/herself time to allow for the implication of his/her actions to sink in. When driving at high speed, one has to ensure that the gap to the vehicle ahead is adequate for stopping if there was need to do so in an emergency. The reaction time of drivers however differs from driver to driver. In an urban environment where a traffic management system is used, drivers drive more closely to each other at speeds between 80kph and 100kph. Outside of this speed interval, the time gaps have generally increased, (Nordic Road and Transport Research, 2008). That argument however may be true in the Nordic countries, where drivers are more patient and can easily be predicted, but may not hold in Nairobi, at least for the time being. The desired situation is where drivers can be predicted, and this will be a feat that has to be won by the relevant authorities, if the trend in road traffic accidents is to change.

5.2.5. Causing accident by driver pulling from near side carelessly

A total of 285 accidents were recorded as having been caused by 'pulling out from near side or from one traffic lane (not from parking area) to another without due care' – cause code 19; with a mean of 9.5 (say 10 accidents per month). Usually, this happens mainly as a result of driver's inattention or indecisiveness, even though it could also have a bearing on impatience. An oncoming vehicle or an overtaking one gets distracted as the erring driver manoeuvres the vehicle, thus resulting in an accident. This could also be attributed to driver training, experience and/or general behaviour.

5.2.6. Causing accident by the influence of drink or drug

An interesting feature of the study was that driving 'under the influence of drink or drug' – cause code 4, only 2 cases were recorded. This meant that the aspect of drinking and driving as a cause of concern was insignificant! This could easily be explained by lack of the means or wherewithal to measure the Blood Alcohol Concentration (BAC). Accident-recording/reporting police officers are not able to prove the level of alcohol in a driver's blood. Unless the victim is taken to a laboratory for a blood test, then it is difficult to secure a conviction for lack of concrete evidence. This procedure necessarily requires support by legislation, which is lacking in Kenya currently. Many accidents caused by drunk-driving will therefore go unreported, as long as the situation persists.

5.3. Hypothesis testing: relationship between driver behaviour and road traffic accidents

The main object of the study was to investigate the hypothesis that there is a relationship between driver behaviour and road traffic accidents occurring in the City of Nairobi. The results of the Pearson Product Moment Correlation Coefficient and Spearman Correlation Coefficient were presented in tables 4-7 and 4-8 in the last chapter. They illustrated that there is a strong positive correlation between driver behaviour and road traffic accidents. For a sample size of 30 months, $r = 0.855$ while $\rho = 0.804$. The analysis showed that the correlation is significant at the 0.01 level. The value of Spearman ρ also indicated that the reliability of the sample was high.

5.4. Classes of victims of road traffic accidents

The analysis carried out as described in the descriptive statistics in appendix 4 showed that non-motorized transport users, and especially pedestrians, are the most vulnerable group. Most fatalities were found to be pedestrians, followed by pedal cyclists. Passengers accounted for the most slightly injured. The possible explanation of this would be that public service vehicles carrying large numbers of passengers within the built-up urban areas are involved in road accidents that are not necessarily serious.

5.5. Day time and night time accidents as an issue of road traffic accident management

From the statistics of January 2005 to the end of the first half of 2008, day and night time accidents were found to be almost equal in number, with those occurring during the day being marginally more. On scrutinizing of the statistics, however, it was observed that the

Friday road traffic accident figures were relatively higher than those for all the other days. The trend was followed closely by Saturday. This trend was found to be consistent throughout the study period. These statistics indirectly answered to the researcher's objective (iv), in that the pattern appeared to point out to omissions that give rise to road traffic accidents occurring on particular days with almost consistent similarity. Such deficiencies largely have to do with management of traffic issues, among them the lack of highway patrols, lack of enforcement of the law (Traffic Act and City Council of Nairobi by-laws), and inappropriate urban road designs. This calls for further research to determine the reasons for this trend.

5.6. Discussions and Conclusions

Careful selection of appropriate options for implementation could lead to reduced road traffic accidents. The options have been identified based on the findings of the main causes of road traffic accidents and are presented as recommendations under section 5.9. It is, however, important to correctly interpret the results in order to reach valid conclusions.

5.6.1. Interpretation of the correlation coefficient

The Pearson Product Moment Correlation Coefficient is always between -1 and +1. The closer the correlation is to +/-1, the closer to a perfect linear relationship, where -1.0 is a perfect negative (inverse) correlation, 0.0 is no correlation, and 1.0 is a perfect positive correlation. The correlations were interpreted as shown below: -

-1.0 to -0.7:	strong negative correlation
-0.7 to -0.3:	weak negative correlation
-0.3 to +0.3:	little or no correlation

+0.3 to +0.7: weak positive correlation

+0.7 to +1.0 strong positive correlation

According to Lucey, (2002), while this rule is somewhat arbitrary, correlation between two variables would produce an r value in excess of +0.9 or -0.9. The assumption made here is that both variables are approximately normally distributed, and their joint distribution is bivariate normal. From the statistical analysis presented above, the Pearson Product Moment Correlation Coefficient, **r** was found to be $0.855 \approx 0.9$. This implies that there is a strong positive correlation between driver behaviour and road traffic accidents. This result is close to 1.0, which, if it were the case, there would be a perfect correlation between the two variables. This revelation implies that the driver is a critical element in the problem of road traffic accidents. This result confirms what was observed earlier in chapter one in the presentation of the *death reducing model* (figure 1-3).

Arising from the finding of the analysis, the hypothesis is accepted, since there is a strong positive correlation between driver behaviour and traffic accidents occurring in the City of Nairobi. This observation can be supported by several factors, among them the lack of, or selective enforcement of the Traffic Act and certain by-laws of the City Council of Nairobi, lack of standardization of the driver training curriculum, various forms of driver violations (including impunity), lack of more substantive involvement of the Ministry of Transport in regulation, and shortcomings with road design.

5.6.2. Causes of road traffic accidents in the City of Nairobi

As briefly discussed in the chapter, the major causes of road traffic accidents have to do with the driver. On acceptance of the hypothesis above, the driver is identified as a key element in the problem of the increasing road traffic accidents. True to the hypothesis, the top five causes of road traffic accidents were found to have something to do with the driver. In this respect, driver training and continuous follow up are therefore key to reducing road accidents occurring in the City of Nairobi. Road design on the other hand must take cognizance of the need to reduce injury severity, and particularly fatalities.

5.6.3. Accident severity by class of road users

It is apparent from the study that all categories of persons are at risk, but passengers and pedestrians are at a higher risk than drivers, motor cyclists and pedal cyclists. The explanation to this is that most of the vehicles involved in the city are PSVs, thus the high number of passengers involved. Further, the main mode of transport is walking, thus give a reason for the high number of pedestrians involved in accidents. As discussed elsewhere in the report, walking and cycling account for $^{2}/_{3}$ of the person trips in developing countries, (The World Bank Institute, 2005).

An important observation in the analysis is that driver behaviour on the road gives rise to accidents that mainly affect the non-motorized transport users, particularly pedestrians. This is in agreement with a research carried out by the Institute of Transport Economics in Norway, (Nordic Road and Transport Research, 2008), which found that the risk of pedestrian accidents is ten times greater than the risk for motorized road users. Safety measures are therefore effective in reducing the risk for pedestrian and cyclist accidents when the driver factors are reduced, e.g. speeding.

Several reasons could explain this phenomenon, among them inappropriate design of non-motorized transport facilities, lack of observance of traffic regulations that require pedestrians to cross the road at designated places, poor visibility, encroachment of roadside developments onto the road reserve, thus giving rise to non motorized transport facilities being taken over by other users and reducing the effective road space. In that respect, pedestrians and cyclist are forced to use the carriageway together with motorized transport, a situation that should not arise.

The analysis showed that a large number of passengers are also slightly injured. For an urban traffic environment, this observation has to do with occurrence of many accidents involving public service vehicles, thus the need to act on regulation of this mode of transport.

5.6.4. Other observations relating to daily accident occurrences

The graphical presentation above (figures 4-1 to 4-3) clearly show that the number of accidents occurring increases from Monday up to Friday, with Friday recording the highest number of accidents. The number then reduces up to Sunday, and then starts to increase again. It can also be observed that Friday and Saturday record the highest number of accidents. The explanation of this seasonal variation has to do with man-made conventions and in this respect the habits (behaviour) of drivers. The traffic accidents recorded on Fridays are much higher than for other days, this number only being followed closely by the records for Saturday. Even the night time accidents for Friday, while lower than day time accidents for that day, are markedly more than the numbers for other days, be it daytime or night time. Friday, commonly referred to as *members day* in Kenya, is a day that is marked with merry-making, mainly by white-collar workers. The day sees more vehicles on the road than other days. The merry-makers while away the night till late, and have to get home. Most of them therefore end up driving under the influence of alcohol, thus having a higher risk of accidents. To aggravate the situation, the number of traffic police officers on patrol at night is low, and further, there are few or no speed controlling measures, thus increasing the chances of drivers on the road to drive recklessly. This however has not been captured as a result of the analysis, and the conclusion is only made based on rule of thumb. The scope of this study did not cover this analysis, though. It would therefore be of interest to undertake research in this area.

5.6.5. Conclusions and recommendations

Arising from the findings of the study, it is concluded that the three elements, road, vehicle and the driver have a role to play in the road traffic accident problem. Attention however, will be directed more to the driver, who has been found to be a major determinant of the enormity of the problem. Most of the 33 causes of road traffic accidents as contained in Appendix 1 clearly point to driver behaviour or habits. To reduce the menace of the problem therefore, several recommendations need to be embraced. These recommendations are enumerated below:

(i) Design: upgrading and making dysfunctional roads self-explaining and forgiving

In almost all countries, road networks are designed from the perspective of the motor vehicle user. Roads should be built to suit their function (high speed, rural, transitional between high speed and rural, and residential) and they should also take into account for the safety of pedestrians and cyclists. Whenever possible, traffic schemes should be designed to minimize the need for enforcement. In addition, the requirement for efficient and safe walking and cycling should be included in national urban roads design standards. The system of NMT connections provides their users with a route which goes as directly as possible to their destinations, in which any detour and waiting times at junctions is reduced to a minimum. A major challenge for the future of Nairobi's transport system will be to give investments for non-motorized transport facilities priority to match the dominance of NMT as a transport mode. The designs must forgive rather than condemn errant drivers to ensure that road safety is enhanced. It is reasonable to expect that the development of adequate NMT infrastructure should receive a very high priority in the future to allow pedestrians and bicycles to circulate safely at the main corridors.

(ii) Traffic control

There is need for more traffic control measures during the day as well as at night. In the short run, strict enforcement of speed limits and testing of alcohol levels in drivers will be essential. Further, there is need to have increased road patrols by traffic police. As part of the efforts to complement enforcement, proper road signage, use of IT, marking and other such simple measures as improvement of road junctions could be undertaken.

Other methods like the use of police helicopters have been used at intermittent times to check speeds in specific areas where there has been a general outcry by residents. Such methods are however not sustainable due to the capital outlay involved. It would be more appropriate to procure several hand-held radar machines and place police officers at strategic positions than use such showy methods, which do not achieve the objectives in the long run.

(iii) Incentives for the traffic police officers

The government will need to put in place measures to motivate police officers working in the traffic department by giving them incentives for working towards the reduction of accidents. Training must be one such incentive, which will go a long way to ensure that the records kept are reliable and complete.

(iv) Data recording instruments

The instruments used in data recording will require to be revised to reflect the changes that have taken place since their development. Such instruments include the accident recording forms which should require the reporting police officer to state the specific time and location of the accident.

(v) Amendment of the Traffic Act: Chapter 403, Laws of Kenya

The Traffic Act will require to be amended with respect to provisions that deal with drivers. In this regard, there is need to institute stiff penalties as a deterrent to errant drivers. It is noted that current speeding penalties are not particularly severe. Section 43 (1) of the Traffic Act (Government of Kenya, 1993), provides a fine of between five hundred and two thousand shillings.

Considering that the Act commenced in 1954, and the relevant section was last updated in 1986, there is a lot of room for amendment to increase the severity of the penalty, thus acting as a speed deterrent. Section 43 (2) provides for disqualification for holding or obtaining a driving license for a period of one or three months for a first and second conviction respectively. This provision, though, is never invoked by the courts, opting for the easier (and more driver-friendly) one of a two thousand shilling maximum fine. It should be noted, also, that other research has shown that increases in perceived detection (by the police) rates are likely to be more influential than increased penalties alone, (Fildes, 1991).

Section 46 allows for disqualification from holding a licence for a period of three years if convicted of causing death by reckless driving. This provision is, however, hardly invoked by the courts. Section 88 allows penalties for a person conducting cattle, dog, or other animal on any road if the person does not exercise care to keep it or them under proper control, so as to become a danger or annoyance to the public. The fine for this is set at five hundred shillings. The section should serve to remove the large herds of cattle roaming the city in times of dry weather. Section 90(2) (a) and 94 provide for a fine of one hundred shillings for driving a vehicle on a footpath! No wonder the public service vehicles will not hesitate to do this where the footpath is just wide enough to allow passage.

Part II of the Traffic (Driving Schools) Rules covers the driving instructors. It is noted that the police have the sole responsibility of deciding who can be an instructor. Apart from the age limit of 25 years, the only other major requirement is to have held a valid driving licence entitling *him* to drive vehicles of the class or classes on which *he* wishes to give instruction for a minimum of 5 years and has not, within the period of five years immediately preceding the date of the application, been convicted of a scheduled offence. No mention is made of the level of education of the applicant, a situation that would need to be rectified. Further, no mention of what should be taught in driving schools is made.

Under the traffic Rules, Part III (Driving Licences and Tests), the Act allows for inspection of only public service vehicles, commercial vehicles and heavy commercial vehicles. This leaves out the bulk of the vehicles registered legitimately, which is a serious anomaly that could be cited as one of the causes of road traffic accidents.

The driver license will require to capture more details on the driver including age. Further, the upgrading of driver license to an electronic one is long overdue. The police should have the capacity to keep/retrieve records of drivers at the point of checking the license, and that is on the road. While this may take time to be implemented, though, it is an option that needs to be planned for and realised in the medium term, i.e. within the next 10 years.

(vi) In-vehicle speed control

In Kenya, top speed limiting devices have been introduced for certain heavy vehicles and public service vehicles to prevent excessive speeds. It may be necessary for these devices to become standard equipment on all vehicles to stop deviant practices by rogue drivers. In addition, technology for extending the operation of speed limiters for use in urban areas exists today, although current designs generally require substantial road infrastructure equipment and costs. These devices need further investigation and development at this time.

(vii) Driver training and standardization of curriculum

While education and enforcement campaigns may not be totally successful in reducing excessive speed, there is need to address the training of drivers. The curriculum currently followed will need to be standardized and enriched to include more of road safety as well as attitude and behaviour change. The time spent by drivers in the driving school is too short to inculcate good behaviour in drivers. Driver instructors too will require to undergo checks before being allowed to train new drivers. Certain minimum qualifications must be set to ensure that the driving task is given the importance it deserves.

A country that is working towards industrialization by 2030 cannot afford to maintain the status quo with respect to road safety issues, and transportation in general. Policy shift to facilitate new thinking in the allocation of resources and implementation of the recommendations highlighted above is necessary in this regard.

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Appendices

Appendix 1: Road Traffic Accident Cause Code

DRIVER	PEDAL CYCLIST	
1.	31	Fatigued
2.	—	A sleep
3.	32	Ill
4.	33	Under the influence of drink and drug
5.	34	Physically defective
6.	35	Inexperienced with the type of vehicle in use at the time
7.	36	Proceeding at excessive speed without having regard to conditions.
8.	37	Failing to keep to side or to proper lane.
9.	38	Cutting in.
10.	39	Overtaking improperly.
11.	40	Swerving
12.	41	Skidding (give cause of skid)
13.	42	Forcing way through persons boarding or alighting from omnibus.
14.	43	Failing to stop to afford free passage to pedestrians at pedestrian crossing places
15.	44	Turning around in a road negligently.
16.	-	Reversing negligently (other than from parking area).
17.	45	Failing to comply with traffic sign or signal.
18.	46	Failing to signal or give indistinct or incorrect signal.
19.	47	Pulling out from near side or from one traffic lane (not from parking area) to another without due care
20.	48	Inattentive or attentive diverted.
21.	49	Hampered by passenger, animals or luggage in or on a vehicle.
22.	50	Turning right without due care.

23.	51	Turning left without due care.
24.	-	Driver negligently opening door of a vehicle.
25.	52	Crossing without due care at a road junction.
	53	Pedal cyclist holding on to another vehicle.
26.	54	Losing control (particulars to be specified)
27.	55	Dazzled by lights of another vehicle
28.	56	Stopping suddenly.
29.	57.	Misjudging clearance, distance, or speed (vehicles or objects).
30.	58	Other apparent error of judgment or negligence (Specify)
30a		Reversing from angle parking space negligently.
30b		Entering parking space (angle or flush) negligently.
30c		Leaving flush parking space negligently.

PEDESTRIAN

59.	Heedless of traffic – crossing road masked by stationary vehicle.
60.	Heedless of traffic – crossing road not masked by stationary traffic.
61.	Heedless of traffic – walking or standing on the Road.
62.	Heedless of traffic - playing on the road.
63.	Heedless of traffic – sleeping, walking, or running off footpath or verge into the road.
64.	Slipping or falling.
65.	Physical defects or sudden illness.
66.	Under influence of drink or drug.
67.	Holding on to a vehicle.
68.	Error of judgment or negligence other than above.

PASSENGER ETC

69.	Boarding or alighting from vehicle without due care
70.	Falling when inside or falling from vehicle.
71.	Other negligence on part of passenger

72.	Stealing ride.
73.	Negligence on part of conductor or goods vehicle's attendant.

ANIMAL

74.	Dog in carriageway.
75.	Other animal in carriageway including bolting horse.

OBSTRUCTIONS

76.	Stationary vehicle dangerously placed
77.	Other obstructions (specify).

VEHICLE DEFECTS

78.	Mechanical defects or failure - brakes
79.	Mechanical defects or failure –tyres or wheel.
80.	Mechanical defects or failure – steering.
81.	Mechanical defects or failure – other causes
82.	No front light.
83.	Inadequate front light.
84.	No rear light.
85.	Inadequate rear light.
86.	Unattended vehicle running away.
87.	Drivers view obstructed e.g. by equipment; load; or obscured windscreen.
88.	Vehicle overloaded; shifted or defective load.
89.	Any other feature of vehicle or equipment which Contributed to this accident (specify).

ROAD DEFECT

90.	Road surface slippery.
91.	Excessive dust obscuring driver's view.
92.	Road surface in need of repair (state defect).
93.	Other road conditions, view obscured, etc. (Specify).

WEATHER

94.	Fog and mist.
95.	Torrential rain.
96.	Glaring sun.

OTHER CAUSE

97.	Other cause (specify).
98.	Cause not traced.

SUMMARY

Codes	1-30c	Drivers
"	31-58	Pedal cyclists
"	59-68	Pedestrians
"	69-73	Passengers
"	74-75	Animals
"	76-77	Obstructions
"	78-89	Vehicle defects
"	90-93	Road defects
"	94-96	Weather
"	97-98	Other causes

Appendix 2: Letter of authorization to collect data

MINISTRY OF LOCAL GOVERNMENT

Telephone Nairobi 340972
When replying please quote

Ref: MOLG/UDD/691/VOL.V/(45)

URBAN DEVELOPMENT DEPARTMENT
P.O. Box 30004-00100,GPO.
NAIROBI

Date **11th June 2007**

FROM: TOWN CL...
TO: 1
2
3

The Town Clerk,
City Council of Nairobi,
P.O. Box 30075,
NAIROBI.

Attn. City Engineer

RE: REQUEST FOR TRAFFIC ACCIDENT DATA FOR RESEARCH PURPOSES - ENG. J. W. THEURI

The above named officer is undertaking a Course in Master of Arts in Project Planning & Management at the University of Nairobi.

For the purposes of his research and bearing in mind the impacts that the research will entail both for the Ministry and the Council, this office is requesting that data pertaining to traffic accident within the Council's jurisdiction for the period January 2003 to December 2006 be availed to him to enable him carry out the research.

Any prompt action taken on this matter will be highly appreciated.

C7CL

Eng. J. N. Maina
DIRECTOR. URBAN DEVELOPMENT DEPARTMENT

Kibiru
P/se avail all available accident data to Eng. Theuri.
AKM 25/06/07

19 JUN 2007

Noted and submitted!
24/06/07.

Appendix 3: Sample raw data forms from police records

THE KENYA POLICE

QUARTERLY ACCIDENT SUMMARY

Province/Division/Station N I A R E A .... ~~Quarter ending~~ MONTHLY JUNE, 2008 ....

1. NUMBER OF ACCIDENTS UNDER EACH CAUSE CODE—

										TOTALS	
1	13	25 4	33	45	57 3	68 9	77	88	97 3	Drivers 1–30c	107
2	14 1	26 8	34	46	58 5	80	—	89	98 4	Pedal Cyclists 31–58	8
3	15 1	27 6	35	47	8	69 4	78		7	Pedestrians 59–68	80
4	16 3	28 4	36	48	59 6	70	79	90 2		Passengers 69–73	7
5 3	17 3	29 18	37	49	60 2	71	80	91		Animals 74–75	
6 2	18 2	30	38	50	61	72 1	81	92		Obstruction 76–77	
7 5	19 14	30a 2	39	51	62 2	73 2	82	93		Vehicle Defects 78–89	
8 6	20 2	30b	40	52	63 58	7	83	2	See Foot-note	Road Defects 90–93	2
9 9	21	30c	41	53	64	74	84	94		Weather 94–96	
10 7	22	107	42	54	65	75	85	95		Other Causes 97–98	7
11 4	23	31	43	55	66 1	—	86	96			
12 2	24 1	32	44	56	67 2	76	87			TOTALS	211

Note.—In all cases where a road defect is the cause of the accident, a copy of form "Roads 201A" will be sent to Roads Engineer, M.O.T. & C., Nairobi.

2. AGE GROUPS OF INJURED PERSONS—

Injury	A—Persons over 16 years	TOTAL	Persons up to 16 years	TOTAL
Fatal	50	50	7	57
Serious	92	92	5	97
Slight	131	131	15	146
				300

3. CLASS OF PERSON INJURED—

Class	Fatal	Serious	Slight	Total
Drivers	6	7	10	23
Motor Cyclists	1	1	2	4
Pedal Cyclists	5	7	10	22
Passengers	4	32	81	117
Pedestrians	41	4[illegible]	43	1[illegible]
TOTALS	57	97	146	300

Note.—
The totals of paragraphs 2 and 3 should agree.

4. DAY AND TIME—

DAY	7 a.m.– 7 p.m.	7 p.m.– 7 a.m.
Monday	16	10
Tuesday	15	11
Wednesday	18	12
Thursday	17	9
Friday	22	17
Saturday	20	18
Sunday	14	12
TOTAL	122	89

5. DRIVERS OF OTHER PERSONS RESPONSIBLE—

European ... nil ... African ... 200 ...

Asian ... 2 ... Others ... nil ...

Not known ... 9 ...

6. VEHICLES OR PERSONS INVOLVED—

	A	B		A	B
Cars and Utilities			Hand Carts [illegible]		
Lorries		[illegible]	Pedal Cycles	[illegible]	
Tractors	[illegible]		Animals [illegible]		
Buses and Taxis			Persons		
Motor cycles			Not known		

NOTES—Under "A" give numbers of vehicles, etc., *Primarily* responsible. Total of column A should agree with total in paragraphs 1, 4 and 5.

Under "B" give numbers of vehicles, etc., *Otherwise* involved.

7. DETAILS OF ALL FATAL ACCIDENTS, INCLUDING A.R. NO., ACCIDENT CAUSE CODE NO., TOTAL DEATHS AND GENERAL COMMENTS—

ACCIDENT SUMMARY

FATAL ACC — 54 — VICTIMS — 57

SERIOUS ACC — 63 — VICTIMS — 97

8. REMARKS— SLIGHT ACC — 94 — VICTIMS — 146

211 300

[illegible signature]

[illegible]

Date ... [illegible]–7–65 ...

To: COMMISSIONER OF POLICE.

THROUGH: Provincial Police Officer,

...

Note.—This Summary must reach Force Headquarters by the 10th of the month.

GPK (L)

Appendix 4a: Causes of road traffic accidents by Code in 2005

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
2005	1	-	-	-	-	-	-	-	-	-	-	-	-	0
	2	-	-	-	-	-	-	-	-	-	-	-	-	0
	3	-	-	-	-	-	-	-	-	-	-	-	-	0
	4	-	-	-	-	-	-	-	-	-	-	-	-	0
	5	-	-	-	-	-	-	-	-	-	-	-	-	8
	6	-	-	-	-	-	-	-	-	-	-	-	-	47
	7	-	-	-	-	-	-	-	-	-	-	-	-	169
	8	-	-	-	-	-	-	-	-	-	-	-	-	49
	9	-	-	-	-	-	-	-	-	-	-	-	-	148
	10	-	-	-	-	-	-	-	-	-	-	-	-	139
	11	-	-	-	-	-	-	-	-	-	-	-	-	131
	12	-	-	-	-	-	-	-	-	-	-	-	-	28
	13	-	-	-	-	-	-	-	-	-	-	-	-	24
	14	-	-	-	-	-	-	-	-	-	-	-	-	38
	15	-	-	-	-	-	-	-	-	-	-	-	-	47
	16	-	-	-	-	-	-	-	-	-	-	-	-	47
	17	-	-	-	-	-	-	-	-	-	-	-	-	46
	18	-	-	-	-	-	-	-	-	-	-	-	-	59
	19	-	-	-	-	-	-	-	-	-	-	-	-	168
	20	-	-	-	-	-	-	-	-	-	-	-	-	5
	21	-	-	-	-	-	-	-	-	-	-	-	-	3
	22	-	-	-	-	-	-	-	-	-	-	-	-	4
	23	-	-	-	-	-	-	-	-	-	-	-	-	6
	24	-	-	-	-	-	-	-	-	-	-	-	-	7
	25	-	-	-	-	-	-	-	-	-	-	-	-	57
	26	-	-	-	-	-	-	-	-	-	-	-	-	171
	27	-	-	-	-	-	-	-	-	-	-	-	-	69
	28	-	-	-	-	-	-	-	-	-	-	-	-	101
	29	-	-	-	-	-	-	-	-	-	-	-	-	126
	30	-	-	-	-	-	-	-	-	-	-	-	-	27

Source: Transportation Unit of the City Council of Nairobi

Appendix 4a (Cont.): Causes of road traffic accidents by Code in 2005

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
2005	30a	-	-	-	-	-	-	-	-	-	-	-	-	46
	30b	-	-	-	-	-	-	-	-	-	-	-	-	4
	30c	-	-	-	-	-	-	-	-	-	-	-	-	4
		-	-	-	-	-	-	-	-	-	-	-	-	1778
	31	-	-	-	-	-	-	-	-	-	-	-	-	0
	32	-	-	-	-	-	-	-	-	-	-	-	-	0
	33	-	-	-	-	-	-	-	-	-	-	-	-	0
	34	-	-	-	-	-	-	-	-	-	-	-	-	0
	35	-	-	-	-	-	-	-	-	-	-	-	-	0
	36	-	-	-	-	-	-	-	-	-	-	-	-	0
	37	-	-	-	-	-	-	-	-	-	-	-	-	0
	38	-	-	-	-	-	-	-	-	-	-	-	-	0
	39	-	-	-	-	-	-	-	-	-	-	-	-	0
	40	-	-	-	-	-	-	-	-	-	-	-	-	0
	41	-	-	-	-	-	-	-	-	-	-	-	-	0
	42	-	-	-	-	-	-	-	-	-	-	-	-	0
	43	-	-	-	-	-	-	-	-	-	-	-	-	0
	44	-	-	-	-	-	-	-	-	-	-	-	-	0
	45	-	-	-	-	-	-	-	-	-	-	-	-	0
	46	-	-	-	-	-	-	-	-	-	-	-	-	0
	47	-	-	-	-	-	-	-	-	-	-	-	-	0
	48	-	-	-	-	-	-	-	-	-	-	-	-	0
	49	-	-	-	-	-	-	-	-	-	-	-	-	0
	50	-	-	-	-	-	-	-	-	-	-	-	-	0
	51	-	-	-	-	-	-	-	-	-	-	-	-	0
	52	-	-	-	-	-	-	-	-	-	-	-	-	0
	53	-	-	-	-	-	-	-	-	-	-	-	-	0
	54	-	-	-	-	-	-	-	-	-	-	-	-	0
	55	-	-	-	-	-	-	-	-	-	-	-	-	0

Source: Transportation Unit of the City Council of Nairobi

Appendix 4a (Cont.): Causes of road traffic accidents by Code in 2005

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
2005	56	-	-	-	-	-	-	-	-	-	-	-	-	0
	57	-	-	-	-	-	-	-	-	-	-	-	-	55
	58	-	-	-	-	-	-	-	-	-	-	-	-	152
		-	-	-	-	-	-	-	-	-	-	-	-	207
	59	-	-	-	-	-	-	-	-	-	-	-	-	52
	60	-	-	-	-	-	-	-	-	-	-	-	-	8
	61	-	-	-	-	-	-	-	-	-	-	-	-	7
	62	-	-	-	-	-	-	-	-	-	-	-	-	9
	63	-	-	-	-	-	-	-	-	-	-	-	-	948
	64	-	-	-	-	-	-	-	-	-	-	-	-	5
	65	-	-	-	-	-	-	-	-	-	-	-	-	4
	66	-	-	-	-	-	-	-	-	-	-	-	-	11
	67	-	-	-	-	-	-	-	-	-	-	-	-	12
	68	-	-	-	-	-	-	-	-	-	-	-	-	212
		-	-	-	-	-	-	-	-	-	-	-	-	1268
	69	-	-	-	-	-	-	-	-	-	-	-	-	158
	70	-	-	-	-	-	-	-	-	-	-	-	-	4
	71	-	-	-	-	-	-	-	-	-	-	-	-	0
	72	-	-	-	-	-	-	-	-	-	-	-	-	5
	73	-	-	-	-	-	-	-	-	-	-	-	-	1
		-	-	-	-	-	-	-	-	-	-	-	-	168
	74	-	-	-	-	-	-	-	-	-	-	-	-	2
	75	-	-	-	-	-	-	-	-	-	-	-	-	1
		-	-	-	-	-	-	-	-	-	-	-	-	3
	76	-	-	-	-	-	-	-	-	-	-	-	-	0
	77	-	-	-	-	-	-	-	-	-	-	-	-	0
		-	-	-	-	-	-	-	-	-	-	-	-	12
	78	-	-	-	-	-	-	-	-	-	-	-	-	0
	79	-	-	-	-	-	-	-	-	-	-	-	-	0

Source: Transportation Unit of the City Council of Nairobi

Appendix 4a (Cont.): Causes of road traffic accidents by Code in 2005

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
2005	80	-	-	-	-	-	-	-	-	-	-	-	-	0
	81	-	-	-	-	-	-	-	-	-	-	-	-	0
	82	-	-	-	-	-	-	-	-	-	-	-	-	0
	83	-	-	-	-	-	-	-	-	-	-	-	-	0
	84	-	-	-	-	-	-	-	-	-	-	-	-	0
	85	-	-	-	-	-	-	-	-	-	-	-	-	0
	86	-	-	-	-	-	-	-	-	-	-	-	-	0
	87	-	-	-	-	-	-	-	-	-	-	-	-	0
	88	-	-	-	-	-	-	-	-	-	-	-	-	14
	89	-	-	-	-	-	-	-	-	-	-	-	-	22
		-	-	-	-	-	-	-	-	-	-	-	-	36
	90	-	-	-	-	-	-	-	-	-	-	-	-	1
	91	-	-	-	-	-	-	-	-	-	-	-	-	0
	92	-	-	-	-	-	-	-	-	-	-	-	-	0
	93	-	-	-	-	-	-	-	-	-	-	-	-	2
		-	-	-	-	-	-	-	-	-	-	-	-	3
	94	-	-	-	-	-	-	-	-	-	-	-	-	0
	95	-	-	-	-	-	-	-	-	-	-	-	-	0
	96	-	-	-	-	-	-	-	-	-	-	-	-	2
		-	-	-	-	-	-	-	-	-	-	-	-	2
	97	-	-	-	-	-	-	-	-	-	-	-	-	0
	98	-	-	-	-	-	-	-	-	-	-	-	-	0
		-	-	-	-	-	-	-	-	-	-	-	-	180
		-	-	-	-	-	-	-	-	-	-	-	-	3657

Source: Transportation Unit of the City Council of Nairobi

Appendix 4b: Causes of road traffic accidents by code in 2006

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2006	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
	5	0	1	3	2	0	2	2	0	5	2	4	0	21
	6	0	5	5	4	5	4	2	3	7	5	9	2	51
	7	19	12	8	13	14	14	12	14	12	12	14	22	166
	8	0	5	10	9	6	9	9	9	9	8	8	14	96
	9	12	11	12	14	18	12	13	12	13	13	15	1	146
	10	7	14	9	8	6	11	14	11	11	17	18	20	146
	11	1	2	6	5	16	8	8	13	6	6	12	3	86
	12	0	1	5	3	7	7	7	7	5	5	16	0	63
	13	0	4	5	4	2	2	4	2	3	2	4	0	32
	14	0	5	4	4	2	7	7	5	4	4	2	2	46
	15	1	2	2	3	3	3	3	4	3	3	6	1	34
	16	3	2	5	3	3	2	4	3	6	8	9	3	51
	17	5	4	8	4	4	6	8	4	5	5	7	3	63
	18	2	3	6	6	5	6	6	9	7	14	11	0	75
	19	4	9	21	7	13	8	7	15	13	17	13	7	134
	20	7	1	2	1	2	6	2	2	2	2	2	4	33
	21	0	0	1	0	0	0	0	0	0	0	0	0	1
	22	3	1	3	2	4	1	2	0	0	1	1	0	18
	23	0	1	1	0	6	0	0	0	0	0	0	0	8
	24	0	0	1	0	2	0	0	0	0	1	1	0	5
	25	2	3	6	4	4	2	3	2	5	8	6	7	52
	26	20	4	8	6	5	7	8	5	6	7	8	12	96
	27	1	4	11	8	6	8	6	7	7	9	7	2	76
	28	0	11	7	5	7	4	8	6	5	8	5	0	66
	29	16	13	12	7	9	6	9	11	6	14	4	11	118

Source: Transportation Unit of the City Council of Nairobi

Appendix 4b (Cont.): Causes of road traffic accidents by code in 2006

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2006	30	10	6	2	1	1	1	2	0	4	3	0	1	31
	30a	0	2	3	1	2	2	1	1	2	2	0	3	19
	30b	0	0	0	1	0	1	0	0	0	1	0	1	4
	30c	0	1	0	0	2	0	0	0	0	1	0	0	4
		113	127	166	125	154	139	147	145	146	178	182	119	1741
	31	3	3	0	1	0	0	0	1	1	0	2	0	11
	32	1	1	0	0	0	0	0	0	0	0	0	0	2
	33	0	0	0	0	0	0	0	0	0	0	0	1	1
	34	0	0	0	0	0	0	0	0	0	0	0	0	0
	35	0	0	0	0	0	0	0	0	0	0	2	0	2
	36	0	0	0	1	0	0	0	0	0	0	0	1	2
	37	5	0	0	1	0	0	0	0	0	0	2	5	13
	38	0	0	0	0	0	0	0	0	0	0	0	1	1
	39	0	0	0	0	0	0	0	0	0	0	1	3	4
	40	0	0	0	0	0	0	0	0	0	0	0	2	2
	41	0	0	0	0	0	0	0	0	0	0	0	2	2
	42	0	0	0	0	0	0	0	0	0	0	0	0	0
	43	0	0	0	0	0	0	0	0	0	0	0	0	0
	44	0	0	0	0	2	0	0	0	0	0	0	0	2
	45	1	0	0	0	0	0	0	0	0	0	0	0	1
	46	0	0	0	0	0	0	0	0	0	0	0	0	0
	47	0	0	0	0	0	0	0	0	0	0	0	0	0
	48	0	0	0	0	0	0	0	0	0	0	0	0	0
	49	0	0	0	0	0	0	0	0	0	0	0	0	0
	50	0	0	0	0	0	0	0	0	0	0	0	0	0
	51	0	0	0	0	0	0	0	0	0	0	0	0	0
	52	0	0	0	0	0	0	0	0	0	0	0	0	0
	53	0	0	0	0	0	0	0	0	0	0	0	0	0
	54	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Transportation Unit of the City Council of Nairobi

Appendix 4b (Cont.): Causes of road traffic accidents by code in 2006

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2006	55	0	0	0	0	0	0	0	0	0	0	0	0	0
	56	0	0	0	0	0	0	0	0	0	0	0	0	0
	57	2	5	1	4	4	3	2	4	8	8	8	4	53
	58	4	7	1	3	6	5	3	5	7	8	6	1	56
		16	16	2	10	12	8	5	10	16	16	21	20	152
	59	1	3	9	5	3	1	4	3	4	3	4	2	42
	60		4	2	2	1	3	2	2	2	2	3	4	27
	61	0	0	1	1	0	2	0	0	1	0	1	1	7
	62	0	0	1	1	0	1	1	1	2	1	1	1	10
	63	94	52	72	89	49	61	61	51	63	61	64	56	773
	64	0	2	1	0	0	0	0	0	3	0	3	0	9
	65	0	0	1	0	0	0	0	0	2	0	1	0	4
	66	0	0	2	1	1	2	0	2	4	0	3	0	15
	67	0	0	3	1	1	2	1	1	3	0	7	1	20
	68	3	16	23	3	8	10	11	11	12	2	14	24	137
		98	77	115	103	63	82	80	71	96	69	101	89	1044
	69	14	9	3	6	8	14	5	3	5	7	7	4	85
	70	2	1	0	1	2	3	1	2	1	1	1	1	16
	71	1	0	1	0	1	2	2	0	0	0	1	0	8
	72	0	1	0	1	2	3	0	0	0	1	1	1	10
	73	1	1	0	1	3	2	3	1	2	1	1	2	18
		18	12	4	9	16	24	11	6	8	10	11	8	137
	74	0	0	0	1	0	0	0	0	0	2	0	2	5
	75	0	0	0	0	0	0	0	0	0	1	0	1	2
		0	0	0	1	0	0	0	0	0	3	0	3	7
	76	0	0	0	0	0	0	0	0	1	1	0	2	4
	77	0	0	0	0	0	0	0	0	0	0	0	2	2
		0	0	0	0	0	0	0	0	1	1	0	4	6

Source: Transportation Unit of the City Council of Nairobi

Appendix 4b (Cont.): Causes of road traffic accidents by code in 2006

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2006	78	1	2	0	0	0	0	0	0	0	1	0	1	5
	79	1	1	0	0	0	0	0	0	1	0	0	0	3
	80	0	0	0	0	0	0	0	0	0	0	0	0	0
	81	0	0	0	0	0	0	0	0	0	0	0	0	0
	82	0	0	0	0	0	0	0	0	0	0	0	0	0
	83	0	0	0	0	0	0	0	0	0	0	0	0	0
	84	0	0	0	0	0	0	0	0	0	0	0	0	0
	85	0	0	0	0	0	0	0	0	0	0	0	0	0
	86	0	0	0	0	0	0	0	0	0	0	0	0	0
	87	0	0	0	0	0	0	0	0	0	1	0	0	1
	88	3	1	0	0	0	0	0	1	0	2	1	3	11
	89	5	2	0	2	0	0	1	1	0	2	1	4	18
		10	6	0	2	0	0	1	2	1	6	2	8	38
	90	0	0	0	0	0	0	0	0	0	2	1	2	5
	91	0	0	0	0	0	0	0	0	0	0	0	0	0
	92	0	0	0	0	0	0	0	0	0	0	0	0	0
	93	0	0	0	0	0	0	0	0	0	1	0	1	2
		0	0	0	0	0	0	0	0	0	3	1	3	7
	94	0	0	0	0	0	0	0	0	0	1	2	2	5
	95	0	0	0	0	0	0	0	0	0	0	2	0	2
	96	0	0	0	0	0	0	0	0	0	0	1	1	2
		0	0	0	0	0	0	0	0	0	1	5	3	9
	97	2	8	2	6	7	9	6	5	5	10	11	6	77
	98	3	12	2	8	9	11	5	7	6	14	21	17	115
		5	20	4	14	16	20	11	12	11	24	32	23	192
		260	258	291	264	261	273	255	246	279	311	355	280	3333

Source: Transportation Unit of the City Council of Nairobi

Appendix 4c: Causes of road traffic accidents by code in 2007

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2007	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
	5	0	7	4	3	0	6	4	2	0	0	0	0	26
	6	3	6	7	5	3	5	7	4	0	2	1	0	43
	7	5	12	12	14	12	14	12	9	17	23	22	31	183
	8	4	5	10	8	9	13	10	7	9	4	6	6	91
	9	12	17	13	12	13	14	14	15	0	2	1	0	113
	10	14	14	14	19	9	12	11	8	6	7	9	8	131
	11	9	7	19	6	14	8	9	6	3	2	6	0	89
	12	4	5	6	4	5	7	7	4	0	1	3	0	46
	13	1	2	3	2	4	2	1	1	0	0	3	0	19
	14	2	4	6	7	5	5	2	2	0	2	0	0	35
	15	3	3	2	2	3	4	3	1	1	0	1	3	26
	16	8	2	2	4	4	4	2	2	0	0	0	3	31
	17	7	4	6	3	3	3	4	3	10	11	6	0	60
	18	6	3	7	7	6	6	5	4	0	0	0	0	44
	19	13	6	18	14	15	6	13	6	5	7	6	0	109
	20	4	3	4	4	4	3	3	1	3	9	2	0	40
	21	0	0	0	0	0	1	0	0	0	0	0	0	1
	22	0	2	0	2	0	2	1	1	1	0	1	0	10
	23	0	0	0	0	0	1	0	0	0	0	1	0	2
	24	0	0	0	0	1	0	0	0	0	0	0	0	1
	25	3	4	3	8	8	6	3	2	3	1	0	0	41
	26	5	6	4	12	7	5	10	5	20	22	22	18	136
	27	7	5	7	6	6	6	5	3	2	2	9	0	58
	28	3	3	5	4	5	10	3	8	0	0	0	0	41
	29	6	19	6	13	14	14	6	7	11	16	12	10	134

Source: Transportation Unit of the City Council of Nairobi

Appendix 4c (Cont.): Causes of road traffic accidents by code in 2007

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2007	30	2	1	1	1	2	1	0	1	4	8	3	4	28
	30a	1	1	1	2	1	2	0	2	0	0	0	1	11
	30b	0	0	0	0	0	0	0	0	0	0	0	0	0
	30c	0	1	0	0	0	0	2	0	0	0	0	0	3
		122	142	160	162	153	160	137	104	95	119	114	84	1552
	31	1	0	2	1	1	0	1	1	0	0	0	0	7
	32	1	0	1	2	0	0	0	0	0	0	1	0	5
	33	0	0	2	0	0	0	0	0	0	1	0	0	3
	34	0	0	0	0	0	1	0	0	0	0	0	0	1
	35	0	0	0	0	0	0	0	0	0	0	0	0	0
	36	0	0	3	0	0	1	0	0	4	0	0	0	8
	37	1	0	5	2	3	2	1	0	1	7	4	2	28
	38	0	0	0	0	0	0	0	0	0	2	0	1	3
	39	1	0	2	1	2	2	1	0	3	2	0	1	15
	40	0	0	1	0	0	0	0	0	1	1	0	1	4
	41	0	0	0	0	0	0	0	0	0	0	0	0	0
	42	0	0	0	0	0	0	0	0	0	0	0	0	0
	43	0	0	0	0	0	0	0	0	1	0	0	0	1
	44	0	0	1	0	0	0	0	0	1	0	1	0	3
	45	0	0	1	0	0	0	0	0	0	0	0	0	1
	46	0	0	0	0	0	0	0	0	0	0	2	1	3
	47	0	0	2	0	0	0	0	0	0	1	1	0	4
	48	0	0	0	0	0	0	0	0	1	0	0	0	1
	49	0	0	0	0	0	0	0	0	0	0	0	0	0
	50	0	0	1	0	0	0	0	0	0	0	0	0	1
	51	0	0	0	0	0	0	0		0	0	0	0	0
	52	0	0	0	0	0	0	0	0	1	0	0	0	1
	53	0	0	1	0	0	0	0	0	0	0	0	0	1
	54	0	0	0	0	0	0	0	0	1	0	0	0	1

Source: Transportation Unit of the City Council of Nairobi

Appendix 4c (Cont.): Causes of road traffic accidents by code in 2007

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2007	55	0	0	0	0	0	0	0	0	0	0	0	0	0
	56	0	0	1	0	0	0	0	0	0	0	0	0	1
	57	6	6	23	6	7	7	7	5	0	1	0	0	68
	58	10	11	34	6	8	8	8	6	0	1	0	0	92
		20	17	80	18	21	21	18	12	14	16	9	6	252
	59	6	9	5	4	5	2	6	8	0	0	1	1	47
	60	2	6	1	1	1	1	0	4	6	1	6	1	30
	61	1	3	1	1	0	0	0	1	0	0	1	0	8
	62	1	4	0	2	1	1	0	4	1	0	2	0	16
	63	56	57	1	64	65	65	69	62	81	84	80	82	766
	64	0	0	0	0	1	0	0	0	2	3	2	0	8
	65	0	0	0	2	0	0	0	0	1	0	0	0	3
	66	0	0	0	1	0	1	0	1	2	0	0	0	5
	67	0	2	2	5	2	1	2	3	0	2	1	0	20
	68	14	13	6	25	12	3	9	17	6	11	16	6	138
		80	94	16	105	87	74	86	100	99	101	109	90	1041
	69	16	7	7	17	9	4	6	8	6	16	11	3	110
	70	1	1	2	1	1	1	3	1	2	3	2	2	20
	71	0	1	1	0	0	1	1	0	3	2	1	2	12
	72	2	2	0	1	1	1	2	0	3	1	2	0	15
	73	6	2	1	1	2	2	2	1	4	3	7	0	31
		25	13	11	20	13	9	14	10	18	25	23	7	188
	74	0	0	0	0	0	0	0	0	0	0	0	0	0
	75	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0
	76	2	5	1	5	1	0	3	1	1	1	2	0	22
	77	3	4	0	6	0	0	1	0	0	0	0	1	15
		5	9	1	11	1	0	4	1	1	1	2	1	37
	78	2	0	0	1	0	0	0	0	0	6	2	2	13

Source: Transportation Unit of the City Council of Nairobi

Appendix 4c (Cont.): Causes of road traffic accidents by code in 2007

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2007	79	1	0	0	1	2	0	1	0	0	0	1	0	6
	80	0	0	0	0	0	0	0	0	0	0	0	0	0
	81	0	0	0	0	0	0	0	0	0	0	0	0	0
	82	0	0	0	0	0	0	0	0	0	0	0	0	0
	83	0	0	0	0	0	0	0	0	0	0	0	0	0
	84	0	0	0	0	0	0	0	0	0	0	0	0	0
	85	0	0	0	0	0	0	0	0	0	0	0	0	0
	86	0	0	0	0	0	0	0	0	0	0	0	0	0
	87	0	0	0	0	0	0	0	0	0	0	0	0	0
	88	1	0	1	2	1	1	1	1	1	0	0	0	9
	89	3	0	1	3	5	2	1	1	3	0	0	0	19
		7	0	2	7	8	3	3	2	4	6	3	2	47
	90	1	1	2	1	0	0	1	1	0	0	0	0	7
	91	0	2	0	0	0	0	0	0	0	0	0	0	2
	92	0	1	1	0	0	0	0	0	0	0	0	0	2
	93	1	0	1	1	0	0	0	1	0	0	0	0	4
		2	4	4	2	0	0	1	2	0	0	0	0	15
	94	2	2	2	0	0	0	0	0	0	0	0	0	6
	95	1	1	1	0	0	0	0	0	0	0	0	0	3
	96	1	3	1	0	0	0	0	0	0	0	0	0	5
		4	6	4	0	0	0	0	0	0	0	0	0	14
	97	5	6	7	7	6	3	9	12	1	0	1	1	58
	98	6	7	10	11	8	4	10	16	19	19	11	6	127
		11	13	17	18	14	7	19	28	20	19	12	7	185
		276	298	295	343	297	274	282	259	251	287	272	197	3331

Source: Transportation Unit of the City Council of Nairobi

Appendix 4d: Causes of road traffic accidents by code in 2008

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2008	1	0	0	0	0	0	0							0
	2	0	0	0	0	0	0							0
	3	0	0	0	0	0	0							0
	4	1	0	1	0	0	0							2
	5	0	2	4	1	2	3							12
	6	0	3	3	3	3	2							14
	7	16	8	8	5	13	5							55
	8	0	7	5	9	11	6							38
	9	0	12	9	11	4	9							45
	10	3	9	8	5	5	7							37
	11	3	6	7	4	2	4							26
	12	0	5	5	3	0	2							15
	13	0	0	4	0	1	0							5
	14	0	1	2	0	0	1							4
	15	1	0	1	0	3	1							6
	16	1	2	3	1	2	3							12
	17	4	3	2	1	3	3							16
	18	0	4	2	2	0	2							10
	19	0	8	5	7	8	14							42
	20	1	1	2	0	2	2							8
	21	1	0	1	0	0	0							2
	22	0	0	1	0	4	0							5
	23	0	0	1	0	1	0							2
	24	0	0	1	0	0	1							2
	25	0	2	4	2	0	4							12
	26	18	5	8	3	8	8							50
	27	0	3	2	2	3	6							16
	28	0	4	3	1	0	4							12
	29	7	9	6	3	6	18							49
	30	0	0	2	2	5	0							9

Source: Transportation Unit of the City Council of Nairobi

Appendix 4d (Cont.): Causes of road traffic accidents by code in 2008

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
	30a	1	0	1	2	0	2							6
2008	30b	0	0	0	0	0	0							0
	30c	0	0	0	0	0	0							0
		57	94	101	67	86	107							512
	31	0	0	0	0	0	0							0
	32	0	0	0	0	0	0							0
	33	1	0	0	0	0	0							1
	34	0	0	0	0	0	0							0
	35	0	0	0	0	0	0							0
	36	1	0	0	0	8	0							9
	37	1	1	2	0	2	0							6
	38	1	0	0	0	0	0							1
	39	0	0	0	0	0	0							0
	40	1	0	0	0	0	0							1
	41	0	0	0	0	0	0							0
	42	0	0	0	0	0	0							0
	43	0	0	0	0	1	0							1
	44	0	0	0	0	0	0							0
	45	0	0	0	0	1	0							1
	46	0	0	0	0	0	0							0
	47	0	0	0	0	1	0							1
	48	0	0	0	0	0	0							0
	49	0	0	0	0	1	0							1
	50	0	0	0	0	1	0							1
	51	0	0	0	0	0	0							0
	52	0	0	0	0	1	0							1
	53	0	0	0	0	1	0							1
	54	0	0	0	0	0	0							0
	55	0	0	0	0	0	0							0

Source: Transportation Unit of the City Council of Nairobi

Appendix 4d (Cont.): Causes of road traffic accidents by code in 2008

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2008	56	0	0	0	0	0	0							0
	57	0	3	10	2	1	3							19
	58	0	4	8	2	0	5							19
		5	8	20	4	18	8							63
	59	1	5	4	7	2	6							25
	60	6	1	1	2	1	2							13
	61	0	0	0	0	0	0							0
	62	0	1	1	0	0	2							4
	63	32	59	52	58	52	58							311
	64	1	0	0	0	0	0							1
	65	0	0	0	0	0	0							0
	66	0	1	0	0	0	1							2
	67	0	1	0	3	0	2							6
	68	5	6	6	19	3	9							48
		45	74	64	89	58	80							410
	69	2	6	17	14	8	4							51
	70	0	1	4	2	0	0							7
	71	0	0	0	0	2	0							2
	72	0	1	1	0	0	1							3
	73	1	2	1	0	1	2							7
		3	10	23	16	11	7							70
	74	0	0	0	0	0	0							0
	75	0	0	0	0	0	0							0
		0	0	0	0	0	0							0
	76	0	0	0	1	0	0							1
	77	0	0	0	1	0	0							1
		0	0	0	2	0	0							2
	78	1	0	0	0	1	0							2
	79	1	0	0	0	0	0							1

Source: Transportation Unit of the City Council of Nairobi

Appendix 4d (Cont.): Causes of road traffic accidents by code in 2008

Year	Cause code	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2008	80	0	0	0	0	0	0							0
	81	0	0	0	0	0	0							0
	82	0	0	0	0	0	0							0
	83	0	0	0	0	0	0							0
	84	0	0	0	0	0	0							0
	85	0	0	0	0	0	0							0
	86	0	0	0	0	0	0							0
	87	0	0	0	0	0	0							0
	88	0	0	0	0	0	0							0
	89	0	0	0	0	0	0							0
		2	0	0	0	1	0							3
	90	0	0	0	0	0	2							2
	91	0	0	0	0	0	0							0
	92	0	0	0	0	0	0							0
	93	0	0	0	0	0	0							0
		0	0	0	0	0	2							2
	94	0	1	0	0	0	0							1
	95	0	0	0	0	0	0							0
	96	0	0	0	0	0	0							0
		0	1	0	0	0	0							1
	97	0	5	11	15	1	3							35
	98	12	6	7	14	6	4							49
		12	11	18	29	7	7							84
		124	198	226	207	181	211							1147

Source: Transportation Unit of the City Council of Nairobi

Appendix 4e: Daily accident records for 2006

DAY OF WEEK		JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTALS
MONDAY	1	18	17	12	18	12	16	12	10	19	15	25	18	192
	2	12	15	18	12	10	8	18	18	12	14	18	17	172
	T	**30**	**32**	**30**	**30**	**22**	**24**	**30**	**28**	**31**	**29**	**43**	**35**	364
TUESDAY	1	19	18	15	17	14	14	13	12	24	16	28	24	214
	2	40	16	19	14	12	12	20	20	13	16	20	18	220
	T	**33**	**34**	**34**	**31**	**26**	**26**	**33**	**32**	**37**	**32**	**48**	**42**	408
WEDNESDAY	1	23	23	18	20	18	18	12	11	26	19	35	15	238
	2	13	18	28	19	15	13	17	17	16	19	34	16	225
	T	**36**	**41**	**46**	**39**	**33**	**31**	**29**	**28**	**42**	**38**	**69**	**31**	463
THURSDAY	1	25	16	19	19	19	19	15	9	25	25	31	21	243
	2	15	13	22	18	16	15	19	16	14	17	21	21	207
	T	**40**	**29**	**41**	**37**	**35**	**34**	**34**	**25**	**39**	**42**	**52**	**42**	450
FRIDAY	1	32	28	27	22	26	33	21	18	37	31	37	20	332
	2	19	29	29	28	22	26	28	27	23	28	31	27	317
	T	**51**	**57**	**56**	**50**	**48**	**59**	**49**	**35**	**60**	**59**	**68**	**47**	639
SATURDAY	1	24	22	31	21	28	30	23	26	19	34	31	25	314
	2	17	25	23	21	26	24	23	25	18	26	17	26	271
	T	**41**	**47**	**54**	**42**	**54**	**54**	**46**	**51**	**37**	**60**	**48**	**51**	585
SUNDAY	1	9	8	15	19	29	27	19	11	21	27	16	12	213
	2	20	10	15	16	14	18	15	21	12	24	11	21	197
	T	**29**	**18**	**30**	**35**	**43**	**45**	**34**	**32**	**33**	**51**	**27**	**33**	410
TOTAL		**260**	**258**	**291**	**264**	**261**	**273**	**255**	**231**	**279**	**311**	**355**	**281**	3319

KEY

1: DAY (7.00 A.M. - 7.00 P.M.

2: DAY (7.00 P.M. - 7.00 A.M.

T: TOTAL

Source: Transportation Unit of the City Council of Nairobi

Appendix 4f: Daily accident records for 2007

DAY OF WEEK		JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
MONDAY	1	18	18	20	18	20	19	22	15	16	26	20	15	209
	2	12	12	16	20	16	16	15	12	12	17	18	10	176
	T	**30**	**30**	**36**	**38**	**36**	**35**	**37**	**27**	**28**	**43**	**38**	**25**	**403**
TUESDAY	1	19	20	22	22	23	21	24	16	18	20	21	16	242
	2	14	13	17	22	17	17	16	13	10	17	15	10	181
	T	**33**	**33**	**39**	**44**	**40**	**38**	**40**	**29**	**28**	**37**	**36**	**26**	**423**
WEDNESDAY	1	24	22	26	23	21	22	23	19	19	23	20	10	252
	2	18	15	19	21	18	18	17	21	17	13	19	16	212
	T	**42**	**37**	**45**	**44**	**39**	**40**	**40**	**40**	**36**	**36**	**39**	**26**	**464**
THURSDAY	1	23	21	23	24	26	22	21	20	18	18	28	14	214
	2	17	17	21	24	19	15	15	17	13	10	20	14	202
	T	**40**	**38**	**44**	**48**	**45**	**37**	**36**	**37**	**31**	**28**	**48**	**28**	**460**
FRIDAY	1	34	33	38	36	35	24	33	26	28	32	21	15	355
	2	21	28	32	37	26	28	26	27	17	10	19	16	287
	T	**53**	**61**	**70**	**73**	**61**	**52**	**59**	**53**	**45**	**42**	**40**	**31**	**640**
SATURDAY	1	20	38	28	38	26	22	26	22	22	25	18	20	305
	2	19	30	18	16	22	18	15	22	23	21	16	15	235
	T	**39**	**68**	**46**	**54**	**48**	**40**	**41**	**44**	**45**	**46**	**34**	**35**	**540**
SUNDAY	1	19	22	12	30	15	20	18	16	20	27	25	14	238
	2	18	16	3	12	13	12	11	13	18	10	20	13	159
	T	**37**	**38**	**15**	**42**	**28**	**32**	**29**	**29**	**38**	**37**	**45**	**27**	**397**
TOTAL		**274**	**305**	**295**	**343**	**297**	**274**	**282**	**259**	**251**	**269**	**280**	**198**	**3327**

Source: Transportation Unit of the City Council of Nairobi

KEY

1: DAY (7.00 A.M. - 7.00 P.M.

2: DAY (7.00 P.M. - 7.00 A.M.

T: TOTAL

Appendix 4g: Daily accident records for 2008

DAY OF WEEK		JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
MONDAY	1	13	12	11	12	12	16							76
	2	6	8	9	10	6	10							49
	T	**19**	**20**	**20**	**22**	**18**	**26**	**0**	**0**	**0**	**0**	**0**	**0**	**125**
TUESDAY	1	6	14	15	14	12	15							76
	2	5	9	11	12	6	11							54
	T	**11**	**23**	**26**	**26**	**18**	**26**	**0**	**0**	**0**	**0**	**0**	**0**	**130**
WEDNESDAY	1	13	11	16	16	12	18							86
	2	7	10	18	11	10	12							68
	T	**20**	**21**	**34**	**27**	**22**	**30**	**0**	**0**	**0**	**0**	**0**	**0**	**154**
THURSDAY	1	12	15	18	13	15	19							92
	2	6	12	14	10	11	9							62
	T	**18**	**27**	**32**	**23**	**26**	**28**	**0**	**0**	**0**	**0**	**0**	**0**	**154**
FRIDAY	1	7	18	21	22	28	22							118
	2	8	16	23	28	15	17							107
	T	**15**	**34**	**44**	**50**	**43**	**39**	**0**	**0**	**0**	**0**	**0**	**0**	**225**
SATURDAY	1	10	23	24	19	27	20							123
	2	10	21	19	18	9	18							95
	T	**20**	**44**	**43**	**37**	**36**	**38**	**0**	**0**	**0**	**0**	**0**	**0**	**218**
SUNDAY	1	10	21	16	13	11	14							85
	2	10	8	11	9	7	12							57
	T	**20**	**29**	**27**	**22**	**18**	**26**	**0**	**0**	**0**	**0**	**0**	**0**	**142**
TOTAL		**123**	**198**	**226**	**207**	**181**	**213**	**0**	**0**	**0**	**0**	**0**	**0**	**1148**

Source: Transportation Unit of the City Council of Nairobi

KEY

1: DAY (7.00 A.M. - 7.00 P.M.

2: DAY (7.00 P.M. - 7.00 A.M.

T: TOTAL

Appendix 4h: Class of persons killed or injured in road traffic accidents per month in 2006

CLASS OF PERSONS		JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	TOTALS
DRIVERS	F	4	3	1	3	3	4	2	6	4	3	4	4	41
	S	8	8	12	11	11	10	8	13	14	16	8	9	128
	SL	12	32	20	17	23	16	14	21	26	8	12	24	225
MOTORCYCLISTS	F	2	0	2	1	0	0	0	0	1	2	0	0	8
	S	4	3	2	4	4	1	3	2	8	5	5	3	44
	SL	5	11	10	5	6	10	5	1	7	6	2	2	70
PEDAL CYCLISTS	F	3	0	4	2	6	2	2	3	2	3	2	5	34
	S	33	4	21	37	7	36	33	74	39	67	66	23	440
	SL	62	62	125	79	115	117	88	138	107	118	167	77	1255
PASSENGERS	F	5	3	6	4	4	6	12	12	9	14	6	6	87
	S	5	28	6	8	7	3	5	4	12	8	6	9	101
	SL	6	20	12	9	14	5	9	9	14	9	4	18	129
PEDESTRIANS	F	19	36	34	56	35	29	37	35	36	29	47	46	439
	S	50	34	51	49	52	39	59	54	59	67	69	71	654
	SL	110	74	93	66	72	73	71	60	92	103	100	70	984
TOTAL	F	33	42	47	66	48	41	53	56	52	51	56	61	606
	S	100	77	92	109	81	89	108	147	132	163	154	115	1367
	SL													

KEY:- F = FATAL S = SERIOUS SL = SLIGHT

Source: Transportation Unit of the City Council of Nairobi

Appendix 4i: Class of persons killed or injured in road traffic accidents per month in 2007

CLASS OF PERSONS		JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	TOTALS
DRIVERS	F	2	2	4	3	1	7	6	5	7	5	6	6	54
	S	7	4	8	11	9	9	8	11	8	20	9	6	110
	SL	29	21	16	27	29	22	18	18	11	8	18	16	233
MOTORCYCLISTS	F	1	1	1	1	0	1	2	1	0	2	2	2	14
	S	5	3	4	3	5	3	6	1	0	5	7	3	45
	SL	11	8	6	5	6	4	22	9	3	1	3	8	86
PEDAL CYCLISTS	F	2	2	2	4	1	1	4	0	4	8	4	4	36
	S	4	2	7	9	12	12	11	6	4	5	5	5	82
	SL	8	17	13	12	17	39	31	7	6	6	10	14	180
PASSENGERS	F	6	3	6	8	2	6	3	20	3	6	6	5	74
	S	48	47	61	37	48	17	37	30	28	30	41	60	484
	SL	117	92	196	127	103	141	137	114	122	100	94	110	1453
PEDESTRIANS	F	32	36	30	37	43	40	45	40	36	27	36	32	434
	S	49	71	50	59	52	58	32	65	52	73	50	45	656
	SL	97	95	156	117	102	87	103	69	40	100	81	52	1099
TOTAL	F	43	44	43	53	47	55	60	66	50	48	54	49	612
	S	113	127	130	119	126	99	94	113	92	133	112	119	1377
	SL	262	233	387	288	257	293	311	217	182	396	206	200	3232
TOTAL CASUALTIES		418	404	560	460	430	447	465	396	324	577	372	368	5221

KEY F = FATAL; S = SERIOUS; SL = SLIGHT

Source: Transportation Unit of the City Council of Nairobi

Appendix 4j: Class of persons killed or injured in road traffic accidents per month in 2008

CLASS OF PERSONS		JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	TOTALS
DRIVERS	F	4	4	4	5	4	6	-	-	-	-	-	-	27
	S	11	6	13	6	11	7	-	-	-	-	-	-	54
	SL	6	18	18	19	12	10	-	-	-	-	-	-	83
MOTORCYCLISTS	F	1	1	1	0	1	1	-	-	-	-	-	-	5
	S	2	1	6	3	1	1	-	-	-	-	-	-	14
	SL	0	3	9	6	2	2	-	-	-	-	-	-	22
PASSENGERS	F	2	9	8	10	15	4	-	-	-	-	-	-	48
	S	31	26	37	39	51	33	-	-	-	-	-	-	217
	SL	85	65	69	37	76	81	-	-	-	-	-	-	413
PEDAL CYCLISTS	F	1	2	3	2	4	5	-	-	-	-	-	-	17
	S	0	4	5	5	4	7	-	-	-	-	-	-	25
	SL	14	5	4	8	4	10	-	-	-	-	-	-	45
PEDESTRIANS	F	26	34	28	36	27	41	-	-	-	-	-	-	192
	S	33	49	60	89	35	49	-	-	-	-	-	-	315
	SL	20	45	72	88	64	43	-	-	-	-	-	-	332
TOTAL	F	34	50	44	53	51	57	0	0	0	0	0	0	289
	S	77	86	121	142	102	97	0	0	0	0	0	0	625
	SL	125	136	172	158	158	146	0	0	0	0	0	0	895
TOTAL CASUALTIES		236	272	337	353	311	300	0	0	0	0	0	0	1809

KEY:- F = FATAL S = SERIOUS INJURY SL = SLIGHT INJURY

Source: Transportation Unit of the City Council of Nairobi