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COMPARATIVE STUDY OF SAFETY OF TAXI AND TROTRO IN THE KUMASI METROPOLITAN AREA

BY

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DECLARATION

I hereby declare that this submission is my own work towards the MSc and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the university, except where due acknowledgement has been made in the text.

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ABSTRACT

Trotros and taxis are vital modes of public transportation as they help address the mobility needs of transportation-disadvantaged groups in Ghana. There have been perceived safety concerns related to public transportation in terms of road crashes in the Kumasi Metropolis. This study analysed and evaluated comparatively the safety of the use of trotros and taxis for public transportation. To realise the aims of this study,

information was elicited from operators and passengers of the two modes using questionnaires. In addition, road traffic crash data was obtained for the study area and analysed. General field observation was used to obtain additional inputs on selected roads within the metropolis. The study established that both trotros and taxis are the major modes of public transportation in the metropolis. In terms of safety, there are similarities in trends for both modes for all accident categories, except for fatalities which showed a significantly increasing trend for trotros compared to that of taxis. Most of the safety issues associated with the two modes were partly due to traffic management and partly due to inadequate infrastructure. It is concluded that despite the similarities in operations, traffic conditions, routing, and accident trends and types, taxis as a mode of public transportation in the metropolis are generally safer compared to trotros.

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CHAPTER 1: INTRODUCTION

1.1 Background

Public transportation is an integral part of national development. When cities expand, due to growth in economy, public transportation provides necessary access and mobility to citizens. The composition of public transportation in Ghana is mainly trotro and taxis. These modes identify with lower income earners for their commercial interactions and private purposes. A significant number of Ghanaians fall into this category and this makes public transportation (trotro and taxis) a vital component of the national economy. When public transportation is properly managed and made attractive, some aspects of safety and congestion concerns can be greatly reduced. However public transport faces severe problems in almost all countries of the developing world, although the situation varies from one country to another (Pucher et al, 2004).

The rapid growth of Ghana's urban population coupled with the collapse of the rail network has put enormous strains on the other urban transport systems. Problems such as road traffic accidents, congestion, noise, air pollution (carbon and toxic gas emissions) among others are prevalent. There is concern that in developing countries, very little attention is given to these critical problems in public transportation.

1.2 Overview of Public Transportation in Ghana

When economic activities increase or when there is population growth such as communities expanding into cities, household settings and activities change. This causes people to make more trips. In the past few decades, such changes have been so rapid that development of public transportation seems to always lag behind. It is therefore, imperative for government to invest in the transport industry for people to get safe, reliable, accessible and comfortable means of moving about.

Public transport is a shared passenger transport service which is available for use by the general public and may be provided by one or more private transport operators or by the government. In Ghana, the modern public transportation system dates as far back as 1898 when the first rail line was constructed from Takoradi to Tarkwa mainly for the commercial exploitation of gold and timber; movement of people became a by-product as a result. In 1927, the Accra Town Council operated bus services in Accra. Governments over the years have established bus service companies such as the Omnibus Services Authority (OSA), State Transport Company (STC), City Express Services (CES), and lately Metro Mass Transit (MMT) Limited. These were introduced for various reasons including government"s social obligations, environmental factors, energy considerations and the promotion of efficient public transportation to increase productivity and economic growth (Yobo, 2013).

The problems associated with public transportation are enormous and mostly observed in developing countries such as Ghana. A glimpse of the national outlook suggests that there is rapid demographic and economic growth, and since successful growth is linked to improved mobility of people, the transportation industry must develop at equal pace, else a substantial level of anxiety and discomfort among commuters will be created. The emergence of commercial motorcycle transport gives an indication of inadequate public transport services. Road transport services provided by operators in both the formal and informal sectors have been characterized by very harsh uncertainty factors which have contributed to the low levels of transport services in the industry. Prominent among the uncertainty factors are

- Reliability
- Safety

- Regulations
- Environmental and economic factors

Observably, there is limited regulatory/institutional effectiveness and lack of a clear and comprehensive policy on public transport. Vehicle operators are subjected to minimal regulations in terms of the authority to operate as commercial vehicles, area of coverage, safety standards of operation, maintenance of vehicles and related emissions and following any regular schedule.

This situation has led to freedom to enter the sector and the liberty to leave at will. According to the Ministry of Transport, the urban public transportation is now dominated by the informal private sector which provides about 95% of transport services but their services are generally unreliable, uncomfortable and unsafe (Wilson, 2006).

Finance is a limiting factor due to the huge capital outlay for public transport operations. The operations are mainly foreign exchange driven; vehicle spare parts, maintenance equipment, tyres and fuel all need to be imported. In spite of the fact that managers of public transport fail to incorporate asset replacement policies and programs in their corporate plans, gains recorded in their operations which could be used to finance asset replacement programs are eroded in no time by inflation and other negative features present in the economy.

The sustenance and growing concern of public transport is, therefore, disturbing to the extent that to replace vehicles, especially at the end of their useful lives becomes very difficult. The vehicles get older, cost of operations and maintenance soar up, eventually either the safety of the vehicle is compromised or its operations grind to a halt.

1.3 Road Safety Challenges

Road safety is a major problem, as motor accident rates recorded year on year basis are rising and often resulting in loss of life, severe injuries inflicted on victims and substantial damage to property, as well as lost time and effort of road regulation authorities. According to the National Road Safety Commission Annual Report for 2011, during the 7-year period from 2002 to 2008, the number of people killed on Ghana‟s roads averaged 1,840 annually. In a country where so many options are not available for transporting goods and people, road travel becomes the only available option. Patrons of the road transport must adjust to the uncomfortable probability of a fatality situation.

The National Road Safety Commission has indicated that, despite huge investments in road safety by way of education and publicity, motor accidents constitute a real menace to transportation. It is estimated that road traffic crashes costs Ghana about 1.6 % of her GDP (US$ 165 million in 2006). Available statistics point to rising absolute fatalities (NRSC, 2011). The existing scenario suggests the current rising trends in population growth and vehicle ownership could lead to further increases in the number of road traffic crashes if serious efforts are not made to reverse the upward trend.

This research focused on the safety aspect of urban public transportation particularly taxis and trotros, since road traffic accidents cause significant damage to national progress in terms of fatalities, damage and loss of property. It is important to put the issues into an engineering perspective, where specific safety concerns are examined in detail and a suitable solution developed to address the problem.

1.4 Trotros and Taxis in Ghana

Minivans operating in the public transportation business called trotros in Ghana are peculiar to third world countries and provide a vital public service by transporting up to twenty passengers around the city and countryside. The trotro system works around a tenet central to Ghanaian society: waiting for fully loaded vehicle before setting off. There is no scheduling, no map outlining routes and no advance tickets sold. One just has to wait at the side of the road to board them. Geared toward the needs of the masses, trotros are privately owned and operated. Trotro is often operated by both a driver and a conductor called a mate (who collects money, shouts out the destination). The mate will hit the roof and side of the van to attract passengers and notify the driver when to stop or leave a bus stop. Used by almost 70% of Ghanaian commuters, trotros are the most popular form of transport for work and shopping in the country as of 2010. In Ghana, trotros are licensed by the government, but the industry is arguably self-regulated. In the absence of a government controlled and regulatory frame, groupings called syndicates oversee the operations of the trotros. These groups may collect dues, set routes, manage terminals, and fix fares. Such syndicates include GPRTU and PROTOA (Blaustein, 2010).

In Ghana, taxis typically operate in a shared mode although use by a single passenger or a small group of passengers is also possible. Trotros and taxis operate along specific routes with pick-up and drop-off locations being determined by the service provider, not by the passenger, although demand responsive transport and shared taxis provide a hybrid.

1.5 Problem Statement

In the developed countries, analyses are frequently made to determine what role vehicle safety improvements play in the historically low fatality and injury rates. Concern therefore arises because in a developing country such as Ghana, it is very rare to see new vehicles being used in urban public transportation and hence unlikely to benefit in the immediate future from the vehicle safety improvements. Efficient safety analysis of the current fleet becomes inevitable if any safety standards are to be met.

There also exist the perception of disconnect between the safety issues on roads, regulations and the improvements required to deal with the problems. Government policy generally tends to concentrate efforts on the concerns of road congestion and accessibility. There are several reasons why road safety is not treated in a proactive manner but rather reactively. One of such is the lack of available data and analysis for evaluating the safety and comprehensive analysis of urban public transportation.

In confronting these issues in a holistic manner, researches are conducted and various recommendations implemented, monitored and evaluated to ascertain if there is an improvement in the initial condition. Unfortunately, the main modes of public transportation (trotros and taxis) in the country have been the subjects of little published research and despite their significance within modern society there is very little literature available. Research into the safety of public transportation is scanty and mostly generalized; this makes it difficult in finding specific engineering solution to the problems. One way of attempting to compensate for these problems is to limit the scope of this research to the essential groups of public transportation of which trotro and taxis are the most popular.

It becomes vital to focus research on the safety of the popular modes of public transportation to ascertain its specific effects on public transportation and serve as a bench mark to evaluate new modes and guide any eventual introduction into the transportation system.

With the sprawling residential development and economic growth in urban areas, public transportation activities will necessarily increase and become diversified with time. Care must be taken because there are enormous losses when road traffic accidents occur as all sorts of transportation modes are introduced unto the network.

These can be enumerated as

- The trauma of death after losing a relative
- Damage to property and injuries
- The loss of productive capacity
- Resources for investigations by the police and insurance companies.

This implies much work must be done in understanding the causes of motor vehicle accidents in urban public transportation, and in developing possible preventative measures that would avoid or minimize accidents.

It becomes so important therefore to investigate the safety trend and its implications, analyse the data collected to aid a better perspective and a regulatory framework on the issue of safety in urban public transport systems.

1.6 Aims and Research Objectives

The overall aim of the research was to gain understanding into the factors that cause concern of the safety of urban public transportation (trotros and taxis), the severity within the vehicle population. A comparative study will be done to ascertain the safest

mode among the two modes for urban public transportation. This research examines a broad range of issues, such as

- The composition of traffic (taxi and trotro)
- Accident statistics, Severity estimation of frequency for both trotro and taxis

The specific objectives were;

1. To examine comparatively, the relationship between accident severity (fatalities and hospitalised crash cases, for the two modes of public transport.
2. To examine comparatively, the locations where frequent crashes occur within the Kumasi Metropolis for both modes of public transport.
3. To examine comparatively the license status of public transportation drivers involved in accidents.
4. To explore any other systematic patterns that may exist, and examine correlations or the interactions between the above variables that impinge on road safety.

1.7 Justification for the Study

There exist a relationship between economic development and easy access and commuting by people. Public transportation plays a crucial role in this respect. They contribute immensely to the day to day operations of commercial and private activities. Therefore studies into the safety of urban public transportation is not just valuable because of its possible benefits to the socio economic functions of the country, but also valuable in its own right in road safety research efforts of the country . The study will provide a basis for evaluating the safety aspects with the aim to reduce the problems that have direct engineering solutions. This will contribute to the larger effort of

reducing the risk of fatalities and will aid in advancing the country toward a desirable, safe and sustainable public transportation system.

1.8 Scope of Study

The study was conducted in the Kumasi metropolitan area. Data was collected based on the major arterial roads. The research was limited to quantitative assessment of road crashes for public transport modes. This excluded the other informal public transportation means such as motor cycles and motorized tricycles (aboboyaa). This study routes are shown in Figure 1.1. The routes marked red indicates the sampled study routes where manual traffic count was done.

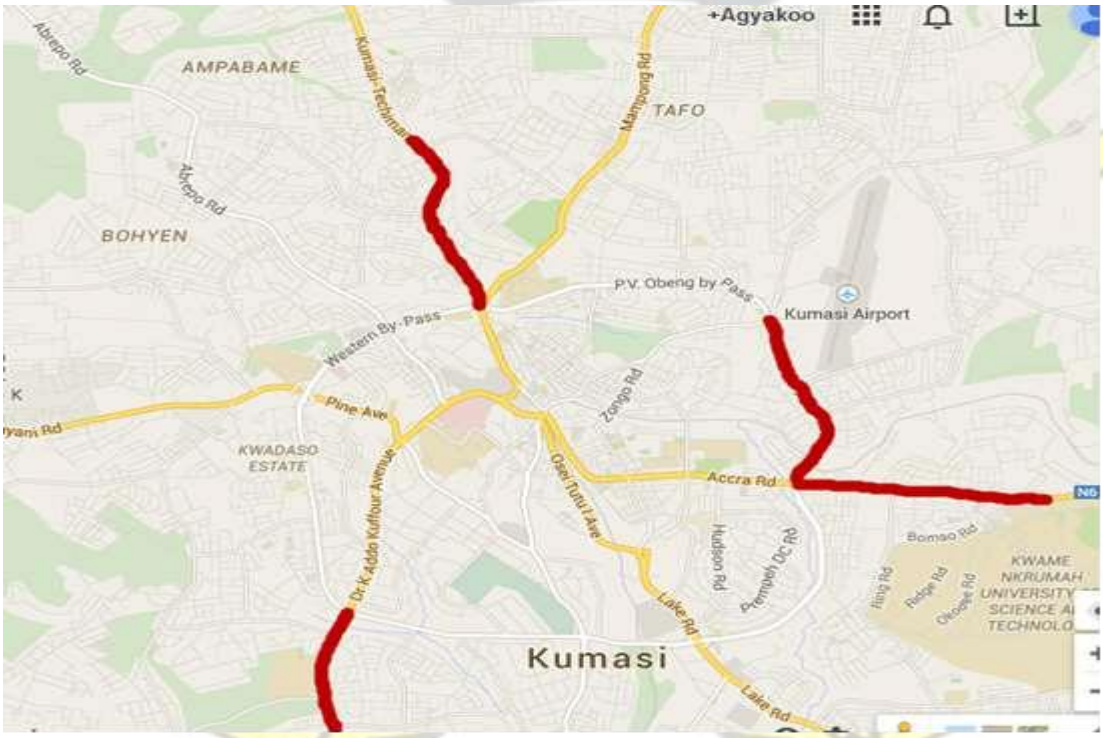

Figure 1.1 Route of Manual Traffic Count Shown Red

Source: Google Earth Map 2011

This research only focused on trotro and taxi operators who have been involved in road traffic accident and those who had not been involved in road traffic accident in

Kumasi Metropolitan Area.

The research specifically looked at the accident statistics and trend to examine if any, the significant disparities between the two modes. The research also aimed to find out the peculiar challenges faced by passengers in terms of the safety of public transport as they traverse the metropolis.

The research looked at the frequency and trends of road traffic accidents Kumasi. It analysed the rate of fatalities and injuries caused by trotros and in the last study period years in Kumasi. Using the health standardized classification; the accidents were classified into Fatalities, Hospitalised cases and Property Damages.

CHAPTER 2: LITERATURE REVIEW

2.1 Accident Overview

An accident is a rare random multifactor event always preceded by a situation in which one or more road users have failed to cope with their environment (ROSPA 1992). It usually implies a generally negative outcome which may have been avoided or prevented had circumstances leading up to the accident been recognized, and acted upon, prior to its occurrence. About 1.25 million people die each year as a result of road traffic crashes, road traffic injuries are the leading cause of death among young people, aged 15–29 years and 90% of the world's fatalities on the roads occur in low- and middle-income countries, even though these countries have approximately half of the world's vehicles (WHO, 2011).

2.2 Classification of Accident

DFID (2005) has defined accident according to severity as follows:

- A fatal accident is one in which one or more persons are killed as a result of the accident, provided death occurs within 30 days;
- A serious accident is one in which there is no deaths but one or more persons are seriously injured i.e. usually detained in hospital as an in-patient;
- A slight accident is an accident in which there are no deaths or serious injuries but a person sustains an injury of a minor character such as a cut, sprain or bruise or receives outpatient treatment;
- Damage-only accident is one in which no one is injured but damage to vehicles and/or property is sustained.

Accident severity is defined by the most serious casualty class of any of the victims of the incident. The road accidents are normally „costed" by the class of the accident. Thus the „cost of an accident" is not the same as the „cost of casualties" resulting from that accident (DFID, 2005).

2.3 Road Accident Data Systems

2.3.1 Accident Database

An accident database is needed for accurate assessment of the road safety situation for every country. In order to be useful, the data need to cover more than deaths and should include data on casualties and the circumstances of the accident. This will help organisations that are able to contribute to safety improvement to devise and implement appropriate measures designed to combat specific problems. It will also allow the situation to be monitored to know whether or not the interventions are working. The main processes involved in producing an accident database include the following:

- Accident reporting and recording system
- Storage and retrieval system
- Analysis system
- Dissemination system

It becomes necessary therefore to ensure that the data is utilised as effectively and widely as possible. Police annual accident statistic reports should be circulated widely and national decision makers should use the data. They should also be made readily accessible to relevant organisations for analysis, comparative studies to aid the design of appropriate countermeasures, produce plans, monitor effectiveness, and carry out further research (ADB, 1998).

2.3.2 Road accident data systems in developing countries

Annual statistical reports are typically produced in developing countries, and while these contain useful background information, they often do not contain sufficient details for the identification of hazardous locations or detailed accident analysis (TRL, 1991). The most important source of data for diagnosing the crash road problem is the police road crash report. In the early 1970's, a survey of road crash information systems used in developing countries (Jacobs et al, 1975) indicated that only 15% of the countries had adequate crash report forms, and none had computer analysis facilities. However, most countries at the moment have a road accident recording system, invariably based on some form of legal obligation to report accidents, especially those involving fatalities or serious injuries, to the police. The police then complete an accident report. The amount of detail, the accuracy of reporting, the percentage of accidents recorded and their availability to non-police users varies enormously from country to country. However, police records may be subject to errors and omissions. In order to improve their crash investigation and research capability in developing countries, TRL developed its Microcomputer Accident Analysis Package (MAAP), which is now used in over 50 countries. MAAP consists of two key components: a police report booklet or form with a recommended structure, and a set of software programs for data entry and analysis (TRL, 2001)

2.4 Road Safety Surveys

Police records of road accidents are the primary source of information on road safety. Traffic police are also the most ideally placed officers to record and manage accident data. Police do, however, need to be motivated and convinced of the usefulness of devoting the considerable effort required to collect this data (Salifu and Ackaah, 2012).

They also need to have adequate resources in terms of staffing, training, and computer systems. The data collected for all recorded accidents need to answer the following questions:

- Where the accident occurred?
- When the accident occurred?
- Who and what vehicles were involved?
- What was the result of the collision?
- What were the prevailing environmental conditions?
- How did the collision occur?

Also road safety audits of locations and routes may also be used to identify potential road hazards (and the need for remedial measures), but require this requires specialist knowledge (IHT, 1990).

2.5 Road Traffic Crashes

2.5.1 Global Situation

In 1998, for less developed countries, road traffic crashes were the most significant cause of injuries, ranking eleventh among the most important causes of lost years of healthy life. According to a World Health Organization (WHO) & World Bank report on "The Global Burden of Disease" (1999), deaths from non-communicable disease is expected to climb from 28.1 million a year in 1990 to 49.7 million by 2020 (an increase in absolute numbers of 77%). Road traffic crashes will contribute significantly to this rise. Also, the estimation of disease burden is expected to move from ninth place to the third place in the rank order of by the year 2020 given in Table

2.1.

Table 2.1 Projected Rank of Road Traffic Crashes from 1990 to 2020

1990			2020
Lower Respiratory Infections	1	1	Ischaemic heart
Diarrhoea	2	2	Unipopular Major Depression
Perinatal	3	3	Road Traffic Crashes
Unipopular Major Depression	4	4	Cerebrovascular
Ischaemic heart	5	5	Pulmonary
Cerebrovascular	6	6	Lower Respiratory Infections
Tuberculosis	7	7	Tuberculosis
Measels	8	8	War
Road Traffic Crashes	9	9	Diarrhoea
Congenital Anomalies	10	10	HIV

Source: www grsproadsafety.org

In assessing the magnitude of the problem of road traffic crashes, according to the World Health Organization, 1.3 million people die through road traffic crashes annually. On the average, in the industrialized countries, and also in many developing countries, one out of every ten hospital beds is occupied by a road traffic crash accident victim (WHO, 1999). A reason why Road Traffic accidents (RTAs) have been neglected in developing countries as given by Jacob (1973) is that RTA rates have been considered to be low in comparison with countries in Europe and North America. Jacob and Hutchinson carried out an analysis for 32 developing countries for which 1968 figures were available. The number of vehicles per 10,000 persons and the number of fatalities per 10000 vehicles were calculated and compared. In order to develop a linear relationship the logarithmic values or the fatality rates were regressed against the logarithmic values of the vehicle ownership rates and the following equations developed:

F/P=V/P

F= Road fatalities

V= Number of vehicles

P= Population

Jacob and Hutchinson (1973) concluded that it is possible that improvement in the safety of the road system, the vehicle and the road-use are not taking place as rapidly in the developing countries as in the more developed. If this continues, the accident situation is likely to become very serious indeed in the developing world particularly in situations of rapid motorization.

2.5.2 Road Traffic Accidents in Developed Countries

In the United States, Motor Vehicle Accidents (MVAs) are the leading cause of injury and death. Americans collectively drive almost 3trillion miles per year and 3million people were injured or killed in 2002. The National Highway Transportation Safety Administration (NHTSA) compiles statistics regarding MVAs and some of the results are alarming in 2001.

- 3 million people were injured in MVAs
- 413,000 died in MVAs
- 40% of the fatalities were alcohol related
- 2600 children under the age of 15 were killed in MVA
- 7500 young drivers (16-20) were involved in fatal crashes
- 3000 motor cyclists were killed
- 4700 pedestrians were killed
- Improper use of seat belts accounted for 63 percent of the fatalities.

Murray and Lopez (1997) observed that the number of RTAs and the number of fatalities have followed a similar pattern in most industrialized countries.

2.5.3 Road Traffic Accidents in Developing Countries

For the developing countries, Blanchard and Hickling (1997) observed that death rates are very often 20 times greater than those of Western Europe or N. America.

For the period 1978-1980, for 35 developing countries he found a negative correlation between fatalities per vehicle and the number of vehicles per head of population, showing that the smaller the number of vehicles relative to the population, the worse the death rate relative to those vehicles.

In the same light, death by MVAs is one of the highest causes of death after Malaria, a disease common in Tropical Africa and one which international bodies are spending millions in resolving.

In lower income countries, the high proportion of pedestrians among road fatalities is due to a variety of factors including the traffic mix on road and the lack of pedestrian facilities in road design (Nantulya, 2001)

2.6 Road Traffic Accidents in Ghana

Public transportation has improved people‟s access to trade, healthcare and other societal benefits, however some negative consequences also prevail, such as road traffic accidents and spread of diseases. The large increase in road traffic has a huge consequence on the growth of crash deaths and injuries. In Ghana, that number grew from 920 killed in traffic in 1991 to 2,237 in 2009. Twenty-five percent of the people killed in 1994-1998 were children up to 15 years old. While accidents involving children are rather few in high-income countries, they account for about 96 % of all traffic fatalities globally (Lund & Rundmo, 2008). The killing of pedestrians happened mainly in larger towns, but deaths caused by bus and minibus crashes were more rural with 82% (Afukaar et al, 2003).

2.6.1 Major Causes of Fatal Road Traffic Accidents in Ghana

Not surprisingly is that the most common accident in Ghana is caused by minibuses, which make up a large part of the transportation in Ghana. Thirty-four percent of all accidents recorded are caused by drivers in minibuses. Number two on the list are pedestrians with a share of 29% of all accidents, although they are hurt more seriously (46% deaths compared to 21% of bus passengers) (Afukaar et al, 2003)

Often an accident has several explanations. The driver can have visual acuteness (a study of truck drivers in Cape Coast showed that 12 of a group of commercial drivers did not have the minimum visual acuity required for driving while 7% had visual impairment, (Ovenseri-Ogbomo, 2011). There are statistics that addresses the distribution of fatal crashes by driver errors when the most indicated single error to fatalities was the "loss of control." More than 30% of the fatalities were caused by this. Number two and three on the list were "too fast" (24%) and "inattentive" (20%). In total, inattentive drivers driving too fast and losing control can account for 75% of the accidents (Ackaah & Adonteng, 2011).

Moreover, the road can be in bad shape with potholes and sharp/ steep bends. Drivers will drive fast, even in town; his speedometer may also not function. The inspection requirement for vehicle safety is very seldom and those existing do not work in practice. There are no police at accidents far from the big towns (Chen, 2010).

Safety seat belts are generally not functioning in Ghana except smaller cars, and those are seldom used. A study from Kumasi shows that only 18% of the drivers used a seat belt and only 5% of the front right passengers. Those numbers are remarkable because there is a national seat-belt law for both front and rear occupants (Afukaar et al,

2010). World Health Organization estimated the effectiveness of seat-belt law enforcement to be 3 on a scale from 0-10 with 20 as best (WHO, 2013).

2.6.2 Accident Statistics in Ghana

Statistics are important for many reasons. They can monitor the effect of new prevention policies; identify hot spots and similar places for an effective intervention and help advocate for allocation of appropriate resources (Lagarde, 2007). There are also some statistics which are not reliable (e.g. the numbers of registered vehicles when there are no deductions of scrapped vehicles and no indications of them being removed from national records).

The history of the statistics for traffic accidents seriously began in 1989 when Ghana joined the National Road Safety Program, headquartered in Accra, and with the Road Research Institute (BRRI) in Kumasi that became responsible for the accident statistics. The first step with the statistics was an extensive training for police officers to make accident reports. Accidents were entered into a central computer using a program popular in 25 other low-income countries. In Ghana, the BRRI staff collected data from each of the 10 regions. The limited economy gave some problems from 1992.

2.6.3 Challenges of Accident Statistics

Statistics are very important in monitoring development, but only through reliable data can political involvement be judged and better initiatives be taken if necessary (Ackaah and Adonteng, 2011). One survey documented that in the 1990s most of the deaths in Kumasi were not registered in official files. Only 70 injury deaths per year were reported from a town with more than 1 million inhabitants. There were subsequent initiatives to correct the faults to get a more reliable statistic. A few years later the number of cases became higher than 600 (Adofo et al., 2010). Ackaah and

Adonteng have estimated the underreporting and non-reporting of accidents. They found that the level of missing accidents should be 37% for fatal casualties, 120% for serious accidents and 199% for slight accidents.

Accident data in Ghana suffers from two main challenges;

- Under reporting
- Under recording.

Under reporting occurs when some of the accidents are not detected or reported to the local police in charge of recording the event.

Under recording occurs when some of the reported accidents are not recorded in the database of the local police. Sometimes very scanty information is available on a recorded accident such that no meaning can be made out of it, or the docket cannot be traced.

According to Salifu and Ackaah, estimates of the shortfalls in road traffic crash data is an important prerequisite for setting more realistic targets for crash/casualty reduction programmes and for a better appreciation of the socio-economic significance of road traffic crashes. Their study was carried out to obtain a realistic estimate of the overall shortfall (under-reporting) in the official crash statistics in Ghana over an eight-year period (1997–2004). They conducted Surveys at major hospitals and among drivers to generate relevant alternative data which were then matched against records in police crash data files and the official database. The entire nation was divided into three regional belts. With these geographical divisions, they selected focal locations (i.e. towns, cities) for the field data to collection. They selected Tamale to represent the

northern belt; Kumasi represented the middle belt while Accra, Tema, Sekondi/Takoradi, Nkawkaw and Koforidua represented the southern belt.

They confirmed that the overall shortfalls came from two sources, namely, „nonreporting" and „under-recording". Their results however showed that the level of non-reporting varied significantly with the severity of the crash from about 57% for property damage crashes through 8% for serious injury crashes to 0% for fatal crashes. They also found that crashes involving cyclists and motorcyclists were also substantially non-reported. Under-recording on the other hand declined significantly over the period from an average of 37% in 1997–1998 to 27% in 2003–2004.

Thus, they concluded that the official statistics of road traffic crashes in Ghana are subject to significant shortfalls that need to be accounted for. They therefore suggested that correction factors must be applied to adjust the official data (Salifu & Ackaah 2012).

2.6.4 Road Safety Fatalities and Injuries Trend in Ghana

Reporting of road fatalities and injuries are mostly done by the local dailies and news media. They provide coverage of RTA"s fatalities and injuries of a large scale due to its sensational nature and newsworthiness. These reports are not necessarily to highlight the problems and necessitate interventions. Other times regional or national road safety commission officials popularize the problem through the news media or local public forums, when commenting on end of year RTA data (Coleman, 2013).

The head of the Ghana national road safety commission, in analyzing national RTA trend in Ghana from 2000-2012 at a public forum, is quoted as saying RTA

fatalities in Ghana is worse compared to death from diseases in that period. This is the perception of Ghana 2000-2012 RTA trend and impact (Hazen et al, 2006).

Averagely, 1,800 lives are lost in Ghana annually through road crashes with 14,000 injuries from an average of 11,000 road traffic crashes; road traffic crashes cost the nation 1.6% of GDP which translates to US$ 288 MILLION (in 2009); 42% of these crash victims are pedestrians; 60% of all crash victims are people within the productive age group (NRSC, 2010). The above statistics are worrying and also implies the indirect destruction of the nation‟s human assets, as well as economic retrogression.

2.7 Vehicle Population and Enforcement of Traffic Regulations

The growth in motor vehicles that accompanies economic growth usually brings increased road traffic congestion. Over the years, vehicle population continues to impose a major infrastructural challenge to Ghana. It as well presents a huge challenge to road safety intervention and management. Whereas this is worrying, the increasing fatalities, coupled with ineffective enforcement of road traffic regulations have completely overwhelmed road safety authorities, Zaato (2012).

Politically, governments in developing countries including Ghana area required to provide the legislative backing and direction, towards prevention and control of road traffic accidents (RTA). In Ghana the mandate to investigate road traffic accidents falls wholly on the Ghana Police Service. They are the personnel charged with the responsibility of establishing the cause of any RTA and prosecuting appropriate persons, if need be. The objectives of RTA analysis form the perspective of the police includes:

- To ascertain the cause
- To prevent re-occurrence

- To prosecute persons who are primarily responsible

In order to address these objectives adequately, it is necessary that the investigating be detailed and revealing.

The common types of public transportation accidents are:

- Collision with another
- Accidents due to mechanical failure
- Negligence
- Collision with a motor vehicle

In addition to police checks and other regulations, operators of trotros and taxis must maintain lawful safety standards and are ultimately responsible for passenger safety.

2.8 Trotros and Taxi Accidents and Safety Issues

Over the years, there is an alarming rate of increase in traffic fatalities in developing countries (Hinds et al., 2007). The issue of the extent of reporting of fatalities as studies on road traffic crash have proven that there was under-reporting in the official crash statistics in Ghana over an eight-year period (1997–2004) data (Salifu & Ackaah, 2012). Results indicated that the level of non-reporting varied considerably with the severity of the crash from about 57% for property damage crashes through 8% for serious injury crashes to 0% for fatal crashes. Increased use of public transport may be a contributing factor in rising trends of road traffic crashes of trotros and taxis. Unsafe and old vehicles widely used to offer services in the public transportation sector have also compounded the dangers (WHO, 2009). Most of the world‟s accidents occurred in low-income and middle-income countries whereby public transport vehicles, private cars, three and twowheeled vehicles and pedestrians significantly contributed to road accidents (WHO, 2009). The total amount of developmental aid received by low and middle income country is to be said lower than the annual costs of road traffic crashes and these are estimated to be between US$65-100

billion. The estimated cost as a percentage of Gross Domestic Product is 1.6% percentage in Ghana as stated by the National Road Safety Commission of Ghana in 2007, (NRSC, 2007).

Large numbers of people who survive from road accidents are severely injured following injuries each year and these injuries place a large burden on health care resources. The majority of the severely injured are not fully recovered 12-18 months later. Psychological disorders are common post injury and are associated with poorer functional and occupational outcomes (Koren et al, 1999).

2.9 Public Transportation Drivers and Safety Issues

An attitude has prevailed in this country that managers and operators of public transport are mainly school dropouts and 'Bookmen'. Most of the drivers of private commercial vehicles and officials of transport associations in the informal lack adequate knowledge of public transport operations, as such recognition and respect is not accorded persons in this industry.

Not much is known of transport as a profession in the country as compared to the accountants, engineers and marketers. Experts in the profession are few but the few have failed to market their activities and assert themselves by contributing to national development on transport related issues.

More often than not, the government does not own majority shares in public transport companies. As such, it cannot exercise dominant influence on the private owners, (Addo, 2005).

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Research Approach

3.1.1 Data Collection

Qualitative and quantitative research methods were employed in collecting data for the research. Firstly, information was extracted from administrative records on traffic and accident data for the two modes of public transport.

Secondly, primary data was collected through interviews and field surveys conducted

Primary data on traffic volume and composition was also collected

Data extracted from Road Accident records in the Kumasi Metropolis from 2005 to 2011 was obtained from the Building and Road Research Institute of Ghana (BRRI). Suitable questionnaires were designed and pre-visits conducted to ascertain the availability of the information required and to meet the objectives of the research. This was done to obtain data from the operators on their backgrounds, daily working hours, type of service, experience, number of crashes they have been involved in and time of crash. Similarly, data were collected from the users of this mode of transport with respect to their reasons for their choice of this mode, safety and other related issues. Traffic count was undertaken at carefully selected routes and data obtained was used in computing

Average Annual Daily traffic (AADT) counts on the

- Tech Junction – Anloga Junction Road
- Suame Roundabout to Magazine Maakro
- Santase Roundabout to Santase
- Airport Roundabout to Anloga Junction

Using the traffic count, the percentage composition together with vehicle population for the country (Zaato, 2012) was used to compute an average national growth rate from 2007 to 2011. This growth rate obtained was further used to compute the average vehicle growth rate for Kumasi metropolis.

The fatalities per 10,000 vehicles for trotro and taxis computed to give a comparative indication of which mode was safer in terms of the total vehicle population in Kumasi. The fatalities per 100 vehicles crashes and casualties for each mode were also tabulated.

3.1.2 Design of Questionnaire

To achieve the objective of the study, the questionnaire was structured into two parts. Part I included questions that sought to identify the profile of the respondents. Part II of the questionnaire included questions that sought to extract information relevant to the safety of public transportation in Kumasi and to identify significant safety variables that influence choice of public transportation mode in Kumasi.

The target respondent group were drivers of public transport services at various locations in the metropolis, other operator groups and public transport patronizers in the domain of public transport in the Kumasi Metropolis. The choice of this category of respondents was based on the fact that they had appreciable knowledge of public transport operation. During the study, open interview schedule was designed for each group, to suit the different data required for the study. A set of questions was posed to the various respondents and their responses noted. (Refer to sample Questionnaire in Appendix B).

3.1.3 Population for Study

The selection of the respondents was limited to

- Drivers of Public transport vehicles (taxi and Trotro)
- Passengers of Public transport.

3.1.4 Sample and Sampling Technique

Non-probability sampling techniques were employed in this study. Purposive sampling, which is an example of non-probability sampling technique, was adopted in identifying key respondents. This is because the researcher required certain categories of respondents who had been involved in public transportation operations, usage and involved in road traffic accident. Statistical method was used in establishing the sample size for trotro and taxis for the study. The sample size was determined using the following simplified formula (Israel, 1992),

$$n = \frac{N}{(1 + Ne^2)} \qquad 3.1$$

Where n is the sample size, N is the population size, and e is the level of significance. The population size was the number of trotros and taxis registered with DVLA for the 2011 in the metropolis. This was obtained from the percentage composition of traffic count (51.1%). The total number of registered vehicles in the metropolis was 200,116 in 2011, (Tetteh Addison, 2012). The estimated taxis and trotro vehicle population in the metropolitan area was computed as 51.1% of 200,116. This gave an estimated 102,260 taxis and trotros operating within the metropolis. Using a significance of 10%, a minimum sample of size of 100 was obtained. The sample size used for the research was 120 drivers and 100 passengers.

3.2 Administration of Questionnaire

The questionnaires were administered to the targeted respondent groups being the transport operators and passengers. Ample time was allowed for the collection of

responses and respondents were guided through the questions. A total of 120 questionnaires were administered to drivers in the Kumasi Metropolis. A total of 50 questionnaires were administered to transport passengers. A sample of the questionnaire is shown in Appendix B.

Aside the administering of questionnaires, direct field observations were also undertaken along some selected roads in the metropolis. This enabled the researcher to gain first-hand information on traffic flows, transport operations and hazards, conflict locations and other intransigent factors caused by the presence of the taxi and trotro on the roads. This was carried out by taking a ride with a taxi and also with Trotro along some selected roads in the study area.

3.3 Road Traffic Crash Data

All road traffic crash data in the study area for the research was obtained from the Building and Road Research Institute (BRRI) accident database in Kumasi. The data for the study area was obtained by querying the Micro-Computer Accident Analysis Package (MAAP). The data covered the period of 2005-2011.

3.4 Traffic Count to Determine Composition

The manual counts method was use to gather data for temporary survey determination of vehicle classification, turning movements, direction of travel, pedestrian movements, or vehicle occupancy. The count periods were 15 minutes interval and it was began 7am to 10am and from 3pm to 6pm. This was conducted at four locations

- The Suame Roundabout to Magazine Maakro route, with the screen line located at the Suame Water Works

- The Santase Roundabout to Santase route, with the screen line located in front of Opoku Ware Secondary School
- The Anloga Junction to KNUST route with the screen line located at Oforikrom Station
- The Airport Roundabout to Anloga Junction route with the screen line located at Prudential Bank at Sawaba Junction

The tallies for both direction of traffic was recorded and classified into Taxis, Trotro and Other Vehicles.

This was to gain an insight into the significance of the two public transport modes by obtaining a fair idea about the composition.

CHAPTER 4: RESULTS AND DISCUSSIONS

4.1 Traffic composition on selected routes

Result of a six-hour manual traffic count conducted along some selected major routes in the Kumasi Metropolis and which generally leads to the central business district (CBD) is shown Table 4.1. The percentage composition is further illustrated in the pie chart of Figure 4.1

Table 4.1: Summary of Six Hour Traffic Count Showing Composition

ROUTE	Screen Line	TAXIS	TROTROS	OTHER	TOTAL
KNUST Junction to Anloga Junction	Oforikrom Station	1611	2614	3220	**7445**
Suame R'about to Magazine Maakro	Suame Waterworks	1169	1998	3493	**6660**

Santase to Santase Roundabout	Opoku Ware School	1509	1745	3354	**6608**
Sawaba Junction to Anloga Junction	Prudential Bank	1225	1874	3031	**6130**
Total Counted and Classified		**5514**	**8231**	**13098**	**26843**
Percentage Composition of Classified Volume		**20.5**	**30.7**	**48.8**	**100**

Source: Field Data, 2013

For all the routes selected for counting, the volume of Trotro was higher than taxi. The highest volume of traffic for the 6 hour manual count was 7445 vehicles recorded on the KNUST Junction to Anloga Junction Road. The percentage composition was, 21.6% taxis, 35.1% Trotro and 43.3% other vehicles. The lowest volume of traffic for the 6 hour manual count was 6130 vehicles recorded on the Sawaba Junction to Anloga Junction Road. The percentage composition was, 20% taxis, 30.6% Trotro and 49.4% other vehicles.

The highest percentage volume of Trotro and taxi were 35.1% and 21.6% respectively and was recorded on the KNUST Junction to Anloga Junction Road. The combined traffic percentage volume from indicated Trotros is 30.7% and 20.5% for taxis for the traffic stream on the four roads

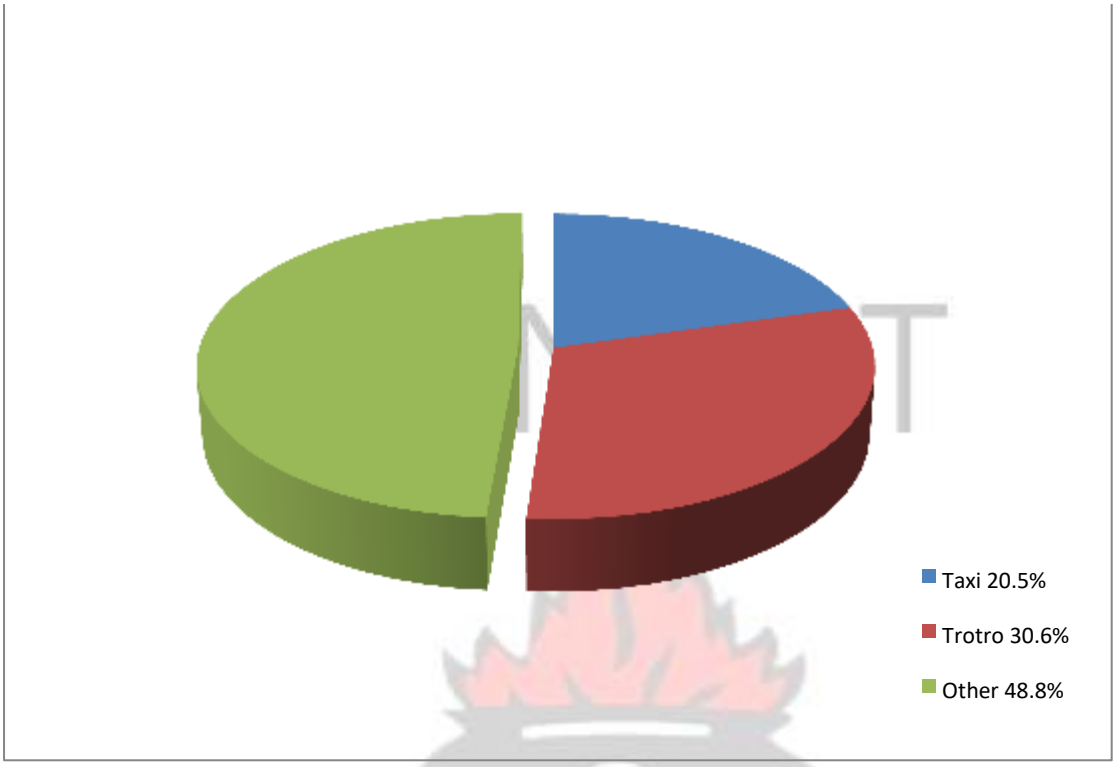

Figure 4.1 Vehicle Category in Traffic Stream

It can be observed from Figure 4.1 that both modes of public transport constitute a high proportion of traffic within the Kumasi Metropolis. The table shows the estimated vehicle population based on the year 2011. Reverse projections were obtained for the years 2007-2010. The composition of the various modes was applied to obtain the estimated vehicle population in various categories of taxis, trotros and other vehicles.

Table 4.2: Estimated Composition of Vehicles in Kumasi Metropolis

YEAR	Estimated Vehicle Population (5.8%)	% of Traffic Count			Estimated Composition of Vehicles		
		Taxis	Trotros	Others	Taxis	Trotros	Others
2011	200116	20.5	30.7	48.8	41024	61436	97657
2010	189068	20.5	30.7	48.8	38759	58044	92265
2009	178630	20.5	30.7	48.8	36619	54839	87171

2008	168768	20.5	30.7	48.8	34597	51812	82359
2007	159450	20.5	30.7	48.8	32687	48951	77812

Source: NRSC, 2012& Field Data, 2013

4.2 Background of Trotro and Taxi Drivers

Out of a total of one hundred and twenty (120) respondents, 57.5% were trotro drivers and 42.5% taxi drivers. The overall age trend was basically similar for both trotro and taxi drivers but for the age category of 46-60 years, which showed that 21.7% of trotro drivers were in that category whilst only 5% was observed for taxi drivers. This implies that for age category of 47 to 60 years, there were approximately as much as 4 trotro drivers to 1 taxi driver. There were no trotro drivers below the age of 18 and also there were no taxi drivers above the age of 60. However there was one taxi driver below the required age of 18 to drive a vehicle. This is illustrated in Figure 4.2.

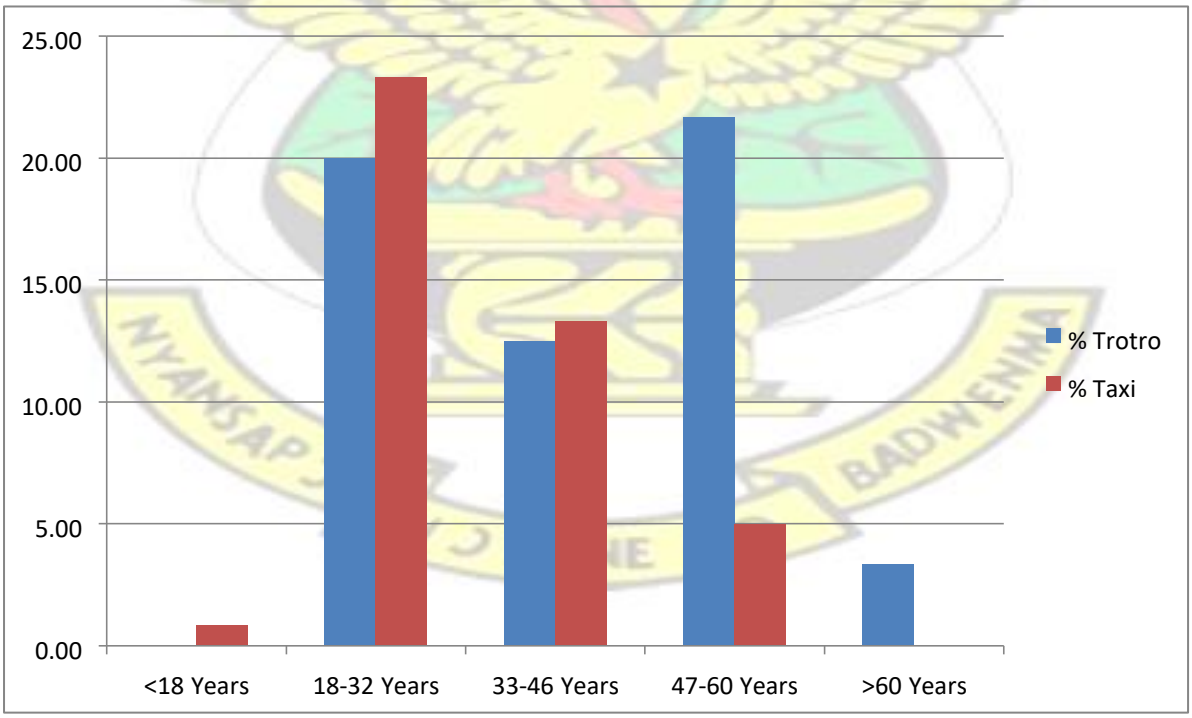

Figure 4.2: Age Distribution of Drivers

4.2.1 Education Level of Drivers

The study revealed that 31.7% of drivers interviewed had no formal education, 21.7% were trotro drivers and 10% were taxi drivers. Also 38.3% had only primary education, out of which 20.8% were trotro drivers and 17.5% were taxi drivers. It further revealed that for the 25% of respondents with junior high school education or middle school leaving certificate, 15% were trotro drivers and 10% were taxi drivers. 5% of respondents had education above JHS level or Middle school but all were taxi drivers. This is shown in Figure 4.3.

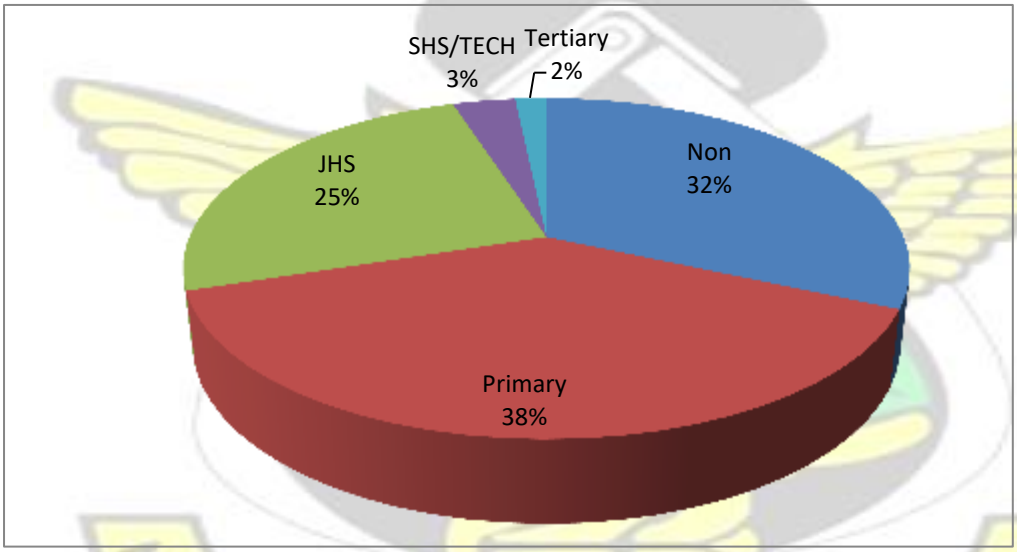

Figure 4.3: Education levels of public transport drivers

Clearly, a substantial proportion of drivers (70%) have primary or no formal education and this reemphasizes the perception that mostly lowly educated and school dropouts make up the majority of public transport drivers. All the respondents interviewed were males. It is also worth mentioning that only two respondents were unqualified to drive as they did not possess the required license and they were both taxi drivers.

4.2.2 Years of Driving Experience

Based on the data in table 4.3, nearly 51% of trotro drivers had operated public transport business for more than 10 years, as against 12% for taxi drivers. Also 47% of taxi drivers had less than 5years driving experience as compared to 17% of trotro drivers with similar experience.

Table 4.3: Years of experience of Trotro and Taxi Drivers

Years of Experience	Trotro	Percentage (%)	Taxi	Percentage (%)
0-5 years	12	17.39	24	47.06
6-10 years	22	31.88	21	41.18
>10 years	35	50.72	6	11.76
Total	69	100	51	100

Source: Field Data, 2013

4.2.3 Safety Impact of Drivers Attitude

The locations where extra precaution is required, 20 taxi drivers out of the respondents took extra precautions on a bend, whilst for trotro drivers it was only 5.8%. It was deduced from the data that, safety issues at intersections without signals affected a higher percentage of taxi drivers, although the situation significantly affected trotro drivers too. At parking bays, of which most passengers of trotro drivers either board or alight, 34.8 percentages required extra precaution at such locations which is not a significant issue for taxi drivers. This is shown on the Table 4.4.

Table 4.4: Precautions Taken at Various Sections on the Road

Extra Precautions	Trotro	Percentage (%)	Taxi	Percentage (%)
On A Bend	4	5.80	10	19.61
Intersection Without Signals	26	37.68	33	64.71
At Round About	15	21.74	6	11.76

Intersection With Signals	0	0.00	0	0.00
Bus Bay	24	34.78	2	3.92
On A Straight	0	0.00	0	0.00
Total	69	100.00	51	100.00

Source: Field Data, 2013

Supplementary enquiries also revealed the problem of extra precaution at intersections without signals for taxi drivers might be the arbitrary stopping along high way routes searching for passengers or alighting of passengers. It was also observed that, a lot of activities go on at intersections and that is where passengers either board or alight from vehicles. This increases the number of decisions being taken by taxi drivers in such locations such, as stopping for passengers to alight, searching for passengers, collecting fares and changes, and drive through all associated conflicts at intersections without signals.

4.2.4 Driver Working Hours

It was observed that generally taxi drivers work for longer hours than trotro drivers. For the regular hours of 0-8 hours, 7.8% of taxi drivers responded, whilst no respondent trotro driver worked for less than 8 hours in a day. Also for extra hours up to 12 hours a day, the percentage respondents shows that 43% of taxi drivers worked for between 8-12 hours every day, whilst 37% of trotro drivers interviewed worked for similar periods. However for drivers working longer hours than 12 hours 25% were taxi drivers whilst 43% were trotro drivers. There was no available study in Ghana to relate the working hours of both modes of transport to their safety implication. But conventional statistics have shown that driving for longer hours is inversely proportional or reduces the concentration of drivers due to fatigue, (Gandevia, 1992). The table 4.5 shows the average number of hours for distribution for the two modes of transports.

Table 4.5: Hours of Work for Drivers of Both Modes

Hours	Trotro	Percentage (%)	Taxi	Percentage (%)
0-8	0	0	4	7.84
8-12	26	37	22	43.14
>12	43	62.	25	49.02
Total	69	100	51	100.00

Source: Field Data, 2013

4.2.5 Drivers Involved in Accidents

It was revealed from the respondents that 70.6% of taxi drivers interviewed have been involved in vehicular accidents during their working years as compared to 50.7% of trotro drivers. For the two modes of transport, these mostly occurred between the 6am to 6pm. Also, 19.4% of accident cases involving taxi drivers were reported to the police as compared with 14% of that of trotro drivers. In most cases, the respondents of both modes said the accidents had influenced their driving in a positive way, as they now drive with more caution.

8.3% of reported taxi drivers‟ accidents resulted in fatalities whilst trotro accidents reported none.

4.2.6 Inspection of Safety Features on Vehicles

It was obtained from the respondents that 51 out of 69 trotro drivers check on their safety features of vehicle before starting work which represents 73.9%. Also 43 out of 51 taxi drivers check on their safety features before starting work which represents 84.3%. Over 50% of drivers of both modes were critical on their brakes, horn and tyres. This gives an indication that drivers are particularly careful with the safety features. Other safety features such as lighting, seat belt were also checked by 33% of drivers of both modes.

On the issue of control regulators on highway, over 70% of drivers of both modes, disregarded simple and voluntary speed control systems. This was also the case for Zebra Crossing of which more than 90% disregarded it. This they attributed to few sign indicators on the highway.

The contrast came from the traffic lights of which 42% of trotro drivers found it difficult to obey whilst over 80% of taxi drivers responded as such.

Taxi drivers were also the majority culprits (72.5%) when it comes to obeying the no stopping/no parking signs along highway routes as compared to 24.6% of trotro drivers. This can be attributed to the respondents complaining about the system of searching for passengers and alighting.

4.3 General Safety Concerns

There were several other concerns about safety issues raised by the drivers of both modes and the relevant ones are listed below

- 67% of taxi drivers reported arbitrary crossing by pedestrians at intersection and hawking on the streets as major safety concern and suggested that, authorities should punish pedestrians and hawkers who do that.
- 44% of trotro drivers also suggested that lack of adequate signs especially speed ramp signs and the haphazard ways they are installed was also safety concern as they cause a lot of traffic problems and accidents.
- 24% taxi drivers also complained that there are few taxi stations forcing them to roam and pick passengers along routes some at intersections which is a hazard as several decisions need to be taken at intersections.
- Trotro drivers complained of general traffic congestion and the need to introduce more signalised intersections.

- Trotro drivers reported inadequate stopping bays along the road especially on the Aboabo to Asawase road at Aboabo traffic light.
- Drivers complained that their own colleagues drive offensively and make very dangerous manoeuvrings.

4.4 Crash Severity for Trotros and Taxis

As mentioned earlier, the road traffic crash data was obtained from the BRRI from 2007 to 2011. This data was summarised and analysed. The tables below indicate the changing trend in Traffic Crash fatality and casualty indices. With this data, I was mindful of the vehicle population and composition. These obviously have implications on the analysis and conclusions that can be drawn from the study.

The analysis was done in relative terms of occurrences. Crash severity within trotro mode of public transportation was considered and related to the other crash severity within taxi mode of public transportation. It is however important to state also that in absolute terms, 2091 and 2265 trotro and taxi accidents respectively have occurred between 2007 and 2011 in the Kumasi Metropolis.

4.4.1 Fatalities Indices

The fatality indices show the frequency of fatal accidents occurring with the total vehicle population, the likelihood of fatalities within a particular mode and its comparison to the other. This was done in terms of fatalities per crashes and fatalities per casualty accidents. This is shown in table 4.6 and 4.7 for trotros and taxis respectively.

Table 4.6: Crash Fatality Indices for Trotros

YEAR	TOTAL	HOSPITALISED	INJURY	FATAL	CASUAL	DAMAGE	ESTIMATED	FATALITES PER	FATALITES PER	FATALITES PER

	TROTRO		ONLY		TIES	ONLY	TOTAL	10,000	100 TROTRO	TROTRO
	CRASHES						VEHICLES	VEHICLES	CRASHES	100 CASUALTIES
2007	380	128	111	48	287	93	159450	3.01	12.63	16.72
2008	392	104	111	62	277	115	168768	3.67	15.82	22.38
2009	447	137	134	77	348	99	178630	4.31	17.23	22.13
2010	449	129	138	65	332	117	189068	3.44	14.48	19.58
2011	423	144	104	73	321	102	200116	3.65	17.26	22.74

Source: BRRI, 2012 and Field data 2011 Table 4.7: Crash Fatality Indices for Taxis

YEAR	TOTAL	HOSPITALISED	INJURY	FATAL	CASUAL	DAMAGE	ESTIMATED	FATALITES PER	FATALITES PER	FATALITES PER
	TAXI		ONLY		TIES	ONLY	TOTAL	10,000	100 TAXI	TAXI
	CRASHES						VEHICLES	VEHICLES	CRASHES	100 CASUALTIES
2007	457	120	131	49	300	157	159450	3.07	10.72	16.33
2008	402	105	115	41	261	141	168768	2.43	10.20	15.71
2009	475	131	157	59	347	128	178630	3.30	12.42	17.00
2010	452	144	143	56	343	109	189068	2.96	12.39	16.33
2011	479	156	145	49	350	129	200116	2.45	10.23	14.00

Source: BRRI, 2012 and Field data 2011

Fatalities of Trotros or Taxis per 10,000 Vehicles

The tables 4.6 and 4.7 reveal the key details in crash severity for both modes. More importantly was, which of the two modes carries a higher potential in fatalities within the total vehicle population.

Considering the fatalities per 10,000 vehicles for trotros and taxis during the study, the data suggested the trend for trotro is increasing slightly with a peak in the year 2009. The situation for taxi was however different, analysis suggested a downward trend of fatalities per 10,000 vehicles for taxis. It also had a peak in 2009 similar to that of trotros. This also made 2009 a very deadly year for both modes of public transport. The

higher number of recorded fatalities for trotro for the 5 year period may be attributed to its higher occupancy ratio as compared to taxis. Since both transport modes operate under very similar road and traffic conditions. In 2007, both modes recorded almost similar fatalities per 10,000 vehicles. This is presented in Figure 4.4.

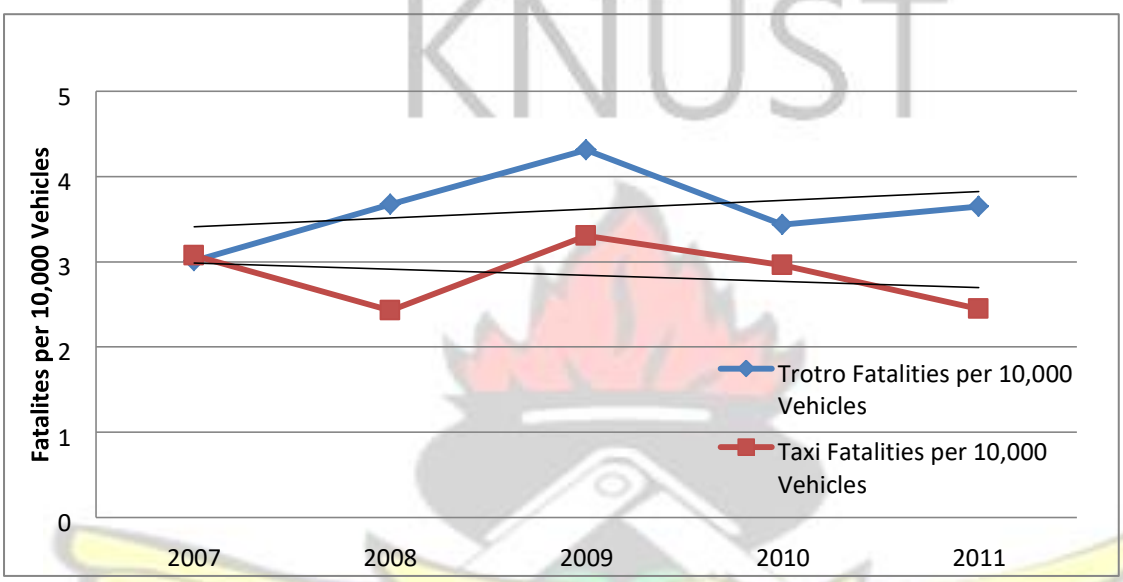

Figure 4.4: Fatalities per 10,000 Vehicles for 2007-2011 (Taxis and Trotros)

Fatalities per 100 Crashes of Trotros or Taxis

Also looking at the fatalities per every 100 crashes for both modes of public transport, the data suggested a steady incremental situation for the trotros operating in the metropolis. The situation improved slightly for trotros in 2010 where a slim drop was recorded, but continued to rise progressively towards 2011. It can also be inferred from the data that, for every 100 vehicle crashes for trotros, there is average of 15 fatalities likely to be recorded.

The data for taxis also showed an insignificant increment over the study period. Relatively compared to trotros, the potential of fatality in a taxis crash is low. It was also inferred from the data that, for every 100 vehicle crashes for taxis, there is an average of 11 fatalities likely to occur. The data further revealed that for taxis, there

was a sharp contrast in the fatalities per 100 crashes in 2010 compared to trotros. The fatalities reduced for trotros, whilst that of taxis actually remained consistent. This is presented in Figure 4.5 below.

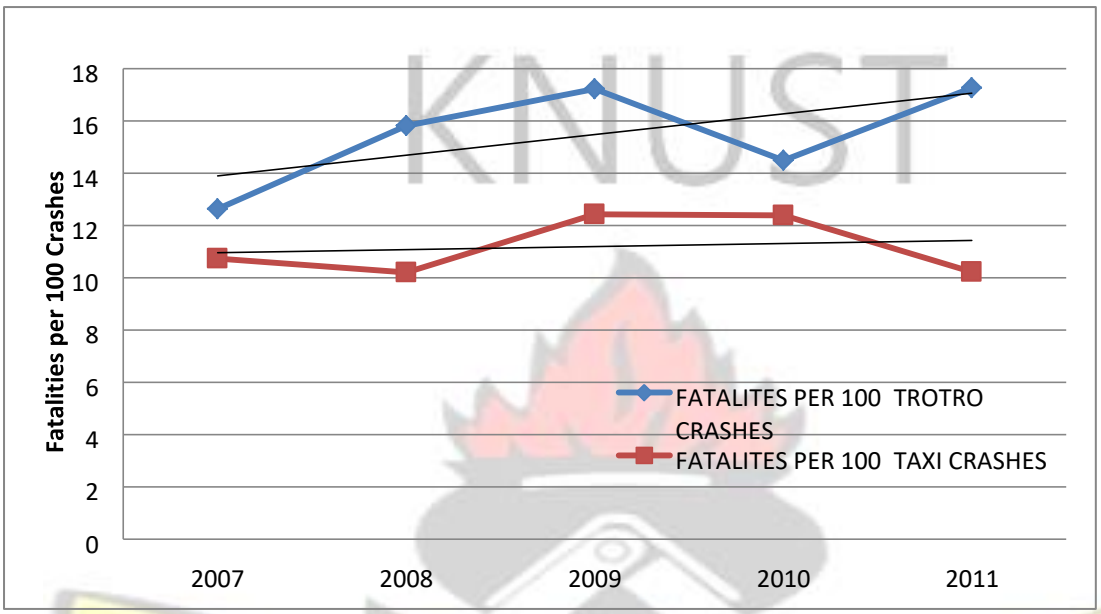

Figure 4.5: Fatalities per 100 Crashes for 2007-2011 (Taxis and Trotros)

Fatalities per 100 Casualties for Trotros or Taxis

For cases involving casualties for trotros, the overall trend revealed a decreasing trend for taxis and the opposite for trotros. From the situation where both have a similar casualty rate for 2007, the drift started and continued through the study period. The peak for trotros was recorded in 2011, highlighting the steady increment. This is in sharp contrast to the case for taxis, where the peak was in 2009 and reduced consistently towards 2011. This is presented in Figure 4.6.

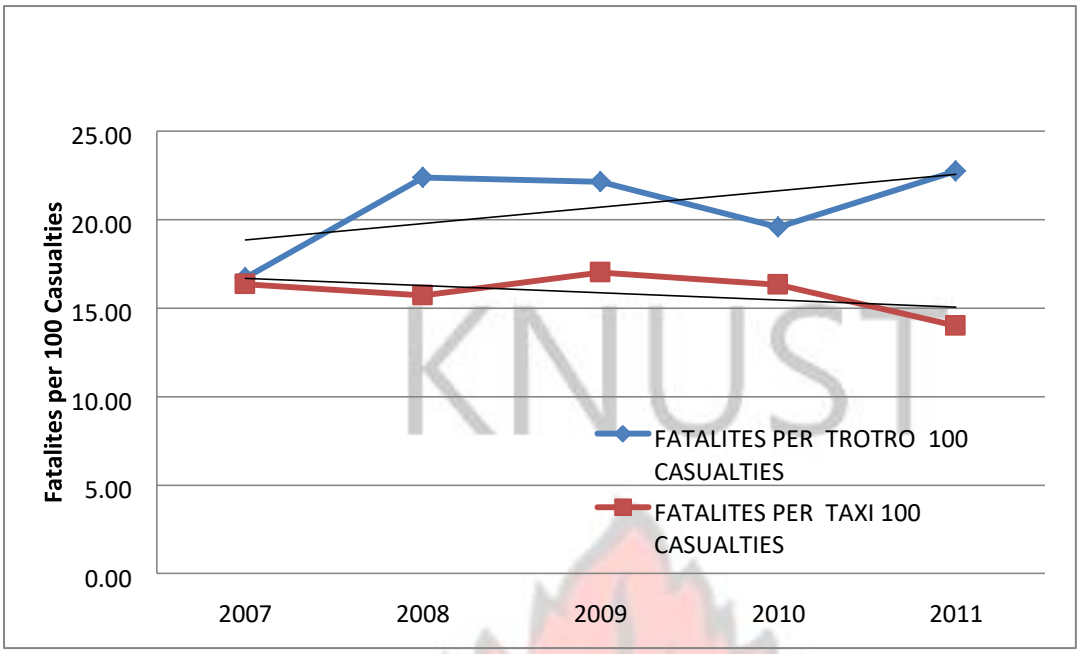

Figure 4.6: Fatalities per 100 Casualties for 2007-2011 (Taxis and Trotros)

The fatalities per 100 casualties for the study period also follow a trend where the situation for taxis generally is decreasing very slightly and the case for trotros is also slightly increasing.

4.4.2 Hospitalised Crash Indices

The Hospitalised Crash indices show the frequency of hospitalised accidents occurring with the total vehicle population, the likelihood of recording a hospitalised crash within a particular mode and its comparison to the other. This was done in terms of hospitalised per crashes and hospitalised per casualty accidents. This is shown in table 4.8 and 4.9 for trotros and taxis respectively.

Table 4.8: Hospitalised Crash Analysis for Kumasi Trotros

YEAR	TOTAL TROTRO CRASHES	HOSPITALISED	INJURY ONLY	FATAL	CASUALTIES	DAMAGE ONLY	ESTIMATED TOTAL VEHICLES	HOSPITALISED PER 10000 VEHICLES	HOSPITALISED PER 100 TROTRO CRASHES	HOSPITALISED PER 100 TROTRO CASUALTIES

2007	380	128	111	48	287	93	159450	8.03	33.68	44.60
2008	392	104	111	62	277	115	168768	6.16	26.53	37.55
2009	447	137	134	77	348	99	178630	7.67	30.65	39.37
2010	449	129	138	65	332	117	189068	6.82	28.73	38.86
2011	423	144	104	73	321	102	200116	7.20	34.04	44.86

Source: BRRI, 2012

Table 4.9: Hospitalised Crash Analysis for Kumasi Taxis

YEAR	TOTAL TROTRO CRASHES	HOSPITALISED	INJURY ONLY	FATAL	CASUAL TIES	DAMAGE ONLY	ESTIMATED TOTAL VEHICLES	HOSPITALISED PER 10000 VEHICLES	HOSPITALISED PER 100 TAXI CRASHES	HOSPITALISED PER 100 TAXI CASUALTIES
2007	457	120	131	49	300	157	159450	7.53	26.26	40.00
2008	402	105	115	41	261	141	168768	6.22	26.12	40.23
2009	475	131	157	59	347	128	178630	7.33	27.58	37.75
2010	452	144	143	56	343	109	189068	7.62	31.86	41.98
2011	479	156	145	49	350	129	200116	7.80	32.57	44.57

Source: BRRI, 2012

Hospitalised Cases per 10,000 Vehicle for Trotros or Taxis

At aggregate level, the total hospitalised cases for trotros and taxis were 642 and 656 respectively. These absolute figures are very close and even applying them to the composition of both modes within the vehicle population of the metropolis, also reveals a striking similarity. This is shown in Figure 4.7 below.

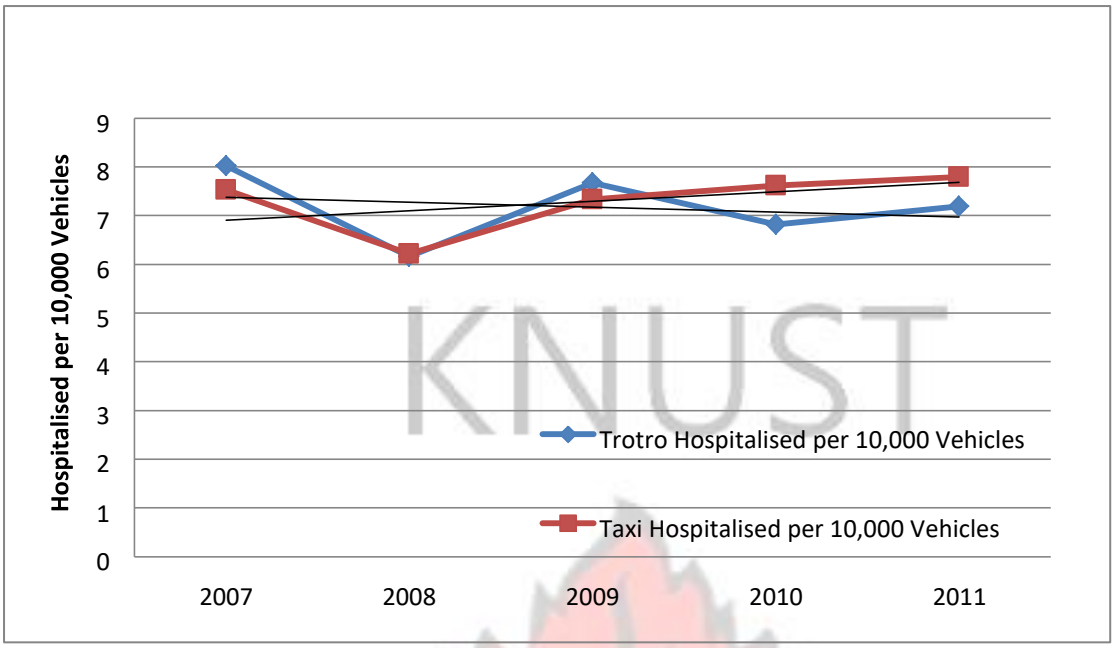

Figure 4.7: Hospitalised per 10,000 Vehicle for 2007-2011 (Taxis and Trotros)

It was observed that the hospitalised cases for both modes of transportation have an almost similar gradient. Reported hospitalised cases for both modes of transport remained almost constant per 10,000 vehicles within the metropolis over the study period. In 2008, both modes recorded approximately the same hospitalised cases for every 10,000 vehicles in the study area.

Hospitalised Cases per 100 Crashes of Trotros or Taxis

From the chart below, the study revealed that per every 100 recorded trotro crashes there is a slight increase in hospitalised cases. The rate of increase is only slower compared to that of taxis, when per every 100 recorded taxi crashes, the hospitalised cases kept increasing steadily. The peak hospitalised cases occurred in 2007 for trotros sharply contrasting that of taxis which occurred in 2011. This is shown in

Figure 4.8

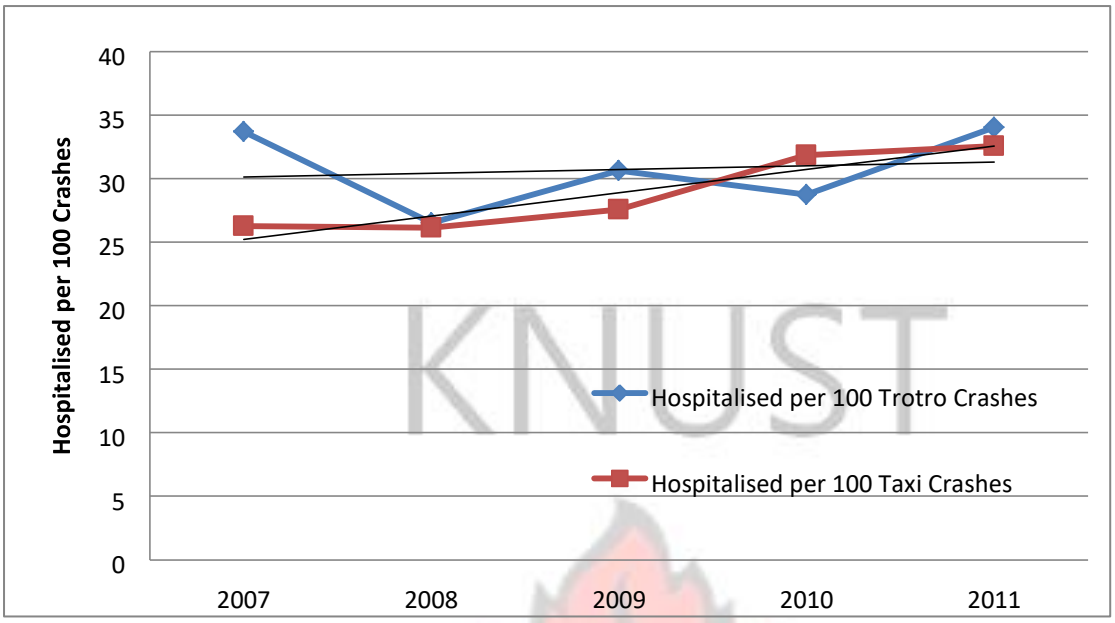

Figure 4.8: Hospitalised per 100 Crashes for 2007-2011 (Trotros and Taxis)

The above chart suggests that even though taxis has much lower occupancy compared to trotros, there is the higher likelihood of getting hospitalised cases when involved in a road traffic crash.

Hospitalised cases per 100 Trotro or Taxi Casualties

The data suggests a haphazard trend in hospitalised cases per 100 casualties for both modes of public transport. However, the data points to a generally increasing situation. Much worrying is the hospitalised cases per casualties for trotros and taxis from 2010 to 2011 which indicated a sharp increase.

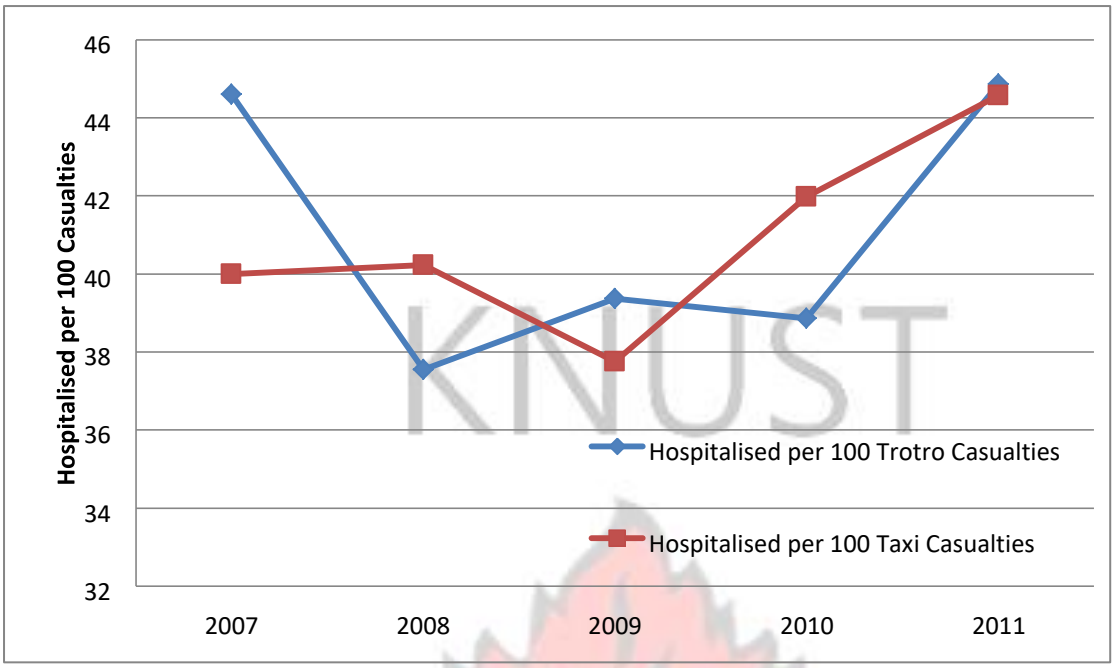

Figure 4.9: Hospitalised per 100 Casualties for 2007-2011 (Trotros and Taxis)

4.4.3 Location of Crashes

From the accident data obtained from BRRI, the location types were categorised into

- On a straight
- Crossroads
- T/Junction
- Staggered crossroads
- Y/Junction
- Roundabout
- Railway
- Other

The charts below (Figure4.10 and 4.11) show all trotro and taxi related road traffic location crashes type for the period of analyses in the study area.

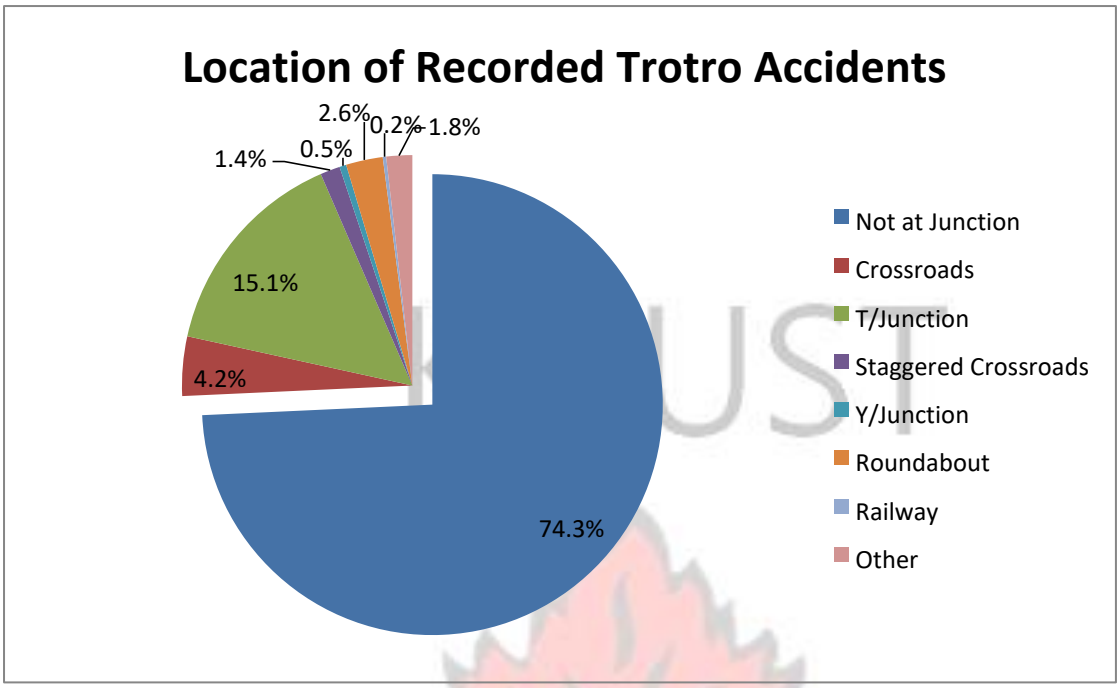

Figure 4.10: Location Frequency of Trotro Accidents

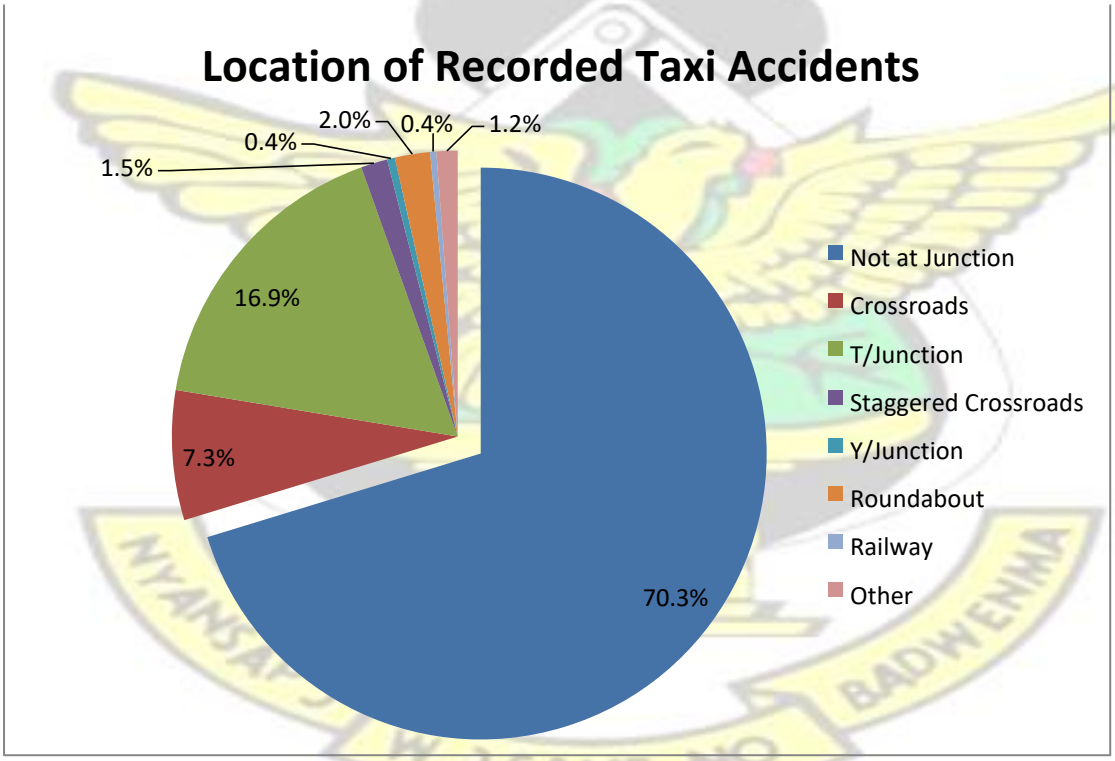

Figure 4.11: Location Frequency of Taxi Accidents Observation from figure 4.10 and 4.11 gives an overall indication that most accident for both modes occur at similar locations. That is to say, for all crashes involving trotros vehicles, over 70% occurred between intersections, and for all crashes involving taxis, over 70% of

recorded crashes were between intersections. This might perhaps suggest that, during these sections, flow interruptions are minimal and as such, both modes are able to operate closer to their desired speed. The general public perception on increased accident frequency at intersections and places like roundabout was not supported by the data available.

4.4.4 License Status of Drivers Involved In Crashes

Data obtained was used to evaluate the license status of drivers involved in accidents for each of the modes of public transportation. For accidents involving trotro drivers only, it can be observed from the chart that approximately 60% of trotro drivers had the necessary permit required to drive. Also for accidents involving taxi drivers only, 50% of taxi drivers possessed the required permit to drive. This is illustrated in the chart below.

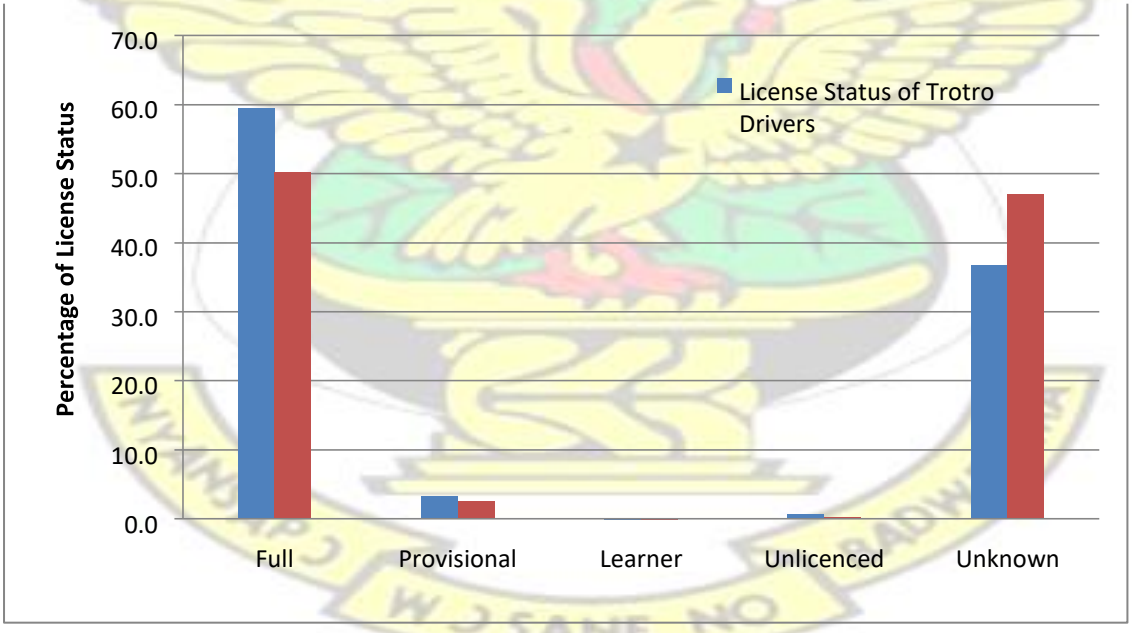

Figure 4.12: License Status of Drivers for Trotros and Taxis (2007-2011)

These revelations are scary as it also indicates that a significant number of drivers operating both modes may not possess the required documentation to drive. The number of unknown licence status drivers for both modes involved in road crashes is significant

for both modes of transport, and it might give an indication that perhaps the do not possess the valid documentation to drive. This study however did not investigate the unknown license status of drivers.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

The overall aim of this study was to compare the safety of the two popular modes of public transportations. Based on the findings, the conclusions drawn from the study are as follows

- The study sought to compare the road traffic crashes frequency and severity within each of the modes of public transport. The study concludes that for both trotro and taxis operating under similar road condition experience almost similar trends in road crashes statistics. Fatalities per Trotro crashes in increasing at a faster rate compared to fatalities per taxi crashes. This requires an intervention.
- There was also a generally similar trend for all other aspects for both modes of public transportation used in the comparative analysis.
- Finally, the study concludes from the analysis that, in general terms of all the analysed data, Taxi as a mode of public transportation is safer than Trotro.

5.2 Recommendations

From the findings of this study, the following recommendations are made

- A special investigation particularly for study of accident fatalities within trotro crashes must be undertaken and findings implemented to bring the increasing rate of fatalities to a minimum
- Continuous data collection on public transport operators and their operations in terms of traffic count is recommended.

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APPENDICES

Appendix A: Vehicle Classification Vehicle Classification

Vehicle Category	Description
Taxis	Commercial Cars for public transportation with 5 seated passengers.
Trotro	Mini vans and Medium buses include those with seating capacity up to 33 passengers.
Others	Vehicles that do not fall into 1st or 2nd category

Appendix B: Questionnaire for Safety Studies of Urban Public Transport

This information is required for the preparation of MSc thesis, any answers provided will be treated as confidential. Data obtained is for academic purposes only.

A. GENERAL QUESTIONS FOR DRIVERS

1. Route ……..
2. Sex: Male Female
3. Age: Below 18 18 – 32 33 – 46 47 - 60 Above 60
4. Education Level

   No formal education Primary JHS SHS Technical Tertiary
5. What mode of transport do you work with? Trotro Taxi
6. Do you have a valid driver"s license? YES NO
7. When was your business established (years)? <5 6-10 > 10

B. SAFETY IMPACT ON HIGHWAYS AND TRAFFIC FLOW

8. How will you describe the safety conditions on your highway route?

   Very dangerous Somehow dangerous Safe Very safe
9. Which locations on your highway route do you take extra precautions? On a bend Intersection without signals At roundabout At an Intersection with signal At the bus bay On a straight
10. How many hours do you work in a day averagely?

    0 - 8 hours 8-12 hours More than 12 hours
11. Have you ever been involved in an accident? YES NO

12. If yes, what time did it occur? ☐ 6AM-6PM ☐ 6PM-6AM

13. Was there any fatalities? ☐ YES ☐ NO

14. Was it reported to the police? ☐ YES ☐ NO

15. Has it influenced your driving in anyway? ☐ YES ☐ NO

16. Do you check your safety features on vehicle before work? ☐ YES ☐ NO

17. If yes which parts? ☐ Brakes ☐ Seat Belt ☐ Lightening ☐ Tyres Horn

18. Which safety control on the highway do you find most difficult to obey?

☐ Speed controls

☐ Traffic lights

☐ Zebra Crossing

☐ No Stopping/ Parking

☐ Other

19. What are the general safety problems associated with operating your mode?

……

20. Do you have any suggestion on safety improvement of your mode?

.....

QUESTIONAIRE FOR SAFETY STUDIES OF URBAN PUBLIC TRANSPORT – KUMASI

This information is required for the preparation of MSc thesis, any answers provided will be treated as confidential. Data obtained is for academic purposes only.

A. GENERAL QUESTIONS FOR PATRONIZERS

1. Route ……..2. Sex: ☐ Male ☐ Female

3. Age: ☐ Below 18 ☐ 18 – 32 ☐ 33 – 46 ☐ 47 – 60 ☐ Above 60

4. How dependent is your business or mobility on public transportation?

Very dependent Somehow dependent Not dependent

5. Which is your preferred choice? Trotro Taxi Other

6. How often do you patronize? Everyday Once a week Once month

B. SAFETY IMPACT ON HIGHWAYS AND TRAFFIC FLOW

7. What influences your choice of mode?

Accessibility Safety Economic Security Time Other

8. Do you inspect safety features on a vehicle before boarding? Yes No

9. Have you ever been involved in an accident? YES NO

10. If yes, what time did it occur? 6AM-6 PM 6PM-6AM

11. Was there any fatalities? YES NO

12. Was it reported to the police? YES NO

13. What do you think must change to affect your choice and do you have any suggestion on the safety improvement of your mode choice?

.....

Appendix C: Summary of Manual Classified Traffic Count

Day of the Week:	*Monday*	**Location:**	*Bomso*		
City:	*Kumasi*	**Time:**	*From*	*7 AM TO 10 AM and 3PM TO 6PM*	
Enumerator's Name:	*RICHMOND OPPONG & KNUST*	**Direction:**	*From*	*Junction to Anloga Junction*	
Date:	*18-Nov-13*		Direction	Both direction	

Time (Hr.min)		Taxis	Trotro	Others	**Total**	Remarks
7:15am-7:30am		70	98	132	**300**	
7:30am-7:45am		68	111	135	**314**	
7:45am-8:00am		55	119	157	**331**	
8:00am-8:15am		68	112	143	**323**	
8:15am-8:30am		54	100	125	**279**	
8:30am-8:45am		62	82	121	**265**	
8:45am-9:00am		74	118	130	**322**	
9:00am-		72	98	135	**305**	
9:159:15amam -		67	89	128	**284**	
9:309:30amam -		56	94	133	**283**	
9:459:45amam -		59	92	131	**282**	
10:003:00pmam-		71	108	128	**307**	
3:153:15pmpm -		62	114	130	**306**	
3:30pm-		64	116	127	**307**	
3:453:45pmpm -		54	130	149	**333**	
4:004:00pmpm - 4:15pm		63	129	147	**339**	
4:15pm-		75	129	147	**351**	
4:304:30pmpm -		69	111	131	**311**	
4:454:45pmpm -		71	112	131	**314**	
5:005:00pmpm -		74	104	133	**311**	
5:155:15pmpm -		79	121	144	**344**	

5:305:30pmpm - 5:45pm		77	116	129	**322**	
5:45pm- 6:00pm		72	108	145	**325**	
Total		**1611**	**2614**	**3220**	**7445**	
Percentage		**21.64**	**35.11**	**43.25**	**100**	

Day of the Week: *Wednesday* **Location:** *Waterworks*

City: *Kumasi* **Time:** *From 7 AM TO 10 AM*

Enumerator's Name: *RICHMOND & OPPONG* **Direction:** *Suame R'about to From Magazine Maakro*

Date: *18 November*

Time (Hr.min)		Taxis	Trotro	Others	**Total**	Remarks
7:00am-7:15am		46	85	136	**267**	
7:15am-7:30am		49	78	133	**260**	
7:30am-7:45am		53	70	149	**272**	
7:45am-8:00am		57	84	127	**268**	
8:00am-8:15am		42	73	167	**282**	
8:15am-8:30am		47	81	151	**279**	
8:30am-8:45am		51	75	147	**273**	
8:45am-9:00am		41	90	151	**282**	
9:00am-9:15am		49	74	134	**257**	
9:15am-9:30am		**39**	69	129	**237**	
9:30am-9:45am		**51**	74	138	**263**	
9:45am-10:00am		**54**	72	144	**270**	
3:00pm-3:15pm		**64**	82	161	**307**	
3:15pm-3:30pm		**48**	88	150	**286**	
3:30pm-3:45pm		**55**	91	143	**289**	
3:45pm-4:00pm		**43**	104	156	**303**	
4:00pm-4:15pm		**53**	92	146	**291**	

4:15pm-4:30pm		**56**	88	163	**307**	
4:30pm-4:45pm		**50**	90	146	**286**	
4:45pm-5:00pm		**45**	102	152	**299**	
5:00pm-5:15pm		**46**	91	148	**285**	
5:15pm-5:30pm		**41**	86	133	**260**	
5:30pm-5:45pm		**38**	84	152	**274**	
5:45pm-6:00pm		**51**	75	137	**263**	
Total		**1169**	**1998**	**3493**	**6660**	
Percentage		**17.55**	**30.00**	**52.45**	100	

Day of the Week: *Tuesday* **Location:** *Opoku Ware School*

City: *Kumasi* **Time:** *From 7 AM TO 10 AM and 3PM TO 6PM*

Enumerator's Name: *RICHMOND & OPPONG*

Date:

Direction Both Direction

Santase to Santase From Roundabout

Time (Hr.min)		Taxi	Trotro	Others	Total	Remarks
7:00am-7:15am		68	76	124	268	
7:15am-7:30am		68	75	162	305	
7:30am-7:45am		64	54	138	256	
7:45am-8:00am		81	77	141	299	
8:00am-8:15am		57	79	136	272	
8:15am-8:30am		65	73	129	267	
8:30am-8:45am		61	79	138	278	
8:45am-9:00am		55	85	143	283	
9:00am-9:15am		61	82	133	276	
9:15am-9:30am		55	75	129	259	
9:30am-9:45am		51	67	136	254	
9:45am-10:00am		73	81	141	295	
3:00pm-3:15pm		67	73	145	285	
3:15pm-3:30pm		62	77	136	275	
3:30pm-3:45pm		71	61	120	252	
3:45pm-4:00pm		73	76	147	296	
4:00pm-4:15pm		67	62	157	286	
4:15pm-4:30pm		51	82	145	278	

4:30pm-4:45pm		61	69	151	281	
4:45pm-5:00pm		59	70	120	249	
5:00pm-5:15pm		56	74	135	265	
5:15pm-5:30pm		59	56	141	256	
5:30pm-5:45pm		63	65	148	276	
5:45pm-6:00pm		61	77	159	297	
Total		**1509**	**1745**	**3354**	**6608**	
Percentage		**22.84**	**26.41**	**50.76**	**100**	

Day of the Week: *Friday*

City: *Kumasi*

Enumerator's Name: *RICHMOND & OPPONG*

Date:

Location: *Oforikrom*

Time: *7 AM TO 10 Am From and 3PM TO 6PM*

Direction: *Airport Roundabout to From Anloga Junction* Normal Station;

Time (Hr.min)		Taxi	Trotro	Others	**Total**	Remarks
7:00am-7:15am		46	63	120	**229**	
7:15am-7:30am		52	68	139	**259**	
7:30am-7:45am		61	45	129	**235**	
7:45am-8:00am		60	61	134	**255**	
8:00am-8:15am		45	67	142	**254**	
8:15am-8:30am		42	81	127	**250**	
8:30am-8:45am		50	91	136	**277**	
8:45am-9:00am		56	94	131	**281**	
9:00am-9:15am		53	83	135	**271**	
9:15am-9:30am		58	76	128	**262**	
9:30am-9:45am		49	79	144	**272**	
9:45am-10:00am		52	85	149	**286**	
3:00pm-3:15pm		52	73	97	**222**	
3:15pm-3:30pm		53	84	106	**243**	
3:30pm-3:45pm		55	81	114	**250**	
3:45pm-4:00pm		57	80	112	**249**	

4:00pm-4:15pm		48	71	96	**215**	
4:15pm-4:30pm		49	90	117	**256**	
4:30pm-4:45pm		53	83	144	**280**	
4:45pm-5:00pm		51	95	114	**260**	
5:00pm-5:15pm		43	81	138	**262**	
5:15pm-5:30pm		41	76	127	**244**	
5:30pm-5:45pm		47	85	121	**253**	
5:45pm-6:00pm		52	82	131	**265**	
Total		**1225**	**1874**	**3031**	**6130**	
Percentage		**19.98**	**30.57**	**49.45**	**100**	

Appendix D: Traffic Crash Data

Age Category Data

	2007		**2008**		**2009**		**2010**		**2011**		**TOTAL**	
CAS	**TA**	**TR**	**TA**	**TR**	**TA**	**TR**	**TA**	**TR**	**TA**	**TR**	**TA**	**TR**
UAL0-5	**XI**3	**OT**1	**XI**5	**OT**3	**XI**5	**OT**5	**XI**5	**OT**3	**XI**6	**OT**3	**XI**24	**OT**15
6-10	7	3	2	3	4	5	6	4	2	4	21	19
11-	1	3	2	2	3	2	1	2	1	1	8	10
16-	0	3	0	3	1	2	1	0	1	5	3	13
21-	12	4	3	1	5	2	4	2	3	1	27	10
26-	5	8	8	2	5	7	8	9	6	5	32	31
31-	8	5	2	3	4	5	11	6	5	3	30	22
36-	6	6	3	4	4	4	2	1	6	7	21	22
41-	4	3	3	3	3	2	3	2	1	6	14	16
46-	2	2	2	0	2	5	2	3	2	4	10	14
51-	4	2	1	0	0	1	0	2	1	4	6	9
56-	0	1	2	2	2	2	1	7	1	1	6	13
61-	0	2	1	0	1	1	0	3	2	1	4	7
66-	0	1	2	1	2	2	2	1	2	1	8	6
71-	0	1	3	2	7	0	1	1	0	3	11	7
76-	0	0	0	2	1	0	1	1	1	2	3	5

81-	0	0	0	0	0	0	0	0	0	0	0	0
86-	0	0	0	1	0	0	0	0	1	0	1	1
91-	0	0	0	0	0	0	1	0	0	0	1	0
96-	1	0	0	0	0	0	0	0	0	0	1	0
Total	53	45	39	32	49	45	49	47	41	51	231	220

Appendix E: Vehicle Damage Category Trotro

YEAR	VEHICLE DAMAGE				Total
	None	Minor	Extensive	Unknown	
2007	51	226	125	7	409
2008	48	230	131	5	414
2009	47	257	182	0	486
2010	45	243	181	10	479
2011	43	235	181	5	464
Total	234	1191	800	19	2252

Taxis

YEAR	VEHICLE DAMAGE				Total
	None	Minor	Extensive	Unknown	
2007	41	254	196	3	494
2008	42	250	131	6	429
2009	33	292	184	1	510
2010	45	278	165	2	490
2011	51	285	191	2	529
Total	212	1359	867	14	2452

Appendix F: Monthly Crash Occurrence Trotro

MONTH	YEAR					Total
	2007	2008	2009	2010	2011	
January	32	19	31	27	37	146
February	32	29	30	25	23	139
March	25	30	28	36	35	154
April	26	23	44	42	28	163
May	35	33	43	38	35	184
June	25	25	37	31	34	152
July	28	25	27	36	30	146
August	30	40	44	33	35	182
September	34	47	42	29	35	187
October	36	42	45	46	41	210
November	42	34	42	45	36	199
December	35	45	34	61	54	229
Total	380	392	447	449	423	2091

Taxi

MONTH	YEAR					Total
	2007	2008	2009	2010	2011	
January	41	14	32	27	31	145
February	24	25	28	20	27	124
March	38	31	46	36	35	186
April	35	28	38	34	37	172
May	40	37	43	31	31	182

June	35	36	42	31	30	174
July	28	32	35	34	43	172
August	39	32	40	47	24	182
September	42	32	44	41	46	205
October	42	48	37	44	58	229
November	36	48	49	63	65	261
December	57	39	41	44	52	233
Total	457	402	475	452	479	2265

Appendix G: Crashes by Time of Day for Trotro

Trotro	**YEAR**					**Total**
	2007	**2008**	**2009**	**2010**	**2011**	
TIME00 - 01	0	0	1	1	2	4
01-02	3	0	1	1	1	6
02-03	1	1	0	3	5	10
03-04	3	0	0	4	1	8
04-05	0	4	1	6	4	15
05-06	6	6	9	13	16	50
06-07	17	16	17	9	12	71
07-08	12	19	12	22	14	79
08-09	17	19	23	17	25	101
09-10	23	12	16	26	21	98
10-11	22	21	23	27	20	113
11-12	21	18	23	25	23	110

12-13	24	24	22	24	16	110
13 - 14	17	10	28	19	24	98
14 - 15	26	23	38	28	32	147
15 - 16	27	38	41	36	22	164
16 - 17	32	32	33	33	40	170
17 - 18	20	28	31	24	30	133
18 - 19	18	29	22	21	25	115
19 - 20	34	38	52	44	40	208
20 - 21	25	24	34	34	25	142
21 - 22	21	16	12	22	16	87
22 - 23	8	11	5	8	4	36
23 - 24	3	3	3	2	5	16
Total	380	392	447	449	423	2091

Crashes by Time of Day for Taxi

Taxis TIME	**YEAR**					**Total**
	2007	**2008**	**2009**	**2010**	**2011**	
00 - 01	4	1	2	6	2	15
01-02	6	0	0	1	3	10
02-03	2	2	0	1	4	9
03-04	1	2	2	1	2	8
04-05	4	3	4	1	4	16
05-06	5	6	5	8	10	34
06-07	11	5	8	12	11	47
07-08	11	20	15	15	16	77
08-09	16	15	17	16	29	93
09-10	23	8	20	22	24	97
10-11	26	20	29	23	24	122

11-12	17	17	19	27	24	104
12-13	26	15	27	17	24	109
13 - 14	29	19	32	15	22	117
14 - 15	29	27	24	28	24	132
15 - 16	32	31	29	42	26	160
16 - 17	37	34	41	34	38	184
17 - 18	31	25	37	23	28	144
18 - 19	25	31	26	30	28	140
19 - 20	49	42	53	43	49	236
20 - 21	26	29	26	38	41	160
21 - 22	29	22	26	21	19	117
22 - 23	14	17	23	18	14	86
23 - 24	4	11	10	10	13	48
Total	457	402	475	452	479	2265

Appendix H: Casualty Ages

CASUALTY AGE	CASUALTY INJURY	2007		2008		2009		2010		2011		TOTAL	
		TAXI	TROTRO	TAXI	TROTRO	TAXI	TROTRO	TAXI	TROTRO	TAXI	TROTRO	TAXI	TROTRO
	Fatal	3	1	5	3	5	5	5	3	6	3	24	15
	Hospitalised	10	1	9	3	9	6	10	12	7	7	45	29
	Injury	2	2	4	5	7	8	4	4	4	3	21	22
01-05	Total	15	4	18	11	21	19	19	19	17	13	90	66
	Fatal	7	3	2	3	4	5	6	4	2	4	21	19
	Hospitalised	10	12	16	8	10	15	16	7	17	15	69	57
	Injury	5	4	8	6	9	7	11	10	7	2	40	29
06-10	Total	22	19	26	17	23	27	33	21	26	21	130	105
	Fatal	1	3	2	2	3	2	1	2	1	1	8	10
	Hospitalised	3	7	4	11	9	8	11	7	12	16	39	49
	Injury	5	11	11	14	2	22	10	6	5	2	33	55
11-15	Total	9	21	17	27	14	32	22	15	18	19	80	114
	Fatal	0	3	0	3	1	2	1	0	1	5	3	13
	Hospitalised	14	9	9	10	12	3	16	13	15	10	66	45
	Injury	21	20	21	16	22	12	14	23	17	18	95	89
16 - 20	Total	35	32	30	29	35	17	31	36	33	33	164	147
	Fatal	12	4	3	1	5	2	4	2	3	1	27	10
	Hospitalised	17	22	20	14	23	9	16	17	28	31	104	93
	Injury	42	35	31	28	40	21	38	35	37	27	188	146
21 - 25	Total	71	61	54	43	68	32	58	54	68	59	319	249
26 - 30	Fatal	5	8	8	2	5	7	8	9	6	5	32	31

	Hospitalised	40	18	26	17	29	41	40	36	40	22	175	134
	Injury	41	59	47	44	58	66	61	77	64	29	271	275
	Total	86	85	81	63	92	114	109	122	110	56	478	440
	Fatal	8	5	2	3	4	5	11	6	5	3	30	22
	Hospitalised	27	23	15	13	15	18	29	29	24	34	110	117
	Injury	27	29	12	16	28	41	52	49	26	17	145	152
31 - 35	Total	62	57	29	32	47	64	92	84	55	54	285	291
	Fatal	6	6	3	4	4	4	2	1	6	7	21	22
	Hospitalised	10	14	15	8	13	29	20	27	26	11	84	89
	Injury	22	31	12	25	27	30	22	29	29	28	112	143
36 - 40	Total	38	51	30	37	44	63	44	57	61	46	217	254
	Fatal	4	3	3	3	3	2	3	2	1	6	14	16
	Hospitalised	11	6	5	9	7	10	6	15	12	17	41	57
	Injury	14	18	10	13	13	22	13	19	14	19	64	91
41 - 45	Total	29	27	18	25	23	34	22	36	27	42	119	164
	Fatal	2	2	2	0	2	5	2	3	2	4	10	14
	Hospitalised	6	12	3	6	8	12	12	11	12	14	41	55
	Injury	6	12	5	5	8	16	12	15	9	12	40	60
46 - 50	Total	14	26	10	11	18	33	26	29	23	30	91	129
	Fatal	4	2	1	0	0	1	0	2	1	4	6	9
	Hospitalised	3	9	4	5	4	6	4	13	3	10	18	43
	Injury	2	13	7	11	6	6	10	8	8	10	33	48
51 - 55	Total	9	24	12	16	10	13	14	23	12	24	57	100
56 - 60	Fatal	0	1	2	2	2	2	1	7	1	1	6	13

	Hospitalised	0	4	6	4	8	12	6	8	2	6	22	34
	Injury	3	6	1	8	9	14	4	10	5	12	22	50
	Total	3	11	9	14	19	28	11	25	8	19	50	97
61 - 65	Fatal	0	2	1	0	1	1	0	3	2	1	4	7
	Hospitalised	1	4	1	3	2	9	6	2	2	5	12	23
	Injury	4	4	3	3	6	7	2	5	4	2	19	21
	Total	5	10	5	6	9	17	8	10	8	8	35	51
	Fatal	0	1	2	1	2	2	2	1	2	1	8	6
	Hospitalised	0	5	1	0	4	2	5	3	3	5	13	15
	Injury	1	2	1	4	0	2	2	1	0	3	4	12
66 - 70	Total	1	8	4	5	6	6	9	5	5	9	25	33
	Fatal	0	1	3	2	7	0	1	1	0	3	11	7
	Hospitalised	1	5	0	1	0	2	5	2	1	2	7	12
	Injury	1	3	0	3	4	7	1	3	2	1	8	17
71 - 75	Total	2	9	3	6	11	9	7	6	3	6	26	36
	Fatal	0	0	0	2	1	0	1	1	1	2	3	5
	Hospitalised	0	0	3	2	1	2	0	0	1	1	5	5
	Injury	0	0	1	0	0	0	0	2	1	1	2	3
76 - 80	Total	0	0	4	4	2	2	1	3	3	4	10	13
	Fatal	0	0	0	0	0	0	0	0	0	0	0	0
	Hospitalised	0	0	1	0	0	1	1	0	0	1	2	1
	Injury	0	1	0	0	0	0	0	0	0	1	0	2
81 - 85	Total	0	1	1	0	0	1	1	0	0	2	2	3
86 - 90	Fatal	0	0	0	1	0	0	0	0	1	0	1	1

	Hospitalised	0	0	0	0	0	0	0	0	0	0	0	0
	Injury	0	1	0	0	0	0	0	1	0	0	0	2
	Total	0	1	0	1	0	0	0	1	1	0	1	3
	Fatal	0	0	0	0	0	0	1	0	0	0	1	0
	Hospitalised	0	0	0	0	0	0	0	0	0	0	0	0
91 - 95	Injury	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	1	0	0	0	1	0
	Fatal	1	0	0	0	0	0	0	0	0	0	1	0
	Hospitalised	0	0	0	0	0	0	0	0	0	0	0	0
	Injury	0	0	0	0	0	0	0	0	0	0	0	0
96 - 100	Total	1	0	0	0	0	0	0	0	0	0	1	0
Total		**402**	**447**	**351**	**347**	**442**	**511**	**508**	**546**	**478**	**445**	**2181**	**2295**

	2007		2008		2009		2010		2011		TOTAL	
CASUALTY AGE	**TAXI**	**TROTRO**	**TAXI**	**TROTRO**	**TAXI**	**TROTRO**	**TAXI**	**TROTRO**	**TAXI**	**TROTRO**	**TAXI**	**TROTRO**
0-5	3	1	5	3	5	5	5	3	6	3	24	15
6-10	7	3	2	3	4	5	6	4	2	4	21	19
11-15	1	3	2	2	3	2	1	2	1	1	8	10
16-20	0	3	0	3	1	2	1	0	1	5	3	13
21-25	12	4	3	1	5	2	4	2	3	1	27	10
26-30	5	8	8	2	5	7	8	9	6	5	32	31
31-35	8	5	2	3	4	5	11	6	5	3	30	22
36-40	6	6	3	4	4	4	2	1	6	7	21	22
41-45	4	3	3	3	3	2	3	2	1	6	14	16
46-50	2	2	2	0	2	5	2	3	2	4	10	14
51-55	4	2	1	0	0	1	0	2	1	4	6	9
56-60	0	1	2	2	2	2	1	7	1	1	6	13
61-65	0	2	1	0	1	1	0	3	2	1	4	7
66-70	0	1	2	1	2	2	2	1	2	1	8	6
71-75	0	1	3	2	7	0	1	1	0	3	11	7
76-80	0	0	0	2	1	0	1	1	1	2	3	5
81-85	0	0	0	0	0	0	0	0	0	0	0	0
86-90	0	0	0	1	0	0	0	0	1	0	1	1
91-95	0	0	0	0	0	0	1	0	0	0	1	0
96-100	1	0	0	0	0	0	0	0	0	0	1	0
Total	53	45	39	32	49	45	49	47	41	51	231	220

Appendix I: License Status of Drivers

LICENCE STATUS	2007		2008		2009		2010		2011		Total	
	Taxi	Trotro	Taxi	Trotro	Taxi	Trotro	Taxi	Trotro	Taxi	Trotro	Taxi	Trotro
Full	209	229	180	198	305	297	276	320	264	294	1234	1338
Provisional	12	17	10	10	22	27	8	10	10	8	62	72
Learner	1	1	0	0	1	0	1	0	0	0	3	1
Unlicensed	1	1	1	5	2	0	1	5	1	2	6	13
Unknown	273	161	238	201	180	162	207	144	256	160	1154	828
Total	496	409	429	414	510	486	493	479	531	464	2459	2252