TRAFFIC CONGESTION:
THE BANE OF A BUS RAPID TRANSIT SYSTEM IN ACCRA, GHANA?

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DECLARATION

With the exception of references used, for which due acknowledgement has been made, I, Agyemang Ernest, do hereby declare that this dissertation is an end product of my own research under the supervision of Associate Professor Jan Ketil Rod of the Department of Geography of the Norwegian University of Science and Technology, Trondheim, Norway.

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Jan Ketil Rød (Assoc. Prof.)

DEDICATION

To the Lady whose love beautifies my World and inspires me to greater heights, Miss Abigail Oduro-Kwarteng; the world's greatest mum, Mary Abora Barfi and my sweet sister Ernestina Nyanta, I dedicate this work.

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"*Give thanks to the Lord, for HE is good. His love endures forever*" (Psalm 136:1). But for your protection, love and care during my entire study period, this thesis would never have seen the light of day. Thank you, Jesus.

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ABSTRACT

The role of transportation to urban dwellers cannot be overemphasised. Transportation enables employment, education, health services and leisure. Indeed, it ensures proper "urban insertion" (Wane, 2001, p.1). However, owing to high levels of motorization, in recent times, inadequate traffic management strategies, as well as inadequate land use and transportation planning, traffic congestion is not uncommon in cities all over the world. The economic, social, environmental and safety costs of traffic congestion are numerous and have gained much attention in the existing literature. This study proceeds with the aim of identifying the causes and the extent to which traffic congestion in the Ghanaian capital city of Accra, conspired with other factors to collapse a pilot Bus Rapid Transit System which was introduced to curb traffic congestion in the city once and for all.

With the use of the triangulation approach, research tools belonging to both the quantitative and qualitative methods of doing research, such the GIS-based techniques; five key informant in-depth interviews; three semi-structured interviews; a focus group discussion and participatory observation, in addition to using the Time-Geographic framework, the Structuration and General Systems theories respectively as interpretative guides, this study made interesting findings.

Improper land use practises, poor siting of terminals and transit points regardless of planning and architectural principles, activities of the informal economy and the woefully inadequate transport infrastructure were identified as the factors that cause traffic congestion on the Kimbu-Adenta highway on which the pilot BRTS operated. While traffic congestion made it impossible to operate scheduled bus services and increased the operational costs of the pilot project, other factors such as unhealthy competition among transport operators in Accra, the absence of a supporting legislative instrument, internal human lapses and the lack of public education were also identified as having contributed to the demise of the pilot BRTS.

Proposals to reduce traffic congestion such as improving transport infrastructure, congestion pricing, enhancing accidents management mechanisms and the implementation of the comprehensive Urban Transport Project (UTP) would not only mitigate traffic congestion but will improve the overall performance of public transportation provision in the city and ensure the success of a future BRTS in Ghana.

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LIST OF ACRONYMS

AMA..... Accra Metropolitan Area

AVI.....Automatic Vehicle Identification

AVL.....Automatic Vehicle Location

BRTS..... Bus Rapid Transit System

CBD..... Central Business District

CERSGIS.....Center for Remote Sensing & Geographic Information Services

CES.....City Express Service

DVLA..... Driver Vehicle and Licensing Authority

ESRI..... Environmental Systems Research Institute

ERP.....Economic Recovery Programme

GDA..... Ga District Area

GhIE..... Ghana Institution of Engineers

GIS..... Geographic Information Systems

GPS.....Global Positioning System

GSS.....Ghana Statistical Service

GTTC.....Government Technical Training Centre

HCM.....Highway Capacity Manual (HCM)

HOV.....High Occupancy Vehicles

IEA..... International Energy Agency

ITS..... Intelligent Transportation Systems

LDV.....Light-Duty Vehicles

MD.....Managing Director

MMT.....Metro Mass Transit Limited

NRSC.....National Road Safety Commission

OSA.....Omnibus Services Authority

KTC..... Koforidua Training Center

STC..... State Transport Corporation

SPSS..... Statistical Package for the Social Scientist

TMA.....Tema Municipal Area

ROW.....Right of Way

UTP.....Urban Transport Project

CHAPTER ONE: GENERAL INTRODUCTION TO THE STUDY

1.1. Introduction

The role of transportation in human life cannot be overemphasised. According to Intikhab et al. (*2008*), efficient transportation system plays an important role in catering to the daily necessities in the lives of the citizens. These include access to amenities and services that are central to the lives of all individuals, like employment, education, health services and leisure. At the individual level, Wane (2001, p.1) also points out that 'transportation is a crucial vector for urban insertion since it gives access to economic activity, facilitates family life and helps in spinning social networks. It links the different spaces of the city on which an individual or a family has to implement his or its tri-dimensional strategy of life (i.e. family, work, residence). So, urban mobility is at the heart of the challenges faced by any city-dweller'.

Consequently, cities in the world have witnessed tremendous motorisation during the recent century, especially since 1988 global car population exceeded 400 million (Walsh, 1990). The reason for this phenomenon, according to Dimitriou (1991) is that in both the Developed and Third World countries, few activities are more poorly managed than urban transport. As such, the failure of public transport to meet the needs of travellers has intensified the demand for private cars. A leading think tank in the UK, *The Optimum Population Trust* reported that in the year 2000, about one in nine of the world's 6.1 billion people owned a car or van. For the same year, the *Mobility 2030* report, issued by the World Business Council for Sustainable Development (2004), suggests that there were nearly 700 million light-duty vehicles (LDVs) i.e. automobiles, light trucks, and derivatives such as sport utility vehicles and minivans in cities of the world. The LDV numbers, according to the report, are said to be growing at 2 % annually until it reaches about 1.3 billion by 2030 and to just over 2 billion by 2050. Interestingly, it is said that nearly all of these increases will be in cities of the Developing World due to expanding economic growth (ibid).

Owing to this high level of motorization, combined with inadequate traffic management strategies, an aging and ill maintained vehicle stock, as well as inadequate land use and transportation planning, especially in the Developing Economies, modern-day cities have witnessed very significant proportion of traffic congestion. Described as a phenomenon of increased disruption of traffic movement on an element of the transport system, traffic

congestion is most visible when the level of demand for movement approaches or exceeds the present capacity of the element (Taylor, 1999). As Taylor et al. (2000) argue, traffic congestion presents a common, if not inevitable, facet of traffic activity in a region, particularly in urban areas.

This phenomenon has resulted in, among other things, longer travel times, additional fuel consumption, high pollution levels, vehicle wear and tear, disutility from crowding; and (in the longer run) the costs of relocating jobs and residences and a deteriorating urban environment that has a direct bearing on sustainable development (Intikhab et al., 2008; Palma & Lindsey, 2002).

The consequences of congestion in both the Advanced and Developing Economies are of special concern in urban policy making and transport planning (Taylor et al., 2000). On the economic front, it is believed that in the US alone, traffic congestion resulted in a loss of $72 billion to some sixty-eight large urban areas in 1997 (Schrank & Lomax, 1999). This figure includes time delay valued at $12 per hour (88 % of the total) and extra fuel consumption. In another study conducted by the Texas Transportation Institute (2004), it came to light that congestion had caused the US economy 3.7 billion hours of travel delay and 8.7 billion litres of wasted fuel. These figures represent an increase of 79 million hours and 262 million litres from 2002 to a total cost of more than $63 billion for the year 2003. In the UK, the Commission for Integrated Transport notes that while drivers in Central London spend up to about 50 % of their time crawling in jammed traffic, businesses in the city are also losing about £2 million a week.[1]

For the rest of Western Europe, the European Commission in 1995 reported the costs of traffic congestion to be about two percent of Gross Domestic Product (Prud'homme, 1997) which is more than double the equivalent US figure quoted above. Although traffic congestion is a global challenge, the economic impact is most disturbing when one considers the situation in the developing countries.

Willoughby (2000; cited in Carisma & Lowder, 2008)[2] indicates that estimated costs of congestion in terms of Gross Domestic Product are particularly high in the Asian cities of Bangkok, Manila and in the Republic of Korea (1.0 to 6.0 %, 4.0 %, and 4.4 % respectively).

[1] http://www.cfit.gov.uk/ruc/factsheets/london/index.htm. Accessed on 05.12.2008.

[2] http://greenconsumerism.net/wp-content/uploads/2008/08/the-cost-of-traffic-congestion3.pdf Accessed on 10.01.2009

This may be due to level of development (particularly as in the case of Bangkok and Manila) and density of population (as in the case of Bangkok, Manila and Republic of Korea). Thus, congestion costs are inversely related to the level of development and directly related to population density (ibid). However, comparatively large cities like Mexico City, Sao Paulo, Santiago and Dakar recorded low congestion costs figures (i.e. 2.6 %; 2.4 %; 1.4 % and 3.4 % of GDP respectively). These figures appear worrisome given the fact that these losses could have been used for development and improvement of the general living conditions of the citizenry. Aside the economic costs, traffic congestion can have profound adverse impacts on the social (e.g. people unable to physically contact relations on time), environmental (e.g. excessive emission of carbon dioxide to cause global warming) and safety concerns.

Given the enormity of the problem, policy makers all over the world have implemented several measures to cut down or minimise the impacts of traffic congestion by properly maintaining the current road and bridge system; constructing new roads, bridges, and non-highway infrastructure; encouraging an appropriate balance between different modes, especially by developing alternatives such as public transportation, and finally, employing transportation systems management and operations strategies to maximize the capacity of the infrastructure already in place (Paniati, 2004). Cities such as Curitiba (Brazil), Lagos (Nigeria), Ottawa (Canada), Los Angeles, and Honolulu (the United States), just to mention but a few, have developed what is termed as Bus Rapid Transit System (BRTS), as one remedy to solving the problem of traffic congestion.

It is interesting to note that even though traffic congestion is such a critical problem in some major urban areas of the world, Palma & Lindsey (2002) are of the opinion that it is not a recent phenomenon at all. It is said that the 'problems of traffic congestion in urban areas were prevalent during the 18th and 19th centuries and also during the heyday of the Roman Empire' (Stopher & Meyburg, 1975, cited in Ogunjumo & Agbemi (1991, p.391). Indeed, chariot riding was banned in Rome during peak hours because of traffic jams (Gibbs 1997). However, the current prevalence of congestion in surface travel has been exacerbated by sheer volume of the automobile and other motorized forms of transportation on the roads. The situation is further aggravated by the human population explosion, especially at the urban centres.

Ghana, like most countries in the Third World, is no exception to the above described phenomenon. Indeed, with its high growth rate and the natural desire among the population to have vehicles of their own, Kwakye and Fouracre (1998, p.1) notes with concern that 'the

high urban growth rate in the country is outpacing the provision of services... thereby making it difficult to plan and programme transport in harmony with urban development'.

1.2. Statement of Research Problem

Located at latitude 5°33' North and longitude 0°13' West, Accra is Ghana's largest administrative and economic centre. As at 2005, a little fewer than 2 million people lived in this urban conurbation and it is estimated that the figure would have risen to 4 million by 2020 (GSS, 2002; Yankson & Grant, 2003). Consequently, one of the key challenges to government and stakeholders is to provide sustainable public transport to the teeming population.

Until the recent last two decades of the twentieth century, Accra had a well planned and managed public transport system that was owned by the state. This public transport system operated using big and comfortable buses which were not only safe and regular, but were reliable as well. However, this state-run urban transport system collapsed due to poor performance of the economy and associated mismanagement (Addo, 2002). This provided the impetus for the growth and development of the famous *trotro* system[3] which has become the major public transport provider in Accra and beyond. Besides this system, a greater number of residents in the city own and use private cars for their daily transportation needs.

Not only are the vehicle stock used under the *trotro* system old and poorly maintained, but they also account for the acute traffic congestion experienced in the city. Therefore, Fouracre et al. (1994) propose a shift to the use of larger vehicles such as buses in order to overcome traffic congestion. Again, it is said that a system of bus service which is convenient, accessible, comfortable, reliable and operating within acceptable levels of noise, vibration and pollution would be such welcoming news to majority of people (Guohua et al., 2007).

Following from the above and against the backdrop of Ghana's desire to achieve a middle-income status by the year 2020, the nation has sought to 'establish an efficiently and modally complementary and integrated transport network for the movement of people and goods at least cost throughout the country' (Kwakye & Fouracre, 1998, p.2). In line with this agenda, the Metro Mass Transit system was introduced in October 2003 with a vision 'to

[3] See Chapter 5. TRANSPORT AND CONGESTION IN ACCRA

provide an efficient urban mass transport system in Ghana through the use of buses'. The Metro Mass Transit Limited was tasked with the operation of this bus service.[4]

The company introduced what was referred to as the *Bus Rapid Transit System (BRTS)*[5] on a pilot basis in Accra, in September, 2005, to mitigate the traffic congestion phenomenon in the city. Following an overwhelming success that was chalked by the pilot project in the initial phase of its implementation, as seen by the massive public ridership, one would have thought that the operator of the scheme – the Metro Mass Transit Limited – would now be basking in the glory of being the pacesetter in implementing a BRTS in the whole country. However, in just a little over two years of its operation, the company reverted back to the provision of 'regular' bus service to the travelling public of Accra. What this simply means is that their buses can now hawk for prospective passengers, just like the private commercial drivers do, besides those who queue at their various designated bus stops.

A lot of researches have been conducted into the phenomenon of urban transportation across the globe and especially in cities of the developing economies. Most of the research is about travel behaviour (Dissanayake & Morikawa, 2008); pollution (Atash, 2007); regulation and management (Sohail et al., 2004); motorization policies (Willoughby, 2001) and congestion (Daganzo & Cassidy, 2008).

Few authors have shown interest in urban transportation issues in Ghana. These authors have researched on issues such as injuries or traffic accidents (Mock et al., 1999; Jørgensen & Abane (1999) and modal choice (Abane, 1993). Aside these notable ones, not much has been written on the issue of transportation in the urban setting, especially as it relates to the impacts of traffic congestion on public transport provision.

Therefore, this study aims to delve into the problem of traffic congestion in Accra, and how it contributed to the collapse of the pilot BRTS. This will go a long way to provide the requisite feedback that could influence transportation practitioners, policy makers, transportation geographers and planners in general, to put in practical measures to address the challenge. This will ensure a general improvement in the transport sector which will have several positive impacts on the residents of Accra.

Coupled with the above, this research perfectly fit into the comprehensive package of measures known as the Urban Transport Project (UTP) in Ghana which aims at enhancing the efficiency and affordability of the urban transport sector, bearing in mind that the overall aim

[4] http://metromass.com/pub_trans_gh.htm. Retrieved on 20.12.2007
[5] See 6.4. BRTS in Ghana: Characteristics

of its development is to contribute to the improvement in the quality of life of the community (Kwakye & Fouracre, 1998).

1.3. Statement of Research Objectives

The erstwhile pilot Bus Rapid Transit System (BRTS) on the Kimbu-Adenta Highway will form the main theme for this research. Specifically, the study aims to:

1. identify the causes of traffic congestion on the Kimbu-Adenta corridor;
2. identify the extent to which traffic congestion adversely affected the pilot BRTS;
3. identify other potential causes for the demise of the pilot BRTS.

1.4. Statement of Research Questions

Emanating directly from the above stated objectives, the following research-worthy questions are asked:

1. what are the factors that culminate in the occurrence of traffic congestion on the former pilot BRTS corridor?
2. to what extent did traffic congestion affect the operations of the pilot BRTS?
3. are there other factors that jointly contributed to the collapse of the pilot BRTS project in Accra?

1.5. Organisation of Chapters

This study has been organised into seven chapters. The first chapter proceeds with a general introduction which is meant to serve as the foundation stone upon which to build the entire thesis. Readers are then introduced to the main research problem and objectives to be addressed, as well as research questions for which answers are sought for in the subsequent chapters. Chapter two presents the theoretical underpinning on which this study positions itself, in addition to a review of relevant and current literature on the subject under discussion.

The main theme for chapter three is a discussion of the methodology employed in this research. Sub-themes such as data sources, research tools used, challenges faced, reliability and limitation issues, as well as how the data is analysed and presented are thoroughly discussed. In chapter four, readers are introduced to the various characteristics of the study area which directly or jointly affect the chosen topic and which will help answer the research questions posed.

With a general discussion on the nature of public transportation services and the severe traffic congestion phenomenon in Accra, chapter five serves as the forerunner for chapter six, which discusses in-depth, the results and findings from the research field vis-à-vis the theories, reviewed literature as well as the stated objectives and questions in this study.

Chapter seven draws the curtain on the study with a summary of the various findings, and the associated policy implications as well as strategic recommendations which when implemented, will go a long way to improve the overall performance of public transport provision in Ghana.

The preceding chapter is a discussion of the theories employed in this study and a literature review.

CHAPTER TWO: THEORY AND LITERATURE REVIEW

2.1. Introduction and Definition of Theory

Theory may be defined 'as a system of interconnected abstractions or ideas that condenses and organizes knowledge about the social world' (Mikkelsen, 2005, p. 157). It is used in explanation (Johnston et al., 2000) and helps us to think through research (Pryke et al., 2003). Therefore, it is argued that 'without theory, there is nothing to research' (Kitchin & Tate, 2000, p.32; Silverman, 1993).

There is no one unified theory that is applied by all social and physical scientists to explain the world. Instead, there are myriad explanatory frameworks that invoke different theoretical paradigms and approaches, some of which are more dominant at different points in time and space (Del Casino, 2006, p. 484).

In most instances, theories are derived from what is called metatheories. Metatheories are 'constituted by epistemological assumptions (how we know the world) and ontological assumptions (how the world is structured to produce knowledge)'. Is it also said that 'ontology and epistemology, taken in conjunction, frame our theories about how the world might work and how best to study that world' (ibid, p. 485).

2.2. Theory: The Philosophical Debate in Geography

The greater majority of the late 20th and early 21st century geographic inquiries have been informed by four major metatheoretical paradigms. These, according to Del Casino (2006) are: spatial science, humanism, critical realism and poststructuralism.

These schools of thought within the discipline of geography have advanced strong arguments as to which approach to theory is best for understanding the complex human-environment relationships in both space and time. Their respective characteristics and arguments, as documented by Del Casino (2006), are presented and discussed.

Spatial science historically is based in the philosophical tradition of logical positivism. Epistemologically, positivism favours objectivity; ontologically, it favours order. Positivism operates within the assumption that through the generation of hypotheses, and the empirically testing of those hypotheses, it is possible to generate laws about how the world works. Once the laws are proven, they 'may be generalisable for universal application'. The spatial scientist, operating from the position of objectivity, treats the field as something 'out

there'; the subject position of the researcher is distinct and separate from the people the researcher claims to study.

In contrast, *humanism* in geography favours subjective experience to objective law. Epistemologically, whereas spatial science favours generalisability, humanism favours individuality. Humanists, through a focus on subjective experience, eschew the notion that it is possible to test hypothesis of the social world empirically; thus they shy away from deductive theories. Theoretically, humanism's interests lie in the area of emotions, individual control and agency, and embodied experience. Similarly, humanists theoretically believe the world to be orderly, although that ordered world is situated and experienced at the individual level. They are also interested in intersubjectivity, that is, relations between subjects and relations between subjects and their place in the world.

Critical realism, the third important theoretical framework in geographical research, is 'based in part in structuralism'. Ontologically, critical realists still assert that there is a real set of processes that structure social life but contend that those processes are mediated by human knowledge and experience. Theoretically, critical realists understand the world through empirical investigations of it, although they have become increasingly interested in the role of discourse and language as objects of analysis of contingent relations. In this school of thought, oppositional tendencies to bifurcate objectivity and subjectivity, as in spatial science and humanism, are collapsed.

Epistemologically, *poststructuralism* operates under the assumptions that the world is understood through subjective experience; ontologically the world is chaotic. The assumptions that experience is subjective but that subjectivity is mediated by the deployment of power through representations and representational practices, therefore, allow poststructuralists to turn their attention not only to the social construction of space but also to the ways in which theorists themselves construct the world through the use of their own epistemological lenses.

While agreeing with Ragurman (1994), cited in Kitchin & Tate (2000, p.6), that such complex philosophical debates often lead to 'a lot of apprehension, disenchantment and an uneasy feeling of being lost in a philosophical wilderness', it is nevertheless recognised that such debates are helpful: first, it enables the researcher to understand what other researchers have done and why, and secondly, it allows for an approach on which to base one's research on, in addition to having a theoretical context in which to justify the outcomes of one's research.

Added to the above, theories and theoretical thinking are important because they inform the overall research process. Indeed, they are more than just our epistemological and ontological assumptions as they greatly influence on the choice of methodology a researcher may adopt.

However, one must not lose sight of the fact that in spite of which 'paradigm' or metatheory a researcher applies, 'theories are only explanations of how the world operates' (Del Casino, 2006, p. 478). Then again, it is possible that the boundaries between theories and their objects of analyses may remain blurry. Therefore, it is best to 'create theories that are multi-paradigmatic and multi-methodological and that it might be best to consider what various theories have in common rather than drawing on the boundaries around what might be different' (ibid,p.487).

2.3. Concepts and Theories Employed in this Study

The *Time-Geographic* framework is employed, in addition to elements in the *Structuration* and *General Systems* theories respectively in answering the research questions. It is aimed that by the use of these framework and theories, an understanding of the factors that conspired to collapse the pilot BRTS could be obtained. Moreover, as in all researches conducted in human geography, the reality associated with the human-environment relationship, both in space and time are often multi-faceted and complex. Therefore, a combination of concepts and theories may illuminate more than any single concept or theory will do.

2.3.1. Time-Geographic Framework

Taylor (2003) maintains that time and space form the basic physical dimensions of the universe. It is believed that our world is a dynamic place and examining how things change over time allows us to discover temporal patterns (Peuquet, 2006).

Thus, even though Hägerstrand's (1970) *Time-Geography* framework was originally proposed to focus mainly on the relationships between human activities and various constraints in a space-time context (Golledge and Stimson, 1997), this framework has been used frequently in a lot of researches to study spatial and temporal characteristics of human activities in physical space (for example, see Carlstein, 1982; Ellegård, 1999; Parkes & Thrift, 1980; Yu and Shaw, 2007).

In order to posit the Time-Geographic framework in its proper perspective for the purpose of this study, the discussion begins with the geographical concept of *space* first. This is then followed by an in-depth discussion of the framework itself and how it applies to this study.

Space as a concept in geography is as relevant as is divisive. Indeed, the argument has been made that 'the importance of the concept of space in geography has always been controversial (Holt-Jensen, 1999; Unwin, 1992) and whether geography or geographers should primarily focus on, or at the very least, give some recognition to the importance of space remains a fundamental question for the discipline' (Kent, 2003, p. 109).

Historically, special importance has been attached to the power to fix the locations of events, places and phenomena on the surface of the earth and to represent these on maps. In his *The Nature of Geography* (1939), Richard Hartshorne argues that areal differentiation is the pivot and pinnacle of geographical enquiry, and he treated geography as a 'correlative discipline' whose research methodology involved making comparisons between maps in order to disclose 'the functional integration of phenomena' over space (Johnston et al., 2000).

However, Hartshorne, like most of his peers, took it for granted that space (like time) was a universal of human existence, an external coordinate of reality, an empty grid of mutually exclusive points, 'an unexchanging box' *within which objects exists and events occur:* all of which is to say that he privileged the concept of *absolute space* (Smith, 1984, p. ix, cited in Johnston et al., 2000, p. 67-8).

According to Holt-Jensen (1999), the proponents of absolute space treat space as a container in which 'first we delimit a spatial section of the earth and then start to examine its content'. He goes on to argue that the notion of vertical connections i.e. humanity's dependence upon local natural resources was the conceptual basis for such studies. Also, even though Johnston et al. (2000) acknowledge that Hartshorne's work occupies a strange position within modern geographical discourses about space, he nevertheless failed to provide a systematic discussion of the concept of space and even his subsequent genealogy of geography as one of the 'spatial sciences' (with astronomy and geophysics) failed to elucidate the conceptual basis of his claim.

Other critics also argue that in contrast to the views expressed above whereby spatial relations are viewed exclusively between the fixed points of a coordinate system, the focus within current discourse on spatial relations must be defined *between objects and events* and thereby made relative to the objects and events that constituted spatial system or spatial structure. Hence, the concept of *relative space* – the location of, and distance between,

different phenomena in the structure –gained prominence among geographers, especially the critics of Hartshorne.

By introducing the concept of relative space, horizontal spatial relations and distance measured in different ways could be given explanatory power. Distance could be measured in terms of transport costs, travel time, mileage through a transport network and even as perceived distance. However, Werlen (1993; also cited in Holt-Jensen, 1999) maintains that the notion of relative space is a blind alley and that actions, rather than space, should be the focus of human geographic inquiry. As noted previously, the concept of space and its various characteristics have been the subject of many debates among human geographers to the extent that newer conception of space as '*real, material, concrete, non-real, imagined* and *symbolic* have all emerged in the discipline (Johnston et al., 2000).

Hägerstrand (1970) and his colleagues at Lund did manage to use the concept of space together with the concept of *time*, which until that era had been considered only as an external factor in activity study. Time, according to Hägerstrand, was as essential as space and should be explicitly included in the investigation process.

Therefore, his conception of *Time-Geography* employs a two-dimensional space as a base map to which time is added as a vertical dimension to conceptualise the time-space paths of individuals 'upwards' and sideways through this three-dimensional diagram as they carried out their everyday tasks. For each individual, he argues, that depending on his or her access to travel facilities, there is a time-space prism that defines the boundaries of what activities are possible from his or her home base. Occasionally, an individual's time-space will crash with that of other people as they also carry out their daily activities. A classical case of this scenario, according to Taylor (2003), is a typical 'rush hour' where commuters' time-space paths converge to create a time-space population concentration.

According to an exposition provided by Yu and Shaw (2007), *Time Geography* assumes that an individual's activities are limited by various constraints. Three types of constraints that can impact an individual's ability to conduct activities in space and time are: *capability constraints, authority constraints*, and *coupling constraints* (Golledge & Stimson, 1997; ibid). Physiological necessities (e.g. sleeping, eating) and available resources (e.g., auto ownership) that can constrain a person from participating in activities are recognized as *capability constraints*. *Authority constraints* reflect general rules or laws that limit a person's access to either spatial locations (e.g., a military base) or time periods (e.g., open hours of a library). *Coupling constraints* are spatial and temporal requirements that allow an individual

to bundle with others to conduct certain activities (e.g., having a meeting at a conference centre at 3pm). Among these three types of constraints, capability and authority constraints focus on issues related to separate individuals while coupling constraints deal with interactions among multiple persons.

There are two major time geographic concepts. These are the space-time path and prism.

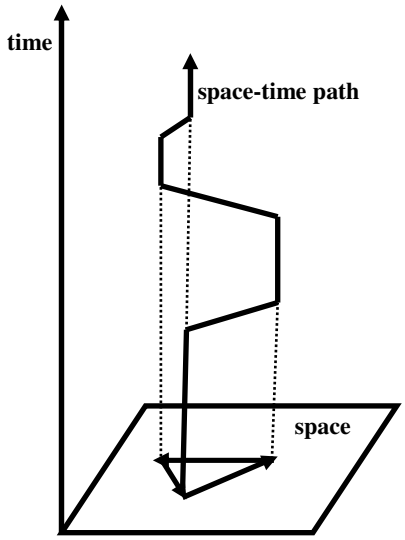


Figure 2.1 The space-time path.

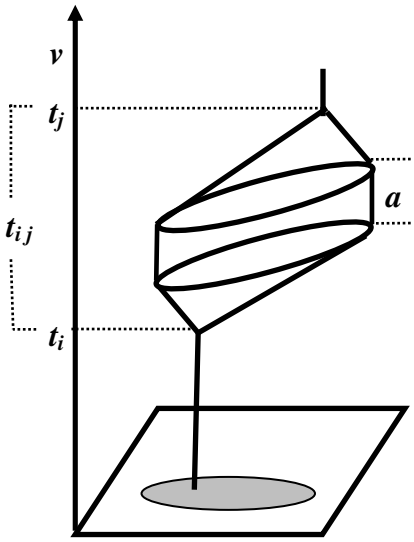


Figure 2.2 The space-time prism. (Hägerstrand 1970)

As illustrated in Figure 2.1, the *space-time path* traces the individual's physical movement in space with respect to time. According to Miller (2003), the path highlights the constraining effects of a person's need to be at different locations at different times. It also highlights the role of transportation in mitigating these constraints. The slope of the curve illustrates the relationship between time and space in movement. A steeper slope indicates less efficiency in trading time for space, i.e., more time required per unit space in movement. The path is vertical when the individual is stationary in space. The path can never be horizontal. The space-time path can be applied at any temporal scale from real time to a lifespan (Hägerstrand 1970; ibid).

The *space-time prism*, as illustrated in Figure 2.2, delimits the possible locations for the space-time path. In the words of Miller (in press),[6] fixed activities anchor a space-time prism since (by definition) these allow only one spatial possibility during their duration. For example, the two anchoring locations in Figure 2.2 could be the person's home (which s/he can leave no earlier than time t_i) and work (where s/he must be no later than time t_j). At some time during the time interval $t_{ij} = (t_j - t_i)$, the person must stop at some location to conduct an activity that will require at least *a* time

[6] http://www.geog.utah.edu/~hmiller/papers/Activities_Space_Time.pdf. Accessed on 12.02.2009

units. Finally, the person can move with an average maximum velocity *v*. The interior of the prism is the *potential path space* which shows the points in space and time that the person could occupy during this travel episode. A person cannot participate in an activity unless its space-time path (reflecting its location and time available) intersects the potential path space to a sufficient degree. Miller further contends that the projection of the potential path space to geo-space provides the *potential path area* i.e. all spatial locations that the person could occupy. A person cannot participate in an activity unless its location falls within the potential path area (ignoring the temporal duration of activities).

Gatrell (2006) remarks that the Time Geographic concept has been critiqued, first, for being reductionist i.e. humans are reduced to actors travelling paths to and from stations (or locations) determined primarily by capability, coupling, and authority constraints. Second, the method is intensive and requires a great deal of resources to effectively establish the time geography of an individual, place or local culture, therefore the scale of analysis is highly localised. Third, Time Geography became embedded within the larger structure and agency debate of the late 1970s through the mid 1980s. Expectedly, Time Geography was critiqued by humanists and structuralists alike as either too dependent on structure or too dependent on agency, respectively.

One could, however, contest Gatrell's (2006) second critique of the Time-Geography framework. The method may have been intensive and required lot of resources in the past but with modern-day GPS tracking technology, it is less laborious to generate time-space diagrams. The GPS tracking technology records where and when an individual has been. The data is then imported into 3-Dimensional lines for visualisation and subsequent generation of the time-space diagrams. If a researcher cannot afford the 'high-tech' GPS technology, perhaps a 'low tech' technology such as the *traffic congestion registration form*, as has been used in this study, could be employed as well.

Again, in spite of the above criticisms and the apparent difficulty associated with its application to real world problems, Miller (in press) acknowledges that a good number of transportation geographic studies, such as Janelle et al. (1998); Kwan (1998); Miller (1999) and Thill & Horowitz (1997a, 1997b) have made good use of the Time Geographic framework. Special mention must, however, be made of the use of the Time Geographic framework in recent *GIS-Transportation* studies i.e. the application and adaptation of GIS to research, plan, and manage transportation. Wu & Miller (2001) have developed what they call a *dynamic potential path tree* (DPPT), which is an improvement of the earlier *network time prism* (NTP), to show variations in accessibility in space based on the individual's

departure time in a network with discrete-time flow dynamics, in addition to studying variation in traffic flow and congestion over time.

How is the Time Geographic framework of relevance to this study? For the purpose of this study, 'human activities', as used as used by the proponents of the Time Geographic framework, is replaced with 'pilot BRT operations'. As the pilot BRTS buses plied their time-space prism i.e. the Kimbu-Adenta highway, their operational success or otherwise is a function of the various constraints. *Capability constraints* (e.g. availability and maintenance of high capacity buses and other operational logistics, service quantity and quality, etc.), *authority constraints* (e.g. availability of road infrastructure, traffic law enactment and enforcement), and *coupling constraints* (e.g. unhealthy competition from *trotro* and taxi operators, traffic congestion) are some of the potential factors that might have jointly conspired to collapse the pilot BRTS in Accra.

2.3.2. Structuration Theory

According to Gregory (1994, p. 600), the structuration theory is seen as 'an approach to social theory concerned with the intersection between knowledgeable and capable social agents and the wider *social systems* and *structures* in which they are implicated' (emphasise mine). Even though authors such as Bourdieu (1977), and Bhaskar (1979) had mentioned this theory in their writings, it was the work of the British sociologist Anthony Giddens (1979; 1984) that popularised the theory and made the most profound impact in human geography (Holt-Jensen, 1999, p. 124).

Structuration theory is based on the proposition that 'structure is always both *enabling* and *constraining*, in virtue of the inherent relation between *structure* and *agency* (and agency and power)' (Giddens 1984, p. 169). Moreover, the dualism between subject (the knowledgeable human agent) and the object (society) has to be reconceptualised as a duality – the duality of structure' (ibid, p. xxi).

Structure, as used here, may be considered as rules and resources. Resources may be of two kinds: *authoritative resources*, which derive from the coordination of the activity of human agents, and *allocative resources*, which stem from control of material products or of aspects of the material world" (ibid, p. xxxi).

He, therefore, draws attention to the fact that structure must be viewed as the 'structuring properties allowing the binding of time-space in social system, the properties which make it possible for discernibly similar social practices to exist across varying spans of

time and space and which lend them 'systemic' form'. Therefore, in his view, 'those practises which have the greatest time-space extension within such totalities can be referred to as institutions' (ibid, p. 17).

Institutions, by definition, are the more enduring features of social life (ibid, p. 24) or as North (1993, p. 3) calls it, 'the rules of the game in society or, more formally, are the humanly devised constraints that shape human interaction'.

North (1993) identifies three kinds of institutions. These are *political*, which mobilizes 'authoritative resources' in that it wields 'the transformative capacity generating command over persons or actors'. The second is *economic*, which controls 'allocative resources', i.e. 'capabilities or more accurately, forms of transformative capacity, generating command over objects, goods or material phenomena' (ibid, p. 33). The third and final is *legal* institutions.

Constraints, as used by Giddens, also refer to the 'limit which the physical capacities of the human body, plus relevant features of the physical environment, place upon the feasible options open to agents' (ibid, p. 174)

The structuration theory has not gone without scathing criticism. For instance, John B. Thompson, a close friend and colleague of Giddens at the Cambridge University, draws attention to the 'looseness' of the latter's explanation of structures as rules and resources and argues that Giddens has not provided adequate account that will make it 'useful and satisfactory to identify social structure with rules (and resources)' (Stones, 2005, p. 47; Thompson, 1989, p. 64). Other critics, such as Archer (2004) and Parker (2000) believe that 'the moment of structuration theory passed sometime ago. It still figures prominently in routine social theoretical talk, but its force is only that of a tired conventional wisdom' (cited in Stones, 2005, p. 45). The main reason for such uneven fortunes of structuration theory 'has been the absence of any concerted and systematic attempt to respond to criticisms at the theoretical level. The person one might expect to undertake this task, Anthony Giddens, defied any such expectations' Stones (2005, p. 2).

Be that as it may, this study finds some elements of the structuration theory quite useful. I will, in the ensuing paragraphs, explain the relevance of employing the structuration theory.

The supply of public transport is limited to a large degree by the existing structures or resources available to the provider. The Metro Mass Transit Limited's operation of an 'express' bus service in Accra could only take place on the existing infrastructure, the major

of which is roads, whose construction and maintenance is largely the function of the political institutions of Ghana. Political institutions can undertake certain decisions that may *enable* or *constrain* human interactions. In the early 1980's, Ghana underwent series of structural adjustments aimed at 'improving the competitiveness and efficiency of the economy' (Ellis, 2000, p. 164). Such adjustment is also typically taken to include attention to infrastructure, both *economic infrastructure* (roads, railways, telecommunications, energy supplies) and *social infrastructure* (health and education services) (ibid, 165).

Thus, the structuration theory illuminates on the research objective of identifying the challenges of urban transport provision in general, and of particular interest, the factors that culminate in the occurrence of traffic congestion in Accra and the extent to which the existing transport structures *enabled* or *constrained* the operations of the former 'BRTS'.

Even though the structuration theory is a sociological concept, Giddens' (1984) assertion that 'there are no logical or methodological differences between human geography and sociology', (p. 368) and that the structuration theory 'will not be of much value if it does not help to illuminate problems of empirical research' (p. xxix), provides further justification for its usage in this study.

2.3.3. General Systems Theory

Hammond, (2002, p. 429) writes the history of systems theory by quoting West Churchman that 'it all began with four people: Bertalanffy, Boulding, Gerard and Rapoport who met in 1954 at the Stanford Center for Advanced Study in the Behavioral Sciences.'

She notes furthermore that one of the famous founders, Ludwig von Bertalanffy and his three categories of systems thinking – technology, science, and philosophy – provide a useful starting point for an analysis of the philosophical and ethical foundations of the systems field (Hammond, 2005, p. 20).

As postulated by L. von Bertalanffy (1968), all things (as objects primarily but also as ideas) have connections with many other things and the significance of any one depends on its relationships with others. Hence, the unit of study should be not a single thing but a system of interrelated objects or ideas (Chisholm, 1967, p. 45).

System is a group of elements organised such that each one is in some way interdependent (either directly or indirectly) with every other element. In addition, it is required that the systems have a function, goal or purpose (Johnston et al, 2000 p. 818).

Furthermore, studies of systems, according to Johnston et al. (2000), have always tended to address four key issues. First, whether a system is *closed* (i.e. has no links to or from a surrounding environment) or *open* (i.e. have and interact with the milieux). The latter is more common in geographical inquiry. Second, whether the system can be divided into *subsystems*, or clusters of interdependent elements which are only weakly-linked to the remainder of the system. Third, whether the links involve *flows, causal relationships* or *'black-box' relationship* (in which the consequence of the link is known but the causal factors are not). Lastly, whether there is a *feedback* in the system such that change in *x* may stimulate change in *y,* and this will in turn have an impact on *x,* either positive or negative. When there is negative feedback, it means that there is disharmony between and among the various sub-systems and this may lead to inefficiencies, or what Bertalanffy (1968) refer to as *entropy* or *disorder* in the whole system.

However, the problem with the systems thinking is that systems may be embedded in systems, and that what we choose to regard as an element at one level of analysis may itself constitute a system at a lower level of analysis. However, these difficulties in the notion of systems embedded within systems *ad infinitum,* according to Harvey (1969, p. 453), is an attractive one.

In geography, the systems theoretical concept has found much relevance, especially in the physical aspects of the discipline. Contemporary physical geographers have extensively used the theory in researching on themes such as atmosphere, weather, climate, biogeographic processes, soils, weathering, mass wasting and land forms (Christopherson, 2005; Pidwirny, 2006; Strahler & Strahler. 2003). The reason for its relevance to physical geography might not be far-fetched especially when one considers the fact that the objects of study and modus operandi of physical geographers are similar or almost the same as the physical sciences from which the general systems theory first evolved.

However, the same cannot be said of human geographers. In fact since its introduction into the discipline of geography by the British geographers, R. J. Chorley (1962) and P. Haggett (1965), it has been said that the 'applications of general systems theory principles within human geography made few substantive achievements, however (the early work on macrogeography was a partial exception), and few geographers now search for such universals' (Johnston et al., 2000, p. 293). Chisholm is even quoted to have described the concept as 'irrelevant distraction' (ibid).

The reason for the lack of popularity of the general systems theory in human geography may be that the concept was introduced during the Quantitative Revolution of the discipline in the 1960s. Studies conducted during this era have been generally labelled as positivistic in the sense that not only did the proponents seek to make generalised statements about human spatial behaviours but they also attempted to incorporate physical laws directly into a social science discipline like geography.

It needs to be mentioned also that this theory has received its share of criticisms by renowned scholars, especially Giddens (1984), who for instance, criticises the theory for what he refers to as its 'empire-building endeavours' by emphasising the pre-eminence of the social whole over its individual parts. Also, in line with hermeneutic tradition, he regards the social and natural sciences as radically discrepant.

Be that as it may, Chisholm's (1967 p. 48) argument that 'the General Systems Theory seems to offer a means of unification through the discovery of principles that are relevant to both physical and human geography' and Bertalanffy's (1968, p. 34) own assertion that, 'it seems, therefore, that a general theory of systems would be a *useful tool*, providing, on the one hand, models that can be used in, and *transferred to, different fields*, and safeguarding, on the other hand, from vague analogies which often have marred the progress in these fields' (emphasise mine), provide major sources of justification for the use of this theory in this study.

This study does not seek to make generalisations. Neither does it seek to relive a futile attempt to force physical laws into the social sciences but certain basic assumptions and concepts of the general systems theory such as *sub-systems*, *relationships and flow* and *feedback* are not only appealing, but it is also believed that they will help illuminate on the factors that conspired to collapse the pilot BRTS in Accra. These are the justifications for the choice of the General Systems Theory.

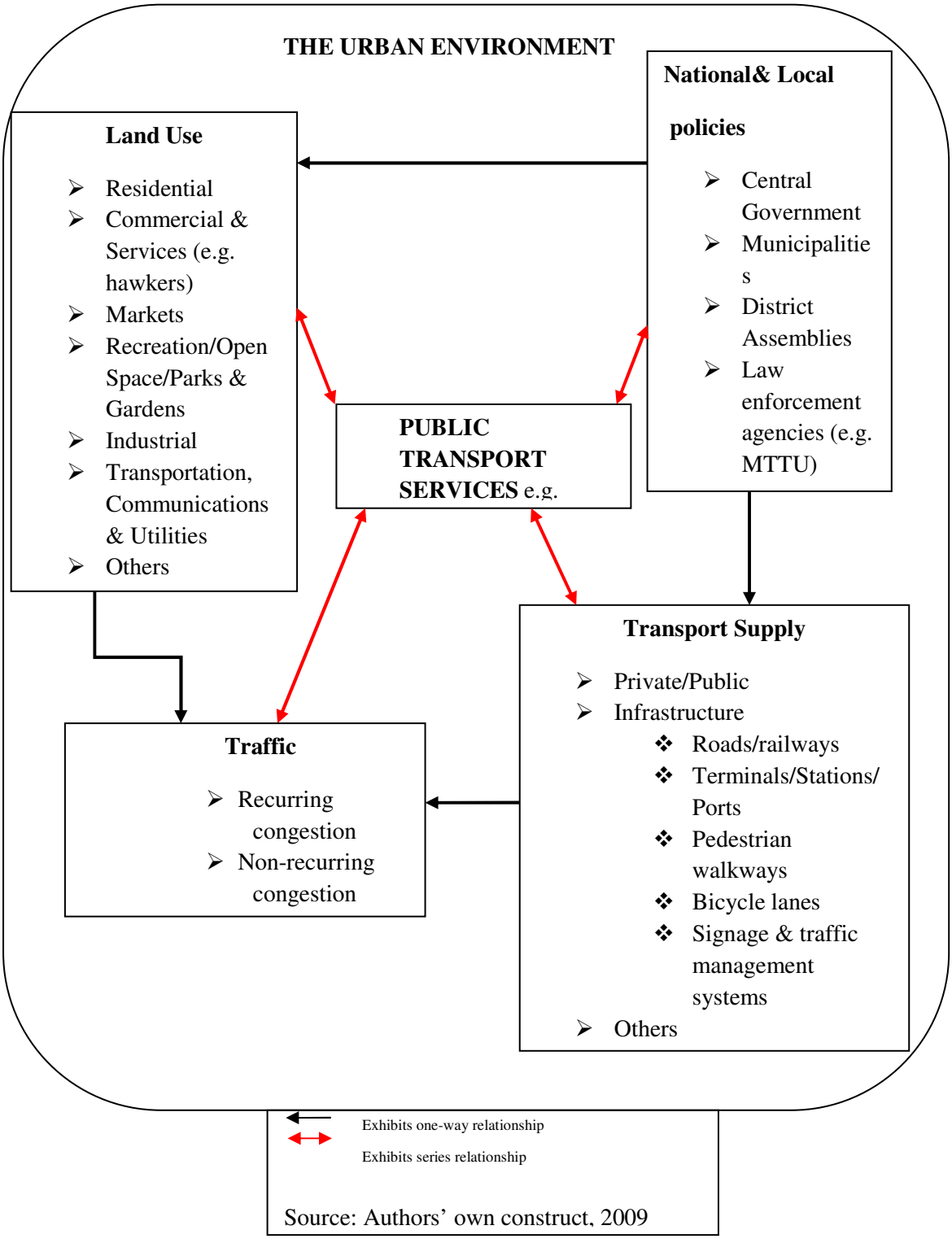
Transport geographers are concerned primarily with 'the provision of transport systems, the use of those systems for the movement of people and goods, and the relationship between transport and other geographical phenomena' (Johnston, 2000 p.855). Transport systems, it is argued, 'are complex and subject to continual change. Furthermore, there is no simple definition of what constitutes a transport system. Much depends on the eye of the beholder' (Button & Hensher, 2001, p. 2). In analysing the urban transport system using the general systems theory, three influencing key subsystems have been identified for the purpose of this study. These are land use, transport supply and traffic.

Land use may be seen as the legal use of land, the type of structures and socioeconomic activities. *Transport supply*, according to Jean-Paul et al. (2006), refers to the capacity of transportation infrastructures and modes, generally over a geographically defined transport system and for a specific period of time. Therefore, supply is expressed in terms of infrastructures (capacity), services (frequency) and networks. The number of passengers, volume (for liquids or containerized traffic), or mass (for freight) that can be transported per unit of time and space are commonly used to quantify transport supply. According to Addo (2002), *traffic*, the third subsystem, is a direct function of land use. Urban transport system is seen as a sub-system which is an integral part of the much wider urban system.

As illustrated in Figure 2.3. below, traffic congestion in Accra, be it *recurring* due to insufficient capacity, unrestrained demand and ineffective management of capacity (e.g. poor signal timing); or *non-recurring* due to accidents, work zones, weather events etc.[7], is a direct function of land use, which is in turn shaped by national and local policies. Again, such policies have direct bearing on transport supply which also influences the occurrence of traffic congestion. All these sub-systems affect public transport services. The urban environment acts as the wider system under which all these sub-systems exist and operate. With the use of General Systems Theory, the linkages or relationships, flow and feedbacks between and among the various sub-systems are illuminated. Besides, it will be useful for this study, to assess the roles, responsibilities and dynamic interactions between and among the various actors (e.g drivers, pedestrians, hawkers, the transport policy makers and legislators such as the political administrators, traffic law enforcers e.g. the police) as parts of one whole system in order to get the full picture as to some of the other possible factors that might have conspired against the successful implementation of the pilot BRTS in Accra.

[7] http://ops.fhwa.dot.gov/program_areas/reduce-non-cong.htm. Accessed on 07.05.2008

Figure 2.3. The Urban Transport System



Source: Authors' own construct, 2009

2.4. Literature Review

2.4. 1. Introduction

Owing to its ubiquitous occurrence, especially in cities across the world, various academic disciplines, such as geography, economics, planning, computer applications and engineering have given tremendous attention to the subject of traffic congestion. The greater part of the current literature, however, seems to be concentrated on issues like modelling traffic dynamics (Chevallier et al., 2009); modelling traffic flow (Cho et al., 2009), and visual based traffic monitoring system (Wang & Ruskin, 2002).

This chapter reviews other relevant literature that defines and characterises traffic congestion as well as the impacts of the phenomenon. Special attention is also given to existing literature on the bus rapid transit system.

2.4.2 Definition and Types of Traffic Congestion

It has been argued, and rightly so, that 'traffic congestion presents a common if not inevitable facet of traffic activity in a region, particularly in urban areas' (Taylor et al., 2000, p. 267). Although this phenomenon is human-induced and it is seen as an integral element in any transport system all over the world, a unanimous definition has defied scholars.

A review of the several definitions reveals three basic recurrent themes. First of all, congestion involves the imposition of additional costs on all users of a transport facility by each user of that facility. Secondly, transport facilities (such as road links, intersections, lanes and turning movements) have finite capacities to handle traffic, and congestion occurs when the demand to use a facility approaches or exceeds the capacity. Finally, congestion occurs on a regular, cyclic basis, reflecting the levels and scheduling of social and economic activities in a given area. This may be properly termed as *recurring congestion*. On the other side of the coin, special episodes of congestion may occur at different points in a network due to irregular incidents, such as road works, breakdowns or accidents. This may also be referred to as *non-recurring congestion* (Taylor, 1992; Taylor et al., 2000). Following this review, a more comprehensive definition which has gained acceptance for use in traffic studies is that of Taylor (1999). He notes:

> traffic congestion is the phenomenon of increased disruption of traffic movement on an element of the transport system, observed in terms of delays and queuing, that is generated by the interactions amongst the flow units in a traffic stream or in

> intersecting traffic streams. The phenomenon is most visible when the level of demand for movement approaches or exceeds the present capacity of the element and the best indicator of the occurrence of congestion is the presence of queues (Taylor et al., 2000, p. 269).

One other theme worth mentioning is that traffic congestion is dynamic and thus, varies spatio-temporally, that is to say, it varies with space and time.

2.4.3. Why Does Traffic Congestion Occur?

Palma & Lindsey (2002) note that the occurrence of congestion in all transportation facilities may be accounted for by three features that characterise travel demand and supply. The reasons are that demand varies over time, supply is relatively fixed over long time periods and output is not storable.

Expatiating further, these authors note that travel demand varies significantly with time. For instance, systematic daily and weekly variations in travel demand are informed by work and school schedules, and by the operating hours of businesses, shopping, and entertainment establishments. Also, annual fluctuations in travel demand are affected by the timing and length of school holidays and religious festivals, by sporting event schedules, and by the seasonal nature of outdoor recreational activities. Other social activities such as sporting meets, fairs, and other 'special events', may as well cause travel demand to fluctuate. While demand has been noted to be variable, transportation supply, on the other hand, is static.

Transportation supply consists of infrastructure and mobile plant. The authors note that whereas infrastructure generally has a longer life span, involves lots of capital, thus, making it very costly and time-consuming to alter, mobile plant, on the other hand, comes in smaller and cheaper units than infrastructure, and has a shorter lifetime, but it still lasts much longer than the time scale of demand fluctuations. The scope to alter the supply of vehicle services is limited by the mobility of the plant itself and by the degree to which differences between regions and traveller groups in the timing of peak demands can be exploited.

Coupled with the above, they note that output is not storable in the sense that a traveller or freight shipment must be present to be transported. Thus, like other services such

as haircuts and concerts, but unlike commodities such as grain and steel, production cannot be stored to smooth imbalances between supply and demand.

Simply put, as a direct function of demand fluctuations, rigid supply and the impossibility of storage, the utilization rate of transportation facilities varies over time. Variations in utilization are magnified by intermittent reductions in capacity due to accidents, strikes, bad weather and so on. Because land is scarce and capacity is expensive, it would be prohibitively expensive to build enough capacity to prevent congestion at all times, hence, the occurrence and perpetuation of traffic congestion in the transport system.

2.4.4. Procedures Involved in Measurement of Traffic Congestion

A lot of literature abound that proposes several techniques that may be employed in studying and quantifying congestion (Francois and Willis, 1995; Schwartz et al., 1995; Lomax et al., 1997). According to a review conducted by Lomax et al. (1997), these techniques could be generally classified under *highway capacity manual (HCM)* measures; *queuing-related* measures; and *travel time-based* measures respectively.

Of these three, the *travel time-based* measures are the commonly used methods in studying travel time, travel speed and delay. This is because they are easy to understand by both professionals and the travelling public. Also their flexibility makes it easy to describe traffic conditions at various levels of resolutions in both space and time. Not surprisingly, it is said that, 'an increasing number of transportation agencies are switching to travel time measures to monitor and manage congestion' (Quiroga, 2000, p. 290.). The only major disadvantage is 'budgetary limitation which usually imposes severe restrictions on the number and coverage of travel time studies' (ibid.). This particular reason is, perhaps, among the several reasons why this technique was adopted and adapted for use in this study.

There are two main sets of travel time data collection techniques. These are *roadside* and *vehicle* techniques respectively. The former includes license plate matching and automatic vehicle identification (AVI). The latter i.e. vehicle techniques, are based on the use of detection devices carried inside the vehicle. Examples of these techniques include the *traditional stopwatch and clipboard* technique as well as the *automatic vehicle location* (AVL) technique. It is said that in 'the *stopwatch and clipboard* technique, the travel time and passage of specific landmarks are manually recorded along the route' (ibid, p. 294).

Following their extensive studies in three metropolitan areas in Louisiana: Baton Rouge, Shreveport and New Orleans where over 180,000 segment travel time and speed

records were generated between 1995 and 1996 from close to three million GPS data points, Quiroga and Bullock (1998) propose the need to compute representative speed values by aggregating the data at the segment level first. This approach enabled them to reduce the huge volumes of data and made it possible to produce simplified reports out of them. They then proceeded to devise several equations that could be used to aggregate the data. One of such equations which calculate the *average* travel time per segment is stated thus:

$$\bar{t}_i = \frac{1}{m_i}\sum_{j=1}^{m_i} t_{L_j} = \frac{1}{m_i}\sum_{j=1}^{m_i}\frac{L_i}{u_{ji}} = L_i\frac{1}{m_i}\sum_{j=1}^{m_i}\frac{1}{u_{ij}}$$

Where m_i is the number of runs (or sample size) per segment; L_i is the length of each segment and u_{ij} is the jth speed record associated with segment i (ibid. p. 110).

However, this equation measures only the harmonic mean, which by definition, is very sensitive to individual values which are much lower than the rest in the series. As a result, these authors note that outlying low speeds, which usually are the case on a typically adverse traffic conditions, could result in very small average speeds.

In order to avoid this situation, their conclusion is that the *median* segment travel times should be calculated instead. It is argued by Duncan, 1986 (cited in Quiroga & Bullock (1998) that 'the median is known for not being seriously affected by others and in many cases it is preferred by statisticians as a measurement of central tendency'. Indeed, it is argued that 'a high median speed represents average traffic condition much better than a low harmonic mean speed' (Ibid, p.124).

2.4.5 The Geography and Characteristics of BRTS

Basically, the IEA (2002) identifies a Bus Rapid Transit System (BRTS) as a system that emphasises priority for rapid movement of buses by securing segregated bus ways. Wright (2002) notes that the BRTS may also be referred to as 'high-capacity bus systems'; 'high-quality bus systems'; 'metro-bus' or 'express bus systems'.

It is argued that BRTS in South America started in Curitiba (Brazil) and have now become widespread in the region including Bogota (Columbia), and Quito (Ecuador). In North America, a number of cities have begun to develop BRTS, including Ottawa (Canada), Pittsburgh, Los Angeles, and Honolulu (the United States). In Oceania, Brisbane and

Adelaide (Australia) have BRTS. In Europe, BRTS are becoming increasingly common in cities in the United Kingdom, including Leeds, London, Reading, and Ipswich. Cities in Asia have started to introduce BRTS, such as the systems in Nagoya (Japan), Taipei (China), Jakarta (Indonesia), and Seoul (Korea). Introductions of BRTS are being considered in Beijing (China), Bangkok (Thailand), Delhi, Pune, Hyderabad (India), and Dhaka (Bangladesh) (see Fjellstrom 2003a; 2003b; IEA, 2002, ITDP, 2003; Wright 2002). In Africa, Lagos (Nigeria) has a functioning BRTS and Cape Town (South Africa) is constructing a BRTS which is set to kick off in March, 2010.[8]

A very well planned BRTS not only have high capacities to carry passengers in a comfortable, rapid, and secure manner, but can also provide low-cost public transport alternatives. It is documented that the use of large capacity bi-articulated buses, for instance, could result in flow rates of 22 000 passengers per hour (in each direction) in Curitiba (Brazil) (Jefferson, 1996; Webb, 1993).

A recent study conducted by the Federal Transit Administration has also revealed that Bogota's *Transmilenio*, New York's *Lincoln Tunnel XBL*, and the Sao Paolo BRTS, for instance, could individually have peak capacities of at least 25,000 passengers per hour. Also, systems in Curitiba (Brazil) and Ottawa (Canada) carry up to 15,000 passengers per hour.[9]
Given the ubiquitous distribution of the BRTS, it can be difficult to pinpoint exactly which specifications a particular system must possess in order to be called as a 'proper' BRTS. However, after extensive studies, the *Bus Rapid Transit Policy Center* of the Breakthrough Technologies Institute, which is an independent, Washington DC-based think-tank, has identified seven major components of a BRTS. These are:

(1) *Dedicated Right of Way.* BRTS vehicles usually operate in their own right-of-way (ROW), thus greatly increasing speed and reducing travel time. Unlike rail, this ROW can be shared with emergency vehicles, providing congestion-free travel for public safety, or with other high occupancy vehicles (HOV's).Where appropriate, BRTS vehicles can leave the dedicated ROW to take passengers directly to their destination. This avoids the need for feeder bus systems, driving, or other options to reach an individual's final destination. While off from the dedicated ROW, BRTS vehicles can use special technologies to keep traffic lights green as the vehicle approaches, thus minimizing red light delays.

[8] http://www.capetown.gov.za/EN/IRT/Pages/default.aspx. Accessed on 13.02.2009

[9] http://www.gobrt.org/ Accessed on 13.02.2009

(2) *Stations*: BRTS stations are convenient and easily accessible. They can range from enhanced bus shelters to complete subway-like facilities. This flexibility in station design enables communities to invest in the stations that are right for them. Stations may include parking, shops, bicycle and pedestrian access. Stations also may include amenities that provide customers with a better transit experience, such as passenger information signs and "next vehicle" displays and announcements.

Good station design normally includes "passing lanes" that enable BRTS vehicles to get around docked vehicles. This enables express service and increases travel speeds. Good station design also includes a passenger platform that is level with the door of the BRTS vehicle. This enables passengers to directly board the vehicle without steps or other obstacles, and thus reduces the waiting time the vehicle must be in the station.

(3) *Vehicles:* There are many vehicles available for BRTS service. Generally, these vehicles are easy to board, comfortable to ride, and quiet. They also use clean fuel technologies, protecting the local environment. Some vehicles look and feel like light rail and have the option of using overhead power, but they are not limited to that power or to tracks. Other vehicles look more like traditional buses, but are easier to board and have no diesel exhaust. The most advanced vehicles offer optical or magnetic guidance, enhancing safety and allowing the vehicle to pull within inches of the platform, just like a subway. BRTS vehicles also include low floors and multiple, double-wide doors. This makes boarding easy and convenient, even for disabled persons. Some vehicles include on-board information systems, telling passengers where they are and when they can expect to reach their destination. Vehicle capacities vary greatly depending on the size and design of the vehicle. Double and triple-section "articulated" vehicles can carry 150 or more passengers, providing ample capacity for peak rush hour demand.

(4) *Fare Collection*: Like rail systems, BRTS fares can be collected before entering the platform. This is important, because the longer the vehicle spends in the station, the longer the total trip time. Where a city also has a rail system, the same fare collection technology can be used, enabling passengers to use a single fare card or token system.

(5) *Service:* BRTS provides high frequency service throughout the day, eliminating the need to consult a trip schedule. BRTS also provides the unique ability to offer a combination of express and local service. Depending upon demand, vehicles can stop at all stations, some stations, or no stations between their origin and destination.

(6) *Route Structure:* The BRTS system's flexibility makes it possible to design systems that offer more passengers the option of a no-transfer, one-seat ride to their destination. Multiple BRTS routes can be implemented, offering the community a thicker network of rapid transit routes. Moreover, these routes can go into neighbourhoods and office parks, thus bringing transit to the people, rather than forcing people to get to a rail station by driving or via feeder bus systems. Once passengers are delivered to these "off-line" stations, the BRTS vehicle can return to its dedicated ROW. The route structure is usually presented in easy to read format, eliminating the need to follow complicated bus maps. This makes the system more attractive to a greater number of customers, thus enhancing ridership.

(7) *Intelligent Transportation Systems (ITS)*: BRTS uses ITS systems to track vehicle locations, control traffic signals, update passengers on travel times, and perform other important functions. These technologies can provide "next vehicle" displays, announce arrivals and departures, ensure better traffic flow, and enhance safety and security on the vehicle and in the station. Some ITS technologies are in fixed locations, such as at the station or on board the vehicle. Through digital wireless, however, next bus and other information can be transmitted to a customer's cell phone.

2.4.6 Arguments For and Against BRTS

Given the fact the one of the characteristics of the BRTS vehicles is to manipulate the traffic signage mechanism to suit their operations, it is reasonable to expect that other vehicle types that also depend on the traffic signage system could be in serious traffic congestion. In effect, the BRTS does not actually deal with the congestion problem.

However, in view of the numerous positive characteristics of the BRTS, for instance, the use of high occupancy vehicles to move people en masse, a lot of vehicles would have been taken from the roads than if all of these passengers had driven their own cars, and therefore, one could safely conclude that the BRTS initiative does indeed tackle traffic congestion in a very significant manner.

Again, in their study about the positive impacts of the BRTS, Wohrnscimmel et al. (2008) noted that exposures to gaseous air pollutants and elemental carbon were by far the highest for commuters who use private and low-capacity public transport vehicles as against those who use high capacity public transport vehicles like a BRTS.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

Seen as 'the process of enquiry and discovery' (Kitchin & Tate, 2000, p.1), *research* has also been defined as 'knowledge production, seeking answers to questions through inquiry' (Mikkelsen, 2005, p. 135). Usually, research proceeds along a *methodology*, which in the words of Kitchin & Tate (2000, p. 6), may be described as 'a coherent set of rules and procedures which can be used to investigate a phenomenon or situation (within the framework dictated by epistemological and ontological ideas)'.

Thus, research methodology may be described as including all the scientific procedures a researcher adopt to generate, analyse, interpret and present data. The adoption and rationale of a particular methodological approach is usually a function of the research's theoretical framework or construct. In the words of Warf (2006, p. 486), methodology is 'a meso-level theoretical construct that allows researchers to translate their epistemological and ontological assumptions into data'.

This chapter involves discussions on the research methodological approach used in this study. Sub-topics that will be discussed include: sources of primary and secondary data, research instruments used, strengths and weaknesses of the methodological approaches employed, challenges faced in this study, reliability and validity of the data as well as the techniques of data analysis and presentation.

3.2 Sources of Primary Data

In the generation of primary data for this study, which took place during the months of June, July and August of 2008, both quantitative and qualitative methods were employed.

Quantitative methods have been defined as 'the use of mathematical techniques, theorems and proofs in understanding geographical forms and relations. Two main types of application exist: *statistical methods,* which are employed in generating and testing hypotheses using empirical data, and pure *mathematical modelling,* which is employed when deriving formal models from a set of initial abstract assumptions. The two types come together in *calibration*: statistical methods are used to estimate, and test the significance of, various parameters associated with a given mathematical model' (Johnston et al., 2000, p. 663).

Qualitative methods 'are concerned with how the world is viewed, experienced and constructed by social actors. They provide access to the motives, aspirations and power relationships that account for how places, people and events are made and represented' (ibid. p.660). These methods represent what Cloke et al. (1992) have aptly described as 'the peopling of human geography' (ibid).

3.3 Quantitative Versus Qualitative Sources of Data Generation

Quantitative data, according to Kitchin and Tate (2000, p. 40) are 'generally structured and the data consists of numbers or empirical facts that can easily be 'quantified' and analysed using numeric (statistical) techniques'. Quantitative methods, we are told, measure objective facts and focus on variables. Reliability is their key. They are value free and in most instances, independent of context. The quantitative approaches deal with many cases or subjects and rely heavily on statistical analysis. The added strength is that the researcher is detached (Mikkelsen, 2005; Neuman, 2003).

Qualitative data, on the other hand, are 'generally unstructured and consists of words, pictures and sounds' (Kitchin & Tate, 2000, p. 40). It has been argued that the qualitative methods have the advantages of being able to effectively construct social reality or cultural meaning and focuses on interactive process or event. Also, authenticity is their hallmark and values are present and explicit. They are situationally constrained and their main focus is on thematic analyses. However, in contrast with quantitative data, the qualitative tradition usually deals with few cases or subjects and the researcher is involved (Mikkelsen, 2005; Neuman, 2003).

Controversies have raged over which research method is appropriate. At the risk of over-generalization, quantitative methods have been identified with positivism. Propounded by Comte (1798-1857) in response to the 'negative philosophy' during pre-revolution France, positivists argue that 'by carefully and objectively collecting data regarding social phenomena, we can determine laws to predict and explain human behaviour in terms of cause and effect. Like empiricists, positivists reject normative and metaphysical (relating to being) questions that cannot be measured scientifically' (Kitchin & Tate, 2000, p.8). The major point of departure from empiricism, however, is that positivism 'requires propositions to be verified (logical positivism) or hypothesis falsified (critical rationalism) rather than simply presenting findings' (ibid).

Among the several criticisms levelled against positivism, Gregory (1986) notes that the first is its empiricist position by the seeming underestimation of the 'complex relationship between theory and observation'. Also, positivism has been criticised for its exclusivity by assuming that 'methods of the natural sciences can be effectively used to explain social phenomena', thus, failing to 'recognise that spatial patterns and processes are bound up in economic, social and political structures' (Cloke et al, 1992; Kitchin & Tate, 2000, p.8). Lastly, positivist's insistence on scientific research being autonomous, value-free, neutral and objective has been rejected. This autonomy argument 'creates a false sense of objectivity by artificially separating the observer from the observed' (ibid). Added to the above, it is argued that quantitative methods, like any specialized language, 'are very useful in answering some questions but not all questions' (Pratt, 1989; cited in Johnston et al, 2000, p. 664).

By being situationally-constrained and dealing with only a few cases or subjects, a major weakness associated with the qualitative methods is the inability to make universal conclusions. Also, reliability—'the ability of a measure to produce consistent results' (Rudestam & Newton, 1992, p. 67)—is hard to obtain. Moreover, with the observer being involved in the observed, there is the inherent disadvantage of researcher bias. It must be pointed out, however, that this problem of researcher bias is not limited only to the qualitative methods but to the so-called 'value-free' quantitative methods as well.

Therefore, it is argued that 'both qualitative and quantitative approaches have their strengths and weaknesses. Neither one is markedly superior to the other...in many studies you need to combine both the qualitative and quantitative approaches' (Kumar, 1996, p. 12). A further argument is made that 'research which combines different qualitative methods and exploits the complementarity of qualitative and quantitative findings looks poised to gain a new respectability within the discipline' (Johnston et al, 2000, p. 664).

Referred to as 'triangulation' by social scientists, a combination of both quantitative and qualitative methods is said to enable researchers 'have a more critical attitude towards the mechanistic use of quantitative methods and a more relaxed attitude to the use of qualitative methods; allow flexibility and improvisations in choice of practical methods, i.e., iteration between data and partial results; the people researched are seen as subjects rather than objects and are often involved in the research process' (Mikkelsen, 2005, p. 144). Furthermore, the triangulation approach, as is adopted in this study, is to enable me gather evidence from multiple sources to address my research questions from different points of view. The added advantage is that the research work is broadened and its validity strengthened (Baker, 1990).

While conceding that the distinction between the qualitative and quantitative methods is good in that it provides an avenue to discuss differences in methodologies, I am of the opinion, just as a good number of scholars, that the division should only be seen as artificial and that the two approaches need to be seen 'as a *continuum* rather than polar opposites' (Kitchin & Tate, 2000, p.40). After all, it is said that 'there is no law that states that qualitative and quantitative methods have to be used in isolation from each other' (Mikkelsen, 2005, p. 40) and that 'if modelling is not accompanied by qualitative analysis, complex but nevertheless comprehensible social forms may be reduced to...'contentless abstractions' which are easy to manipulate but difficult to interpret' (Sayer, 1992, p. 201). Also, my choice of the triangulation method is to be able to understand the 'interpretation and meaning that people give to events they experience' (Polkinghorne 1991, p. 112; Rudestam & Newton, 1992, p.31).

GIS-based techniques were the main research tool employed in generating the quantitative data for this study. Against this backdrop, it is salient to reiterate my awareness of the over-generalised critique against the quantitative methods as being closely associated with positivism. Thus, if a study, like this one, employs statistical methods and/or GIS, it is too often wrongly labelled as being positivistic. Readers must take note that even though it has been demonstrated that GIS has antecedents in cartography and quantitative methods, an argument is put forward that 'there is an inchoate but emphatic sense, among researchers, that GIS extends quantitative techniques' (Schuurman, 2004, p. 7). In actual fact, Fotheringham et al. (2000, p. 234) have traced the metamorphosis in the geneology of GIS and they conclude that 'we have witnessed the progression from models whose only justification was an empirical regularity and an analogy to gravitational attraction; to models derived from either non-behavioural or aspatial theories imported from other disciplines; and finally to models based on principles of spatial information processing, sub-optimality, hierarchical decision making and spatial cognition. Current research lies in consolidating and improving this latest framework'.

Again, it is believed that 'GIS has re-established the importance of intuition and simplicity of exploration over those very hard-core confirmatory hypothesis-testing techniques' (Schuurman, 2004, p.112). These authors provide ample justification for the use of the GIS-based techniques for the quantitative data generation.

In order to identify the other potential factors that led to the collapse of the pilot BRTS, in-depth interviews with key informants; focus group discussion and participatory observation were the used as research tools for the generation of qualitative primary data.

3.4 Research Tools Employed in Primary Data Generation

3.4.1. GIS-based Techniques

In the view of Affum & Taylor (1999), the temporal and spatial distribution of congestion in a region is important, and the use of GIS software for database integration, data analysis and data display is most advantageous. Basically, GIS is seen by Thill (2000, p.4) as a 'computer-based systems for the capture, storage, manipulation, display and analysis of geographic information'. Indeed, GIS technology is able to integrate common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps (Derekenaris et al., 2001; ESRI, 2009; Franklin, 1992; Muller, 1993). Also, GIS 'presents geographers with ways to visualize spatial arrangements and, in the process, restore intuition as a valid heuristic technique' (Schuurman, 2004, p. 112). In recent times, transportation experts have found the benefit of using the GIS as a powerful tool in their work. According to Thill (2000, p. 4), it is now common to come across the acronym *GIS-T* which simply refers to 'the application and adaptation of GIS to researching, planning, and management in transportation'.

In compliance with the suggestion by Taylor et al. (2000) that 'rigorous spatial analysis using GIS is only possible when the appropriate map databases are available', existing spatial data comprising the road network of Accra was obtained from the Centre for Remote Sensing and Geographic Information Services (CERSGIS) of the University of Ghana and the Ghana Geological Survey Department respectively. With these geographic data and with the use of the ArcGIS 9.3 software, a base vector map with links to a database was made by the author.

Using the Global Positioning System (GPS), which is a satellite-based navigation system consisting of a network of 24 satellites placed into orbit by the U.S. Department of Defence, and which until the 1980s was primarily the preserve of the military, the locational coordinates of all bus stops designated for the pilot BRTS, from Kimbu to Adenta, were

manually picked and recorded in a log book. This was done with the use of the high-sensitivity, WAAS-enabled eTrex Vista HCx GPS receiver.[10]

These GPS points were co-referenced with the existing spatial data on Accra. The actual exercise to map the geography of traffic congestion on the selected corridor then followed. This was done by adopting and adapting to the *traditional stopwatch and clipboard* technique as suggested in the literature by Quiroga (2000, p. 294) that 'the travel time and passage of specific landmarks are manually recorded along the route'.

In this study, I made use of the *traditional stopwatch and traffic congestion registration form* technique (see Appendix 1 Traffic Congestion Registration Form). This digitally formatted form was used to measure travel time on the Kimbu-Adenta highway by recording the time an MMT bus departed from a particular stop to the next stop. This process continued for the entire duration of the journey. This process was repeated many times and with different bus drivers in order to avoid the danger of being unduly influenced by the driver's driving style (Taylor et al., 2000). As a general rule of thumb, it is suggested that in 'order to overcome the sampling problem, each route should be driven at least 15 times with different drivers each time', even though 'this is seldom a practical proposition, and may introduce its own inaccuracies' (ibid, p.264).

Taking into the consideration the fact that traffic congestion varied spatio-temporally, the data was captured during the 'rush hour' periods, i.e. morning and evening peaks as well as the afternoon off-peak periods. Working only during the weekdays, i.e. Monday to Friday and making six trips daily, a total number of 120 trips were made.

3.4.2. Interviews with Key Informants and a Discussion[11]

As part of the methods for generating qualitative data for this study, in-depth interviews were conducted on operators of the former pilot BRTS and policy makers in charge of public transportation in Accra, in addition to a transportation expert at the University of Ghana.

In the words of Kvale (1996, p. xvii), interviews are 'conversations where the outcome is a co-production of the interviewer and the subject'. Indeed, it is 'an *inter view,* an inter change of views between two persons conversing about a theme of mutual interest' (ibid, p. 2)

[10] For further information, visit http://www8.garmin.com/aboutGPS/waas.html
[11] See Appendixes 2-4. For Question or interview guides.

In order to obtain special knowledge about the operations of the Metro Mass Transit Limited, in general, and specifically on the pilot BRTS, the General Manager of the company was interviewed for a little above one hour, due to intermittent distractions from telephone calls and workers who needed one form of assistance or the other from him. The interview was done with the use of a flexible checklist or guide. This interview guide outlined the topics and issues to be covered. However, the sequential arrangement of the questions was occasionally ignored in order to follow the responses I received from the informant. According to Patton (2002), by adopting such an approach, the comprehensiveness of the data is increased. Also, the data collection is made somewhat systematic for each respondent and logical gaps in data can be anticipated and closed. Lastly, the interviews remain fairly conversational and situational. However, this approach is limited in that important and salient topics may be inadvertently omitted. Also, interviewer flexibility in sequencing and wording questions can result in substantially different responses from different perspectives, thus reducing the comparability of responses (ibid).

The Deputy Managing Director of the company was also interviewed via telephone due to time constraints. This approach was necessitated by the fact that even though the responses from the first key informant was generally helpful, he was ignorant about some specific facts about the pilot BRTS since he had not assumed office by then. The interview with the Deputy went smoothly and most salient points were clarified for the study, even though a face-to-face encounter, rather than a phone conversation, would have been ideal. Owing to the huge financial costs involved in making telephone calls, this was the only telephone interview I could arrange and it lasted for less than thirty minutes. Consequently, the telephone interview was not as in-depth as I had wanted it to be.

On the other side of the coin, three MMT drivers who have been working on the Kimbu to Adenta corridor before, during and after the pilot BRTS were accosted and interviewed as well. The selection of these interviewees was based on the discretion of the author, on the basis of the criteria mentioned above and with the use of the judgemental or purposive sampling technique. While admitting that this sampling approach is seriously flawed in that it is subjective and that 'individuals may be selected on the basis of the sort of responses they are likely to give, and the responses the interviewer is looking for' (Kitchin & Tate, 2000, p. 54), this exercise was meant to solicit information from the drivers who were actually on the ground and implemented the service. The interviews were done in the MMT buses as they waited at the main bus stations to be filled to capacity with passengers before

taking off. Even though this approach to data generation proved quite helpful, the comprehensiveness or otherwise of each interview was a function of the time it took for the buses to be full, an average of fifteen minutes.

In order to present the views of the end users of the now defunct pilot BRTS, three passengers –a man and two women –who were on-board the MMT buses plying the Kimbu-Adenta corridor and who had been using the bus service since 2005 when the pilot BRTS was introduced were accosted and engaged in a focus group discussion with the question guide as above. These passengers were among the first to board the buses and also met the above criterion. They were interviewed until the buses were full to capacity and was about to depart, a procedure which lasted for an average of fifteen minutes. The sampling technique for selecting the participants and the associated weaknesses are the same as noted above.

For the purpose of this study, key players in charge of making and implementing government transportation policies in Ghana were interviewed as well. These key informants include: the Deputy Director (Planning and Development) at the Department of Urban Roads, and a senior team member at the Urban Transport Project office, all of the Ministry of Transportation (Roads). These informants provided useful and insightful details for the study.

Lastly, a professor and expert in transportation geography at the University of Ghana was also interviewed as a key informant for this study. This interview lasted for close to one hour. These key informants, just like the management of the company, have special knowledge on the given topic but according to Mikkelsen (2005), they are not necessarily the 'leaders' and readers must be aware that there is also the risk of being misled by the key informants' sometimes biased information.

3.4.3. Participant Observation

Participant observation was done simultaneously with the traffic congestion data collection exercise. Also referred to as ethnography and field studies, participant observation involves 'the researcher participating directly in the setting, if not also the activities, in order to collect data in a systematic manner' (Brewer, 2000, p. 6; cited in Silverman, 2006a, p. 69).

Providing a justification for this method of data generation, it is said that 'all social research is a form of participant observation, because we cannot study the social world without being part of it' (ibid).

With the use of a field notebook, pens, pencils and a photo camera, I acted as a passenger on-board the Kimbu-Adenta bound MMT buses to observe at first hand, the nature of service provided on this corridor. This method of data generation was meant to identify *where*, *when* and *why* traffic congestion occurs on the said corridor and *how* it negatively conspired, with other potential factors, to collapse the express transit system. This also afforded me the opportunity to verify the data obtained from the key informants.

3.5. Secondary Sources of Data

Secondary sources of data can be seen as already existing data. According to Johnston et al. (2000), this sort of data set is used for research projects other than that for which it was originally collected. Data set such as censuses may be stored in computer data bases, on the internet or housed in archives from where they are made available to other researchers. This further use of the data, it is argued, 'allows for both efficiency in data collection and the conduct of comparative studies (across space and time) that otherwise will be impossible' (ibid, p. 730.). The added advantage is that it enables the researcher to have a basis for corroborating upon or filling in the gaps in existing knowledge. However, it may be difficult for a researcher to adopt and adapt to some secondary data since they might either be irrelevant or unsuitable to a particular topic of research interest.

Secondary sources of data for this study were obtained from books and journals, in the libraries and on the internet, especially the *Transportation Research Part C*; official reports such as census data from the Ghana Statistical Service data base and newsletters of the Metro Mass Transit Limited.

3.6. Challenges Faced in this Study

This study had some challenges, particularly during the primary data generation.

First, since this study was conducted in a post pilot BRTS scenario, the travel time data generated via the traffic congestion registration form may not represent the true account of how the situation was during pilot BRTS era. This is because during the pilot BRTS period, the 'express' buses were only supposed to stop at their designated terminals. Even though the same fleet of buses and possibly the same drivers were used for generating the data in this study, the current service is such that the drivers may stop at any point on the corridor to pick up and/or allow passengers to disembark, in addition to stopping at their

designated terminals. This challenge obviously lengthens the total travel time. However, there were instances when some drivers did not stop at the designated bus stops or elsewhere on the corridor due to the fact that no passenger was embarking or disembarking.

Second, unlike the pilot BRTS which operated on the basis of 'one-passenger-one-seat', there was serious overcrowding in the buses, especially during the evening peak hours when passengers clamoured for any available space in the bus in order to get home. This was the culture of stress I encountered during the whole month of making 120 uninterrupted travels. Such stress affected my health and I had to seek the help of two research assistants from the University of Ghana to share the load with. While this approach was of immense help in the conduct of this study, it may compromise the quality or reliability of the final data if something went wrong with the assistants' generation of data. We usually held series of peer reviews to assess each other's work and to re-strategise as the work progressed. I also made sure that they all complied with the same coding principle. For instance, they were to ensure that the number of data entries corresponded exactly with the available space provided on the *traffic congestion registration* form. Lastly, each one of them was given extra forms that could be used in the event that an error occurred in the data entry. These checks and balances, it is believed, will greatly reduce the level of errors in the data generation.

Finally, all of my key informants, with the exception of the Deputy Managing Director of the Metro Mass Transit Limited, proved extremely useful and devoted much of their time to being interviewed, thus, enhancing the quality of the data. This key informant was one of the key architects of the pilot BRTS. Not only was he involved in the hatching of the concept, but he was also actively involved in the implementation of the pilot project. Obviously, the contributions of such an individual would have been invaluable to this study. However, try as I did to meet him for a face-to-face in-depth interview, it could never materialised on grounds that he was extremely busy. Realising that I had limited time, all I could do was to have a brief interview on the cell phone during one weekend with him. Given the fact that most of the information he gave only corroborated upon that which had already been given by the General Manager and that there were no other top level individuals in the managerial position to be interviewed further, the data could be said to be generally accurate, informative and reliable as well.

3.7. Validity, Reliability and Limitations of this Study

All good scientific research work aims at producing knowledge which is not only valid but reliable as well. This study is no exception to that ideal. Rudestam & Newton (1992) have defined reliability to mean the ability of a measure to produce consistent results. Validity, on the other hand, indicates that a measure in fact measures what it purports to measure. In other words, validity 'concerns the soundness, legitimacy and relevance of a research theory and its investigation' while reliability may refer to 'the repeatability or consistency of a finding' (Kitchin & Tate, 2000, p. 34). These two themes of validity and reliability are of much relevance to qualitative-based studies as they are for quantitative-based studies (Silverman, 1993b; Kitchin & Tate, 2000).

According to Rudestam & Newton (1992, p.74), limitations may refer 'to restrictions in the study over which you have no control'. The note-worthy limitations for this study were especially related to the data generation.

For instance, the use of the qualitative research instruments, i.e. the interviews and the participation observation in this study, behoves on me as a researcher to be more reflexive.

> Reflexivity requires an awareness of the researcher's contribution to the construction of meanings throughout the research process, and an acknowledgment of the impossibility of remaining 'outside of' one's subject matter while conducting research. Reflexivity then, urges us 'to explore the ways in which a researcher's involvement with a particular study influences, acts upon and informs such research (Nightingale & Cromby, 1999; p. 228 cited in Ryan, 2005, p. 3).

Expatiating further, it is said that:

> the concepts of reflexivity may be a way of bringing qualitative methods to account for themselves in a way that goes to satisfy the demands of scientific method. This is generally a matter of questioning how the processes of research and analysis have an effect on research outcomes. This whole process of self-examination has become known as 'reflexivity' (May, 1998; cited in Ryan (2005, p. 3)

Concerning the use of the key informant interviews, I am aware of the risk of being misled by key informants' sometimes biased information (Mikkelsen, 2005). My position as a researcher and a student gives me some power but my power may not be equal to that of my informants, who are qualified professionals. There is the tendency on the part of the

management of the bus company, for instance, to speak only the politically correct language and to polish up their own mistakes while exaggerating on other information as to why the pilot BRTS collapsed. This unequal power relation might affect the quality of data to be derived from the interview. Dowling (2000) suggests the identification and efficient negotiation of such power relations. Perhaps the use of the checklist in the interviews helped to create the necessary rapport that enabled the best possible responses to be obtained in spite of the unequal power relations.

As much as possible, the purpose of the research was explained in detail to the informants and their informed consent was sought before commencing with the interviews. All these procedures were deliberately followed to assure the respondents of utmost confidentiality, and in some cases, anonymity where it was so desired. This was to ensure that the respondents will, out of their own volition, provide the right and reliable kind of information for this study.

The quality and trustworthiness of data from the participatory observation may also be affected by my own subjectivity. This is because I am familiar with the phenomenon under investigation and there is the likelihood of my inability to completely detach my personal views, opinions and prejudices in my capacity as a researcher and user of public transport on the congested corridors of Accra.

The travel time data were recorded using minutes as the unit of measure. However, due to high speeds at some of the less congested segments of the Kimbu-Adenta highway, the total journey duration (i.e. the difference between the times of departing from the origin of a segment to its point of exit, marked by the bus stops) recorded zero. In order to avoid discrepancies in the data caused by the division of travel time by zero, when speeds were high, I substituted zero with 0.75. This means that any segment run that took less than a minute to cover was estimated to have taken three quarters of a minute or fourty five seconds.

Lastly, Quiroga (2000, p. 291) suggests that even though GIS packages can be used to provide estimates of distance, ‘it is clear that the accuracy of these estimates depends on the accuracy of the underlying digital base map’. The GIS data, notably the road network of Accra, that was used in composing the base map in this study can be said to be out of date with very recent changes due to construction and/or upgrading of the road network. A case in point which readers should be aware of is that during the era of the pilot BRTS, the bus drivers had to go round the Tetteh Quarshie Roundabout (refer Figure 4.1). By the time of conducting the field work, however, the Roundabout had been reconstructed to an

interchange whereby the drivers have to drive straight through without having to make the detour. This means that the total journey duration for that particular segment alone has been shortened than it used to be hitherto. The rest of the spatial data represent accurately the road network in Accra. Also, very recent GIS or spatial data are either unavailable or expensive to obtain; hence, the decision to use the existing GIS data anyway.

With the exception of these limitations faced in this study, majority of which have been addressed and tackled, the data used in this study can be said to be of relatively high validity and reliability.

3.8. Techniques for Data Analysis and Presentations of Findings

Using the appropriate analytic technique, the field data was analyzed both quantitatively and qualitatively. Concerning the quantitative data, the *ReadSoft DOCUMENTS* software was used to scan and digitally retrieve the travel times as recorded on the *Traffic Congestion Registration form*. This was then corrected for errors and exported into the Statistical Package for the Social Scientist (SPSS) 15.0 software for further analyses. Analyses done include calculating the median, mean and cumulative travel times for each segment of the highway used in the study. The SPSS was also used to compose a bar chart representing the median segment speed for the various days of the week (see Figure 6.4). With the use of Microsoft Office Excel 2007 software, the data are also presented in a tabular format. In order to present the data in a thematic map form, which is said to be typical in traditional time travel studies (Quiroga, 1998), the ARCGIS 9.3 software was used to prepare the base map, out of which the corridor of interest was selected. Again, it was possible to import the median travel times from the Excel format to enrich the geographic database out of which the colour coded thematic maps, as used in this study, were composed (see Figures 6.1-6.3).

With regards to the qualitative data, the information generated from the in-depth interviews, the focus group discussion and from my own observations is presented by the use of quotations and transcriptions. As noted earlier on, the qualitative data is meant to assist me provide an interpretation and meaning of the quantitative data.

CHAPTER FOUR: THE STUDY AREA

4.1. Location and Size

Located at 5°33' North and 0°13' West and bounded by the Gulf of Guinea in the south, the University of Ghana in the north, Tema Township in the east and by Korlee Lagoon in the west is Accra, Ghana's largest administrative and economic capital. Out of what used to be the three townships of James Town, Christianborg and Ussher Town in the 1870s and covering an area of less than 10 km^2 (Yankson & Grant, 2003), Accra's current size has grown considerably.

Accra is found in the Greater Accra Region, the smallest of the 10 administrative regions of Ghana, in terms of area, occupying a total land surface of 3,245 square kilometres or 1.4 % of the total land area of Ghana. The political administration of the region, as in all other regions in Ghana, is through the local government system. According to Article 35 (d) of the Constitution of Ghana, the state is obliged 'to take appropriate measures to ensure decentralisation in administrative and financial machinery of government and to give opportunities to people to participate in decision-making at every level in national life and government'. The Constitution further provides for a minimum of 5 per cent of national revenues to be paid to district assemblies for development purposes. Other significant legislation supporting decentralisation includes the Local Government Act of 1993 (which creates the district level structures and defines their functions), and the District Assemblies Common Fund, 1993 (which provides the parameters for sharing of the recycled revenues).
The principal local government unit is called the *District*, with these being separately defined in relation to their population. Depending on population size, we have the metropolitan assemblies (population above 250,000), municipal assemblies (population above 95,000), and district assemblies covering rural and urban communities over wider geographical areas in Ghana (IBIS Transport Consultants Ltd, 2005).

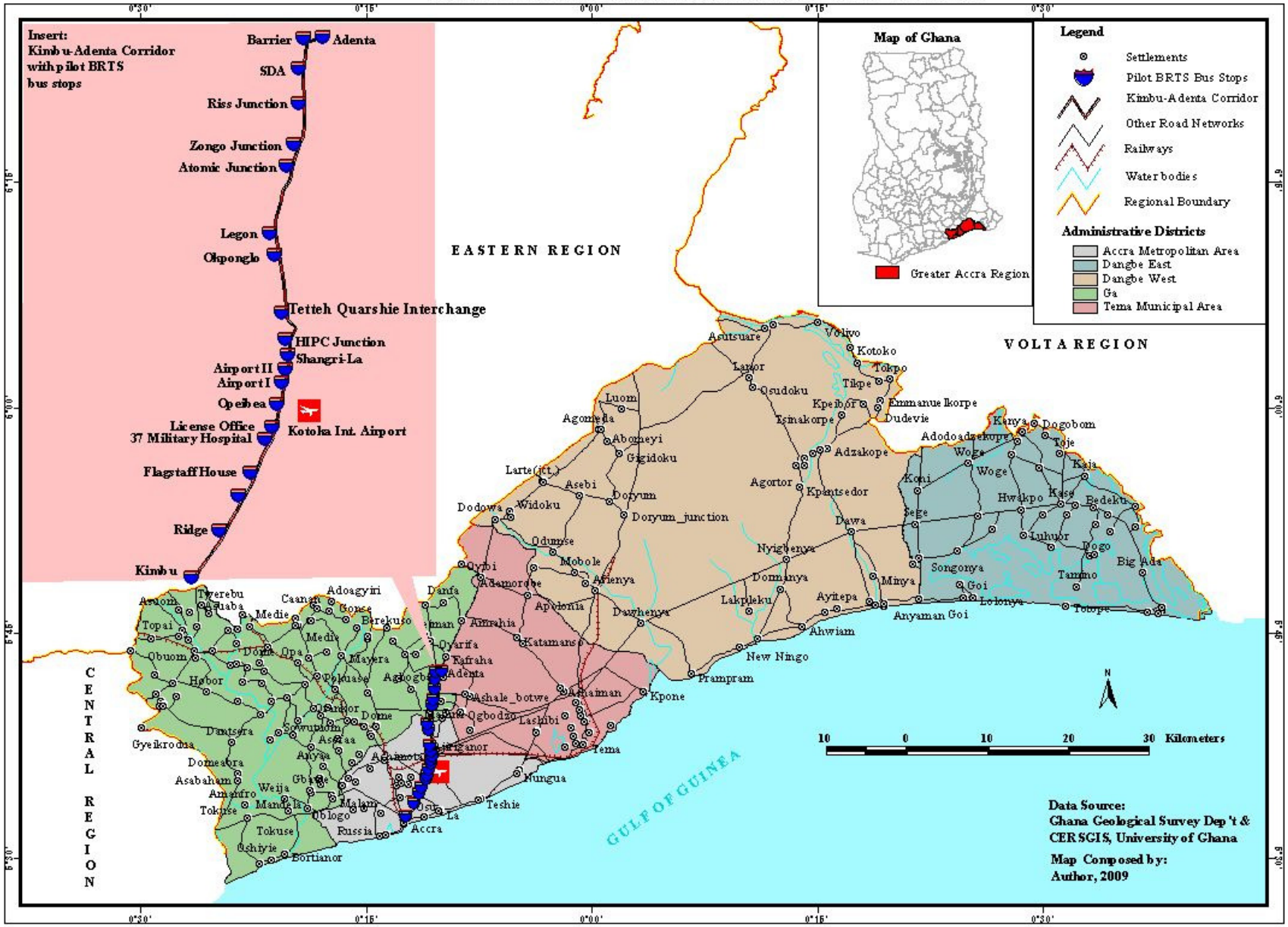
Therefore, in the greater Accra conurbation, all the three classes are represented. These are the Accra Metropolitan Area (AMA), with a total land size of 200 square kilometres and 57 % of the total population of the city; Tema Municipal Area (TMA) which has 17 % of the total population and the Ga District Area (GDA) with 26 % of the city population. The Ga District has recently been split in two, recognizing its population growth as a result of overspill from the metropolis (ibid).

Of the administrative regions, AMA is the most completely urbanized and largely constitutes the city of Accra. However, broader definitions of Accra also exist and by current Local Government Act, the Greater Accra Region now constitutes AMA, TMA, Ga East, Ga West, Dangme West and Dangme East districts. However, other recently constituted districts including the Ashaiman, Ledzekuku-Krowor, Weija and Adenta municipalities respectively have been added.[12] Dangme East is the least populated with a little above 3 % of the population of Accra.

Particular attention has been given to explaining these political administrative bodies in the city of Accra for the reason that whereas the provision of the road infrastructure is essentially the work of the central government, public transport regulation is the sole responsibility of the districts within which a particular transport service is found. In relation to the focus of this study, i.e. the former pilot BRTS, the road network that was selected for the project is mostly found within the administrative domain of the AMA. However, it stretches along the Ga district and the Adenta municipality respectively. See Figure 4.1 below.

[12] http://www.ghanadistricts.com/region/?r=1&sa=21&PHPSESSID=d58fb86d0 Accessed on 31.08.2008

Figure 4.1. A MAP OF THE GREATER ACCRA REGION SHOWING THE STUDY AREA



4.2. Topography and Climate

Accra is characterised by low physical relief as the Precambrian rock system that underlies most of the nation has been worn down by erosion almost to a plain.[13] There are several gently undulating slopes rising to a height of less than approximately 23 metres above sea level.

Given the fact that Ghana is located only a few degrees north of the equator, the climate is tropical. The only seasonal changes are the two distinct wet and dry seasons. According to the Meteorological Services Department, two main rainy seasons occur in the whole coastal plain, where Accra is located, with the principal reaching its maximum in May and June and the subsidiary in October. The average annual rainfall is about 730mm which falls primarily during the two rainy seasons. Rain is rarely prolonged and the average duration of rain is between 2 and 3 hours. Rain persisting for over 12 hours is very uncommon. In the dry months, rain is likely to fall on less than 10 hours in a month and even in the wet seasons, the average total duration of rain is only about 30 to 40 hours in a month. Variations in intensity of rainfall are considerable and rates of 203 mm per hour may be reached and even exceeded for short periods.[14] Short but heavy downpours in Accra usually give rise to local flooding where drainage channels are obstructed. At times, portions of road network may be washed away, potholes may be created in the middle of roads, or rain eroded sand may accumulate usually along the sides of the roads. On such days, the average travel speeds are reduced, thereby, creating very severe traffic congestion.

Ghana's warm and humid climate has an annual mean temperature between 26 and 29 °C. Variations in the principal elements of temperature, rainfall, and humidity that govern the climate are influenced by the movement and interaction of the dry tropical continental air mass, the dry, dusty *harmattan*, which blows from the northeast across the Sahara. The harmattan season usually begins from November to late March or April.

In Accra, as in most parts of the country, there is very little variation in temperature throughout the year. The mean monthly temperature ranges from 24.7° in August (the

[13] http://www.visitandlearn.co.uk/LocationFactfiles/Ghana/Economy/tabid/383/Default.aspx Accessed on 31.08.2008.
[14] http://www.meteo.gov.gh/climatology.html downloaded 31.08.2008. Accessed on 31.08.2008.

coolest) to 28° in March (the hottest) with annual average of 26.8°. Figure 4.2 presents an illustration of the average weather condition (i.e. rain, average maximum daily temperature and average minimum temperature) for Accra.[15]

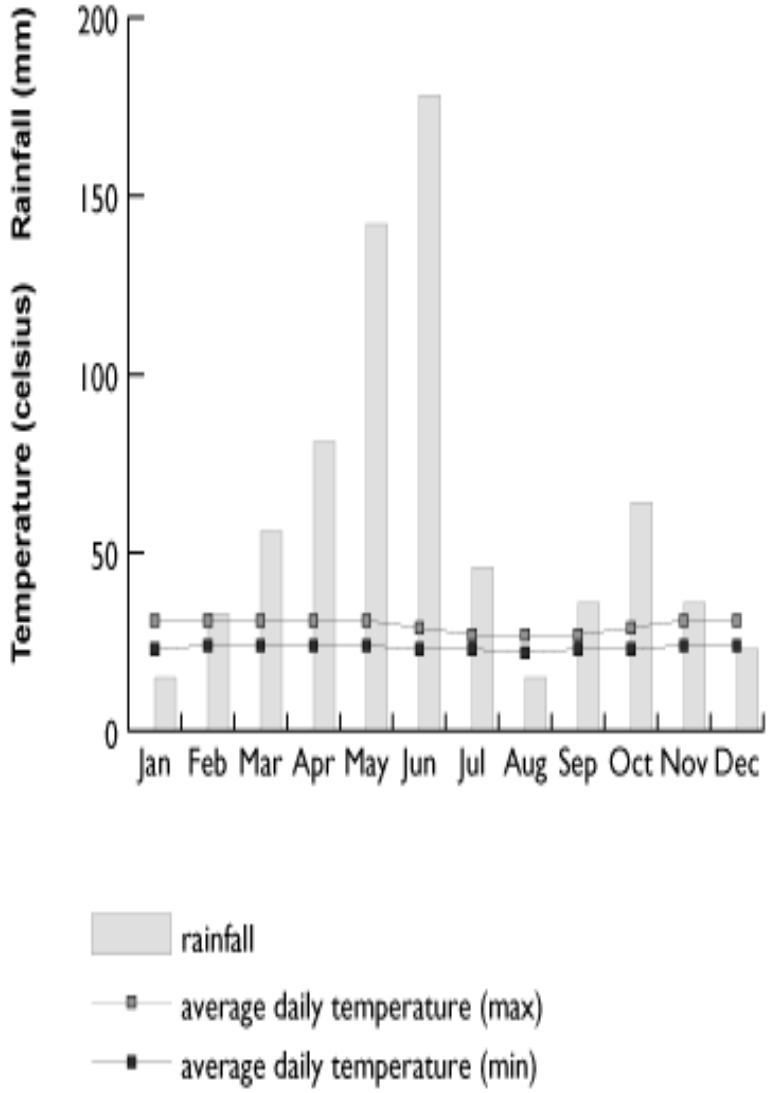


Figure 4.2 Average Weather Conditions in Accra

When temperatures are high, especially in the afternoon, commercial drivers in particular find it unbearable to queue gently in the slowly moving traffic. Some of them resort to driving on the shoulders of the road for a while but their attempt to force their way back into the main traffic flow further exacerbate the traffic congestion situation in the city.

[15] http://www.bbc.co.uk/weather/world/city_guides/results.shtml?tt=TT000240 (BBC weather homepage). downloaded 31.08.2008

4.3. Demographic characteristics of the Study Area

Demographic features, such as population size, density and growth, sex and age structure as well as distribution, are considered as important parameters that must be taken into consideration in transportation studies and analysis, especially on the effects of these factors on the incidence of traffic congestion.

4.3.1. Population size and growth

Accra, Ghana's capital since 1877 is reputed to be among the most populated and fast growing Metropolis of Africa with an annual growth rate of 3.36 %. With the second largest population after the Ashanti region, the Greater Accra regional share of the total population of Ghana has progressively soared from a little above 7 % in 1960 to about 15.4 % in 2000.

Due largely to the rapid industrialisation and expansion in the manufacturing and commercial sectors in some major areas within the metropolis in the period between 1960 and 1970, there was the influx of migrants into Accra, largely from the Eastern Region in view its proximity to and cultural links with, the Greater Accra Region. Beside this, there was also a large migration from the Volta, Central and Ashanti Regions respectively in that order, resulting in high population growth rate between 1960-1970 intercensal years.

The reverse is observed in the 1970-1984 intercensal years, when due to the acute stagnation of the Ghanaian economy during the 1970's, the growth rate of Accra's population took a nosedive. Again, the decline in agriculture in the agrarian communities in Ghana; industrialisation in the region, coupled with the late 1980s and 1990s boom in the service sector, the migratory flow into Accra resumed. A summary of demographic statistics of Accra is presented in tabular form below:

Table 4.1 Demographic Characteristics of Accra

Characteristics	1960	1970	1984	2000	2002**
Population	338,396	636,667	969,195	1,658,937	1,801,606
Growth rate	-	6.32%	7.51%	4.3%	4.3%

Source: Computed from 1960, 1970, 1984 and 2000 Population and Housing Censuses. **indicates Projected[16].

It must be acknowledged that the census population figures above do not show the daily generation of people into Accra. It is estimated that the city accommodates between 2.5

[16] http://www.ghanadistricts.com/region/?r=1&sa=21&PHPSESSID=d58fb86d0 downloaded 31.08.2008

million to 3 million people in terms of socio-economic activities aside the residential dimension captured by the 2000 National Population Census.

4.3.2. Population density

The region has remained the most densely populated region in the country since 1960. Population density has increased from 151.6 in 1960 to 895.5 in 2000. The intercensal growth rate of 4.4 % between 1984 and 2000 is much in excess of the national average of 2.7 % per annum and implies a doubling time of 16 years. This is, in part, a result of migratory movements to the region. The densely populated nature of the region is brought into sharp focus when it is compared with the other regions. Table 4.2 compares the Greater Accra region with the country as a whole as well as with the Northern region, by far the largest in terms of land area but the smallest in terms of population size.

Table 4.2. Comparative Characteristics of the Greater Accra Region

	Area (Sq.km)	Population	Density	Growth Rate(%)
Greater Accra	3.245	2,905,726	895.5	4.4
Northern Region	70.384	1,820,806	25.9	2.8
Total Country	238,533	18,912,079	79.3	2.7

Source: 2000 Population and Housing Census, GSS[17]

4.3.3. Age and Sex Structure

The region's age structure is still a youthful one with the proportion of persons under 15 years varying from 31.6 % in AMA to about 42 % in Dangme East, while that of the aged (65 years and older) ranges from 3 % in the Ga District to a little above 8 % in Dangme East.

The male population has grown from 261,547 in 1960 to 1,436,135 in 2000. The corresponding female figures are 230,270 in 1960 and 1,469,591 in 2000. During the period 1960-2000, the female population grew much faster than the male population. According to official sources, the factors responsible for the excess females in 2000 may include male out-migration, female in-migration and higher male mortality. The seemingly severe economic conditions of the 1980s and 1990s might have compelled relatively more male emigration.[18] The primacy of the Accra as an administrative, educational, industrial and commercial centre

[17] http://www.statsghana.gov.gh/docfiles/Ghana%20in%20Figures.pdf. Accessed on 31.08.2008.

[18] http://www.ghanadistricts.com/region/?r=1&sa=21&PHPSESSID=d58fb86d0 Accessed on 31.08.2008

in attracting people from all over Ghana, continues to be the major force for rapid population growth, with migration contributing to over 35% of the population increase. Until quite recently when Accra has seen marked improvements with regards to the expansion of the existing road infrastructure as well the construction of new ones, the traffic congestion situation was most severe. The need to cater for the travelling needs of the teeming population was nowhere near the available infrastructure. With human and vehicle population soaring while the road infrastructure remained virtually constant, traffic congestion results. Again, the dense population, especially during Christmas holidays when more people come to the city to shop, could spill into the roads, causing vehicular movement to grind to a halt.

CHAPTER FIVE: PUBLIC TRANSPORTATION SERVICES AND TRAFFIC CONGESTION IN ACCRA

5.1. Introduction

This author believes that the factors that led to the collapse of the express bus service on the Kimbu-Adenta highway represent a microcosm of the overall factors that affect public transport provision in general in Accra. As such, a discussion on the broader context within which the pilot BRTS operated before its demise will be most ideal.

This chapter, therefore, takes a look at the public transport system as well as the phenomenon of traffic congestion in the city of Accra. Sub-themes that will be considered include an overview of the regulatory framework for public transport, the road network and the types of public transport services provided in the city. Also, the incidence and the causes of traffic congestion are discussed as well.

5.2. The Transport Sector

Generally, the Ghanaian transport system has been dominated by the road sector, even though other modes such as air, rail, in-land water and marine are equally important. A recent survey conducted by the National Road Safety Commission (2008) suggests that about 22 million passengers are moved by road whilst a total of about 122 million tons of freight is moved per annum[19].

So important is this sector that the ministry of government responsible solely for the planning, construction and maintenance of roads and highways of Ghana has been labelled the 'Ministry of Transportation'. To the outsider, this might create the impression that transportation in the whole of Ghana is only about the road sector. The Ministry of Transportation works through several Departments and Agencies.

These have been categorised as the *Road Infrastructure Sub-Sector* and may include the Ghana Highway Authority (responsible for the administration, development and maintenance of trunk roads and related facilities in the country); Department of Feeder Roads (provision of access to rural communities and centres of socio-economic activities through rural roads) and the Department of Urban Roads (responsible for administration, development and maintenance of urban roads and related facilities).

[19] http://nrsc.gov.gh/publications/doc/COMMERCIAL%20DRIVER%20STUDY.pdf. Accessed on 02.02.09.

The second group is the *Road Transport Services and Safety Sub-Sector* and may include the Driver Vehicle and Licensing Authority (DVLA), the National Road Safety Commission (NRSC) and the Metro Mass Transit Limited (MMT).

The last group is the *Road Transport Training* which includes the Government Technical Training Centre (GTTC) and the Koforidua Training Center (KTC).

All these agencies and departments work together to ensure that Ghana becomes the transport hub of West Africa[20].Note again, the emphasis placed on road transport as the main conduit for showcasing the country in the sub-region. It is therefore logical to conclude that urban transport in Accra, the nation's capital, 'is synonymous with road transport' (Addo, 2002, p.1).

5.3. The Road Network of Accra

Addo (2002) and Tamakloe (1993) are of the opinion that the road network in and around the city of Accra is based on a system of radial routes converging on the Central Business District. A major weakness in the network, as identified by these authors, is the lack of adequate east-west corridors. It is said that the lack of a good road system causes a country's 'wheels of development [to be] mired in mud' (Ellison 2002). As such, the relevant government authority is undertaking infrastructural developments in the transport sector with the hope that this identified weakness may be resolved in the near future. The Department of Urban Roads notes for instance, that the designs for 106 km of arterial roads, 60 km of local roads and 3 Interchanges have been completed for the Accra East corridor and the first 2.7 km of the proposed 15 km main arterial link to the west of Accra has been built already.[21] Presently, however, there are only four radials, three of which are heavily used and experience considerable traffic congestion. Following extensive studies on these arteries, Segbefia (2000, cited in Addo, 2002) notes that flows of vehicles per minute ranged from 10 to 14 in morning peak hours and 8 to 12 in evening peak hours.

The road network of Accra, on the whole, is generally fairly extensive. According to the Statistical and Analytical Report (2000-2006) issued by the Ministry of Transportation

[20] http://www.mrt.gov.gh/pages.asp?page_Id=49&expandable=0 Downloaded on 02.02.09.

[21] Status of Key On-going Programs (December 2007)
http://www.mrt.gov.gh/userfiles//Document1.pdf. Accessed on 02.02.09.

and the Ghana Statistical Service, the Greater Accra Region has the highest road network size of 5,123 km. The Ga District has the longest urban roads and sections of earth roads, about 2,070 km and 1,711 km respectively. Accra Metropolitan Area has the longest length of asphaltic concrete roads, about 151 km. Earth roads constituted about 48 % of the network as at the end of 2006. Compared with the national averages, the Ga District and Accra Metropolitan Area have the highest share of the total national urban road network with 21% and 19 % respectively followed by Tema with 12 %.

In addition to the above, Addo (2002) identifies what is considered as local roads whose primary function is to provide access to residential areas. In his opinion, the structure of the road network in Accra, as a whole, is however weakened by the haphazard location and management of most terminal and transit points. Most often, residential areas are developed without any consideration of public transport terminals. This unfortunate situation is a direct consequence of lack of discipline and strict compliance with laid down planning principles. It is not uncommon to identify terminals that are built either near streets or on privately owned land, which inhibits the development of permanent structures. Hence, it is estimated that whereas about 56 % of all terminals are between 1,000 and 3,000 square metres in size, only 5 % are of the size above 12,000 square metres. This unfortunate situation comes against realisation that there is a positive correlation between the size of a terminal and the number of vehicles handled within the hour (Addo, 2002; Oppong, 2000).

5.4. Evolution of Accra's Present Urban Transport System

Within the above described environment, Accra's present urban transport system has evolved over the years from one that was characterised by a well planned and managed public transport system that operated with big, comfortable, safe, regular and reliable buses, and which enjoyed state monopoly, to the current transport system which is dominated by individual operators.

The three state-owned bus companies that operated in Accra were the State Transport Corporation (STC), Omnibus Services Authority (OSA) and City Express Service (CES). However, it must be pointed out that the STC has no mandate to provide urban bus services. Rather, it is responsible for providing inter-urban services, principally between regional capitals, but also serving other large urban centres as well as cities in neighbouring countries. OSA was constituted in 1969, under the then Ministry of Local Government, to provide

services previously provided by municipalities. In 1972 OSA was further empowered to operate in any other areas prescribed by the then Commissioner for Local Government. Until recently, OSA operated mainly country-wide urban-rural services.

CES was formed in 1981, as a special Department within the then Ministry of Transport and Communications, following the delivery of 600 new Tata buses. They also operated urban-rural services but, like OSA, made only a very small contribution to urban transport. Urban mileage for CES in January 1992 was less than 10 % of total (Fouracre et al., 1994).

Against the backdrop of rising losses, overwhelming operating difficulties, and stiff competition from the private sector, OSA had had to withdraw its services to the public. Under Ghana's Economic Recovery Programme (ERP) in the early eighties, the state divested itself of its public investment in bus operations. The responsibility of running bus services in cities like Accra was therefore relinquished to the private sector. This era marks the genesis of the famous '*trotros*' of Ghana which have become the mainstay of Ghana's current public transport system.

Fouracre et al. (1994) argue that during this era, the growth in vehicle numbers exceeded population growth over the same period. The majority of these vehicles (over 80 % in 1991) are concentrated in the main urban centres. The high growth in vehicle numbers between 1984 and 1991 seems to coincide with the ERP. Public transport accounts for just over 80 % of total motorized trips in Accra. The majority of these trips are by *trotros* or minibuses (48 %), with taxis and big buses carrying 23 and 11 % respectively (ibid).

Trotros are based on a range of vehicle types, but have commonality in their purpose and mode of operation. In more recent times, the *trotros* have been augmented by purpose-built mini-buses, due to the ban on their use for long distance journeys. Ofosu-Dorte (1992, cited in Fouracre et al 1994) notes that due to a 1989 restriction imposed on all minibuses (up to 23 seats) to limit their operations to routes of 50 km and below, an estimated 10,800 minibuses had been switched to urban operations. Also, saloon-cars are now used as shared taxis. Taxis have a legal seating capacity of four passengers, while the *trotros* and minibus seating capacity range in size from 12 to 30 seats. On basis of this, the available seats on offer in Accra are about 720 per 10, 000 population. This would seem high, but must be offset against a daily vehicle output which is probably quite low i.e. under 150 km (Fouracre et al., 1994). All *trotros*, including mini-buses and shared taxis, are owned by the private sector. There are no market entry limitations but a major hallmark of this sector is the presence of very powerful and influential owner and driver unions.

According to the Ministry of Transportation and Ghana Statistical Service (2006), there are currently twenty three identified public transport operators. These operators all belong to one recognised umbrella union, called the Ghana Road Transport Co-ordinating Council (GRTCC). However, the total number of operators, as mentioned above, could be challenged. As observed in Table 5.1 below, only 22 operators are mentioned.

Table 5.1 GRTCC Membership

Number	Name	Acronym
1	INTERCITY STC COACHES COMPANY LIMITED	STC
2	GHANA PRIVATE ROAD TRANSPORT UNION	GPRTU
3	CONCERN TRANSPORT UNION	CONCERN
4	ASSOCIATION OF LIBERAL TRANSPORT OPERATORS	ALTOPS
5	GHANA NATIONAL CARGO TRANSPORT ASSOCIATION	GNCTA
6	COMMERCIAL DRIVERS ASSOCIATION	CDA
7	POSITIVE TRANSPORT UNION	PTU
8	UNITY TRANSPORT UNION	UNITY
9	EXPRESS DRIVE TRANSPORT	AWOTWE
10	GHANA COACHES OWNERS ASSOCIATION	GHACOA
11	GHANA CO-OPERATIVE TRANSPORT ASSOCIATION	GCTA
12	GREAT IMPERIAL TRANSPORT	IMPERIAL
13	GHANA HAULAGE TRANSPORT DRIVERS ASSOCIATION	GHTDA
14	PROGRESSIVE TRANSPORT DRIVERS ASSOCIATION	PROTOA
15	GHANA ROAD HAULAGE ASSOCIATION	GRHA
16	PERGAH TRANSPORT SERVICE	PERGAH
17	REDEEMER TRANSPORT SERVICE	REDEEMER
18	LABOUR ENTERPRISE	LET
19	KINGDOM TRANSPORT SERVICE	KTS
20	TRANSCITY EXPRESS	CITY EXPRESS
21	AGATE TRANSPORT SERVICE	AGATE
22	MIGHTY TRANSPORT UNION	MIGHTY

Source: Ministry of Transportation and Ghana Statistical Service (2006)

Fouracre et al. (1994) contend that some of the unions have derived their power through the patronage of earlier governments which encouraged their organization and development. Their power is exerted through control of the terminals from which services are operated. Without access to a terminal, independent operators have limited opportunities to generate custom. Through their control of the terminals (which are referred to as lorry parks), the unions have effective quantity control of the public transport sector and hence control of service quality. From experience, passengers have learned that there is little prospect of

boarding a vehicle other than at the terminals which have thus become the main foci of passenger demand. Since the financial rewards inherent in the control of lorry parks are high, rivalries have developed between and even within unions. Monopoly access to its lorry parks is jealously guarded by each union branch.

The ownership of all terminals rests with the Municipal Assemblies, who have firm and unambiguous statutory powers to establish, maintain and control parks and terminal facilities. However, management is assigned to the unions and the bus companies. Terminals are usually shared by both taxis and minibuses. Each terminal consists of a number of parks. According to a recent survey of one hundred and fifty-six minibus and taxi parks, spread over 33 terminals (95 % of the total in Accra) by TDP Consult, GPRTU, the largest of the unions, administered 128 (82 %) while GCTA administered the rest.

Owing to the operational procedures of 'queuing and holding' at the terminals, unions would rather compete for the terminals instead of the routes. According to this practise, vehicles are 'held' at terminals and not released until they are full to capacity. This practice is specified by the union constitution and violations of the queuing principle are a serious offence, even though, a report released by the TDP Consult (cited in Fouracre et al, 1994) suggests that some union officials use their privileged position to '*jump*' the strict queuing principle. Occasionally, some vehicles are also sent out empty, or as it is referred to in local parlance, '*waa-waa'*, in order to service *en-route* passengers, but few drivers would volunteer for this duty. This system ensures full loads for each driver, but relies for its success (to the drivers) on the absence of competing groups.

Quite clearly, urban transport system is an urban issue and must be seen as an integral part of the general urban planning and development. 'Many cities throughout the world organize their own transport policy and development, usually with a measure of supervision by the relevant Urban Affairs Ministry, who control the budget. While this approach provides the best hope for integrated urban planning, it depends critically for success on two components: the creation of a professional cadre of urban transport planners (in both local and central government administrations) which can command status and the availability of staff that are qualified to establish and maintain the cadre. Neither of these two requirements presently exists in Ghana, and is unlikely to exist for some time' (Fouracre et al., 1994 p. 48).

Without any proper transport policy enforcement by the relevant government authorities, the services of the private transport operators in Accra leave much to be desired. For instance, Addo (2002) contends that the transport unions have not been able to regulate

effectively driver behaviour. As such, drivers and their aides could therefore be discourteous to passengers and other road users knowing very well that severe sanctions are rarely applied even when reports are made to the executive members of the unions. Again commercial vehicle drivers even flout some of the Road Traffic Regulations such as driving on the shoulders of the road to avoid the slow pace in the mainstream of traffic; stopping abruptly in the middle of moving vehicular traffic to drop and pick passengers, and sometimes even jumping red traffic light signals, probably due to the insufficient number of police personnel in the city. Oppong (2000, cited in Addo, 2002) argues further that the absences of well designed and properly located bus stops, as well as insufficient and inadequate terminals are factors that also promote driver misconduct. The road network structure and orientation as well as the disjointed location and distribution of terminals make it difficult for public transport users to make uninterrupted journeys. Often, more than 80 % of public transport users need to make two or more legs before getting to their final destinations (Oppong, 2000).

Consequently, many passengers are prepared to pay more for a better service by using shared taxis which may charge two or three times the bus fare (Addo,2002) even though the fact remains that the more than 30,000 taxis add very substantially to serious congestion and pollution in Accra (Armstrong-Wright, 1989; Fouracre et al., 1994).

The Metro Mass Transit (MMT) has been added to the public transport services provided in Accra in recent years.

5.5. Traffic Congestion in Accra

A recent urban transport study in major cities in Ghana conducted by the Dutch company *DHV Netherlands*, with assistance from the Municipal Development Collaborative Limited of Ghana, suggests that more than 70 % of major roads in Accra and Kumasi (the second largest city) are congested with travel speed recording lower than 20 km/hr and it is likely to get worse if current trends are maintained (Ghana Institution of Engineers (GhIE), 2008).

5.5.1. Causes of Traffic Congestion in Accra

Traffic congestion all over the world is a function of human activity. At a one-day conference on 'Traffic Congestion in Major Urban Cities in Ghana' held at Accra on February 21, 2008 by the GhIE, seasoned engineers from all over the country took turns to address the problem

of traffic congestion. Some of their views, which I personally share, are presented and discussed.

The first obvious cause of traffic congestion in Accra is the alarming rate at which vehicles are growing in the capital city. As at 2004, a total number of 181,000 vehicles had been registered in Accra. According to projections, this figure could rise above one million by 2024 (ibid.) One may argue that the desire for car ownership is a reflection of people's improved standards of living. Under Ghana's current *Growth and Poverty Reduction Strategy*, the government's thematic priorities include: macroeconomic stability; private sector competitiveness; human resource development; and good governance and civic responsibility. Sound macro-economic management along with high prices for gold and cocoa helped sustain GDP real growth rate of 6.3 % in 2008 (CIA's World Fact Book, 2009).[22] In addition, with an expected boom to the Ghanaian economy from the oil industry by 2010, people's purchasing power is expected to improve, especially those in the middle working class. Consequently, vehicular population might even exceed the projected figure for Accra.

Some may counter argue, and rightly so, that in many countries, including Ghana's neighbour Nigeria, the discovery of oil has not always resulted in a general improvement in people's living standard except for the few elite in the society. This is referred to by Auty (1993) as the 'resource curse' – the paradox that the local population do not benefit from the oil wealth, but instead tend to have less economic growth and in addition suffer from the environmental costs of harnessing the resource for the world market. However, by strengthening Ghana's democratic and accountability processes and thereby avoiding corruption and governmental mismanagement of resources, it is expected that the benefits of the discovered oil will improve the lot of the citizenry which will in turn reflect on their vehicle ownership patterns.

The argument put forward by Olswewski & Turner (1993) explains the point which has just been made regarding the relationship among economic well-being, vehicle ownership and traffic congestion. According to them 'economic growth and increased affluence leads to a growth in vehicle ownership which in turn usually produces the unwelcome effects of urban traffic congestion and major environmental problems' (ibid., p. 355). Although conceding that the above assertion may be true, Dargay et al. (2007) are of the view that the relationship between vehicle ownership and income levels is neither linear nor one-to-one. In fact, by

[22] https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html#Econ. Accessed on 10.01.2009

pooling annual data over the period 1960-2002 from the USA, Germany, Japan and South Korea, these authors suggest an S-shaped relationship. Vehicle ownership grows relatively slowly at the lowest levels of per-capita income, then about twice as fast as income at middle-income levels (from $3,000 to $10,000 per capita), and finally, about as fast at higher income levels, before reaching its maximum level ('saturation') at the highest levels of income.

Against the back drop of vehicle increase, Accra suffers from inadequate road infrastructure capacity, the second factor that is believed to account for traffic congestion in the city. Addressing the said GhIE conference, Kwablah (2008) noted that most of the arterial routes in the city have some missing links or in very poor condition, thereby increasing the overall travel time on most of parts of the network. Also, ongoing road infrastructure development to widen the existing road network, and the development of interchanges jointly account for massive traffic congestion in the city.

Moreover, inefficient use of the existing road capacity has been identified as a third and major contributory cause of traffic congestion (ibid). In this chapter, I have already discussed the nature of Accra's urban transport system. As such, that will not be the focus of further discussion but one obvious characteristic of the system that needs to be mentioned again is the over-reliance on the use of low carrying-capacity *trotro* vehicles. Available figures indicate that in 2004, 1.3 million passengers commuted the Central Business District of Accra on a daily basis. Out of this figure, 1 million used *trotro* or taxi. By 2024, an estimated 3.04 million passenger trips/day will enter or leave the CBD (GhIE, 2008). While majority of the *trotros* are old and badly maintained, their carrying capacities are between 12-15 and 22-33 passengers. The legal carrying capacity for taxis is 4 passengers. According to Kwablah (2008), whereas *trotros* and taxis carry 52 % and 9 % respectively of the travelling public, they use 27 % and 18 % road space. Another mode of transport which carries few people i.e. 13 % but uses maximum road space (33 %) is private cars. The rest of the statistics are presented in Figures 5.1 and 5.2.

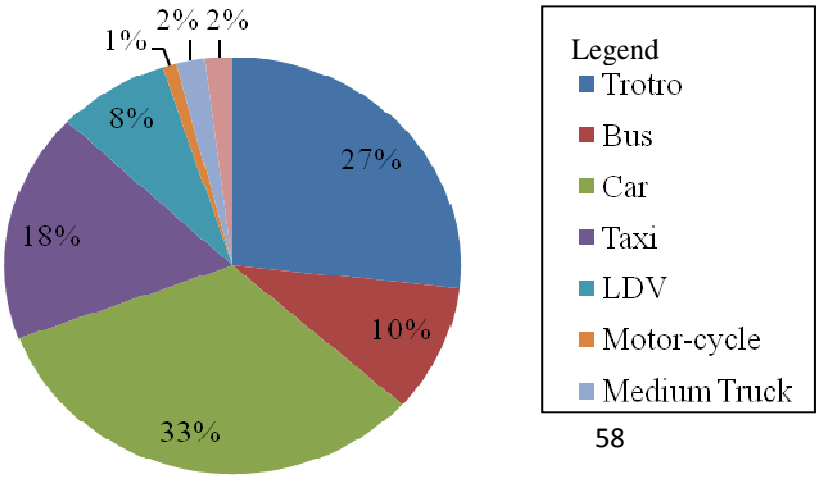


Figure 5.1 Percentages of Road space Usage per Transport Mode in Accra (Source: GhIE, 2008).

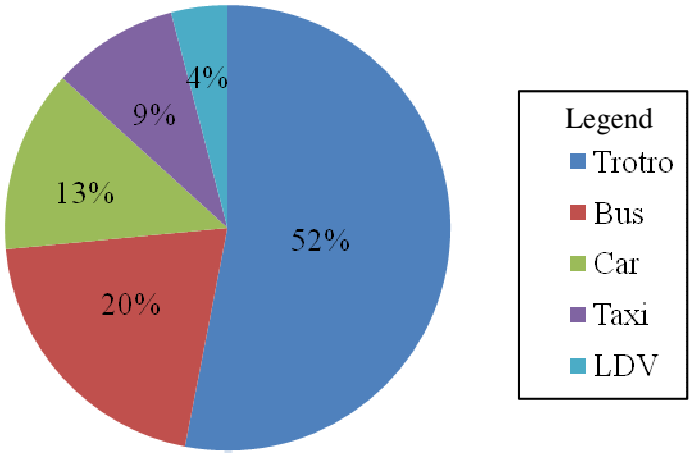


Figure 5. 2. Percentages of Passengers Carried per Transport Mode in Accra. (Source: GhIE, 2008).

The land use and traffic nexus as observed in Accra could also account for the endemic traffic congestion in the city. Addo (2002) notes that the attainment of a vibrant and comfortable city life is a function of land use, transport, cultural values and the imagination and management skills of city officials. However, owing largely to the unplanned nature of Ghanaian cities, of which Accra is no exception, coupled with weak local governance and an urban economy which is primarily trading-oriented, the various land use types such as residential, commercial, industrial, recreational, educational, sanitary etc are haphazardly developed. The plates below, obtained from the GhIE (2008), illustrate some of the land use and traffic patterns which either cause or perpetuate the incidence of traffic congestion in Accra.

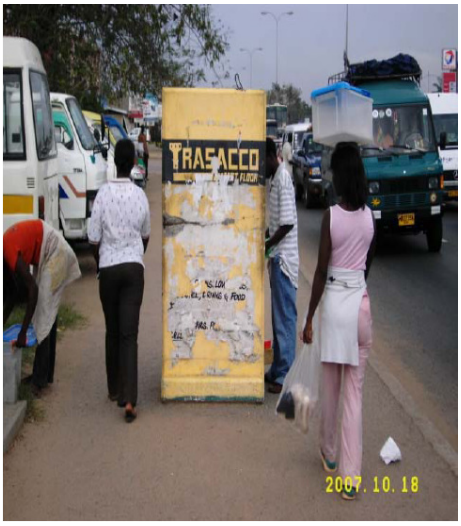


Plate 5.1 Transport terminal on road shoulder

Plate 5.2 Commerce compete for space with vehicles (Traders erect umbrellas to provide shade!)

The over-concentration of economic activities in Accra, especially at the Central Business District is symptomatic of planning failure. Also, Tema's failure as a twin city with no viable central business and magnetic commercial centre has worsened traffic congestion in Accra (Tackie, GhIE, 2008). The spontaneity with which passenger terminals develop and their ubiquitous distribution in wrong locations also generate avoidable traffic.

As if these are not enough, road reservations are abused with impunity especially for commercial activities by residents of Accra.

Plate 5.3 Blocking of the Walkway with Adverts. (Source: ibid.)

Plate 5.4. Driving on shoulder of road further compounds traffic congestion (Source: ibid.)

CHAPTER SIX: RESULTS AND DISCUSSIONS

6.1. Introduction

This chapter presents the results from the fieldwork undertaken for the purpose of this study. Discussions of the findings are also presented. An overview of the Metro Mass Transit Limited, the operators of the former express service; the characteristics of the pilot BRTS, traffic congestion on the Kimbu-Adenta highway as well as the other potential factors that might have conspired to collapse the pilot BRTS are some of the key themes that will be explored in this chapter.

6.2.1. The Metro Mass Transit: Brief History and Ownership

In order to salvage the situation and prevent further worsening of the afore mentioned challenges to public transportation in the city, i.e. the domination of the Ghanaian public transport scene by the single operator services, and the negative externalities such as traffic congestion and the associated pollution, the current transport policy of the government of Ghana has been to establish what is believed to be 'an efficiently and modally complementary and integrated transport network for the movement of people and goods at least cost throughout the country' (Kwakye & Fouracre, 1998, p.2). This is to enable the country to achieve a middle-income status by the year 2020 and also to serve as the gateway to the entire West African sub-region.

President Kufour advocated for the establishment of the *Metro Mass Transit* (MMT) Bus system at his inauguration speech on January 7th, 2001. Expectedly, Ghanaians in general, and those in Accra, in particular, heaved a sigh of relief when in October 2003, the Metro Mass Transit or the 'the Kufuor Bus', as it came to be called, was established. The Metro Mass Transit Limited, a joint venture between the Government of Ghana (which owns 45 % shares through the assets of the now defunct Omnibus Services Authority) and private investors (55 % ownership), which has a vision 'to provide an efficient urban mass transport system in Ghana through the use of buses',[23] was tasked with the operation of the bus service. The private shareholders are National Investment Bank, State Insurance Company,

[23] http://metromass.com/pub_trans_gh.htm. Retrieved on 14.02.2009

Agricultural Development Bank, Social Security and National Insurance Trust (SSNIT), Ghana Oil (GOIL) and Prudential Bank limited.

The fleet of MMT buses were imported on a gradual basis from China, Holland, or assembled locally. The Italian government also donated some buses to augment the Ghanaian government's laudable efforts. By the end of 2006, the total fleet had reached 677. See Table 6.1 below.

Table 6.1 Fleet Size and Passenger Capacity of MMT Buses

TYPE	DESCRIP-TION	SEATING CAPA-CITY PER BUS	STANDING CAPA-CITY PER BUS	NUMBER OF TYPE	TOTAL SEA-TING CAPACITY	TOTAL STAN-DING CAPACITY	TOTAL CAPACITY
YAXING SINGLE DECK	BUS	35	65	310	10,850	20,150	31,000
YAXING DOUBLE DECK	BUS	68	52	87	5,916	4,524	10,440
DAF PF	BUS	63		73	4,599	-	4,599
DAF PE	BUS	34	66	101	3,434	6,666	10,100
VD JONCKHEERE	BUS	63		63	3,969	-	3,969
VDL NEOPLAN	BUS	64		43	2,752	-	2,752
TOTALS				**677**	**31,520**	**31,520**	**62,860**

Source: Ministry of Transportation and Ghana Statistical Service (2006).

The total MMT staff strength as at the end of the same year stood at 2,536. Nearly half of this work force i.e. about 45 % worked in Accra and its environs. The average driver to bus ratio is 1:4. The MMT bus system operates three types of routes. These are: Intra-city, Intercity and Long distance. Currently the most operated route is the intra-city, followed by the intercity and long distance in that hierarchy (Ministry of Transportation and Ghana Statistical Service, 2006).

6.2.2. The Metro Mass Transit: Services Provided

In an interview with Mr. Henk Visschers, the former Manager of Conexxion –the largest Dutch public transport company –and now the Managing Director (M.D) of the MMT, he pointed out that the company offers *Intra-city services*, by which he explained to mean normal city bus operations that connect between central bus terminals with city outskirts where people can board and alight at designated bus stops. This service is usually patronised by commuters and market women that move in-between their homes and their various work

places. Yaxing, Iveco and VDL buses are the types of vehicles used for the intra-city services.

He noted again that the company offers *Rural-Urban* services. Because of the long journey, the rural service has a low but solid frequency. This service is meant to open up villages in isolated districts for social and economical activities. An example is the Accra-Ho, Accra-Assin Fossu route. The company has dedicated the DAF buses run the rural-urban bus services.

The MMT limited also operates high frequency trips to short distances, such as between Kimbu and Tema and between Kumasi and Obuasi or Kumasi and Sunyani respectively. This is the *shuttle services* run by the company. Finally, the MMT offers *Intermediate and long distance* services to link major cities like Accra and Kumasi, Accra and Tamale etc.

As a bold attempt to solve perhaps one of the most common and disturbing of all the problems of urban transportation, i.e. congestion, the MMT Limited introduced what they referred to as the *Bus Rapid Transit System (BRTS)* on a pilot basis in Accra, in September, 2005.

6.3. BRTS in Ghana: Characteristics

The introduction of the pilot BRTS in Accra by the Metro Mass Transit Limited was characterised by a fast trip connection between the southern Kimbu station and Nkrumah Circle with the northern suburbs of Legon, Madina and Adenta, with Tetteh Quarshie acting as a central transport hub and change over point.

According to the Managing Director of the MMT, the routes selected for the pilot BRTS comprised of three loops, two of which were small as well as bigger one. The first was scheduled bus services plying from Adenta to Tetteh Quarshie; the second, from Tetteh-Quarshie to Kimbu and finally, between Kimbu and Adenta. According to the operational plan, a *VDL* bus was supposed to pass on these routes every 15 minutes. He affirmed that the company had planned to add Tetteh Quarshie to La-Paz and Tetteh Quarshie to Circle respectively to the sphere of operation of the pilot BRTS.

The extension of the pilot project was informed by the massive ridership enjoyed by the Kimbu-Adenta pilot BRTS as exhibited by the astronomical rise in daily ticket sales to about twenty thousand, according to the management of the service.

Explaining how the pilot BRTS actually operated, Mr. Ernest Asare, an MMT driver from Adenta to Kimbu since 2003, and who had taken part in the pilot BRTS had this to say:

> *'Initially we operated a system that ensured one leg of journey from Adenta to Kimbu in Accra until the BRTS was introduced. Thus, the journeys were now divided into two legs: from Adenta to Tetteh Quarshie and Tetteh Quarshie to Kimbu in Accra. Passengers were charged an initial fare of one thousand cedis only from Adenta to Tetteh Quarshie. They continued their journeys in different buses from Tetteh Quarshie to Kimbu in Accra, also at another fare of one thousand cedis'.*

Mr. George Ahiati, another MMT driver who has been working since 2006 on the Adenta-Kimbu corridor also recounted that due to the availability of buses, passengers never had to wait for longer periods of time at Tetteh Quarshie before their second journey to Kimbu.

As to why these particular routes were selected, the managing director intimated that cognisance was given to the characteristics of the road network and as well as the infrastructure. This view was corroborated upon by the deputy managing director who suggested, for instance, that the Tetteh Quarshie-Kimbu highway was quite big due to the fact that most part of the highway had four lanes which allowed free flow of vehicular traffic. Another driver of the bus company, Mr. Emmanuel Opoku who had been part of the pilot BRTS operation, in an interview, also recollected that a reconnaissance survey was done on the Adenta-Kimbu highway to gather data on bus ridership in addition to identifying bus stops that received massive patronage from passengers. After these exercises had been conducted, the BRTS was introduced on a pilot basis to the public.

Another major feature of the pilot BRTS was the use of bus conductors. Initially the conductors, together with the drivers, formed the driving crew. However, during the second phase of the project, the conductors were replaced with ticket booths made out of wood and placed at certain designated bus stops (See Plate 6.1 below). The drivers of the pilot BRTS were banned from hawking for prospective passengers en route or allowing passengers from disembarking at other points besides the designated bus stops. These booths therefore served as the main foci for all activities related to the pilot BRTS. For instance, they served as venues where passengers could buy their tickets before the buses arrived. The conductors will then deface the tickets after which the passengers will be allowed to board the buses. The booths also served as bus terminals where drivers of the express service could take a breather

as they waited for passengers to board. From observation, but for the main terminal at Kimbu, none of these booths had adequate shelter to protect passengers from the vagaries of the weather or comfortable seating places for passengers to rest while waiting for the buses.

Plate 6.1. A passenger buying a bus ticket at an MMT ticket booth (Author's field work, 2009)

Apart from the above mentioned characteristics, the pilot BRTS in Accra never had most of the seven components as had been reviewed in the literature, especially an important component as a dedicated ROW. The buses were made to compete for road space with other users of the Kimbu-Adenta highway.

As to whether one could therefore conveniently classify the erstwhile express bus service in Accra as a BRTS, the response is divisive. Whereas management of the bus company strongly believe it was a BRTS or had a semblance of it, and even argue that in developing countries such as Ghana, one could not possibly introduce a state-of-the-art technology aggressively without implementing it in a simple and gradual manner, the public transport regulators at the Ministry of Transportation think otherwise.

According Dr. Darku, the Deputy Director in-charge of Planning and Development at the Department of Urban Roads, the Metro Mass Transit Limited, as one of the numerous public transport providers has never been mandated to operate anything called a BRTS.

While conceding that the bus company had requested his outfit to mark some segments of the Kimbu-Adenta highways as '*Bus Only'* which they did, he was of the view that that exercise alone was simply not enough. Without effective enforcement of the law by the police to ensure strict compliance by other motorists, the MMT express buses did not have a dedicated ROW which is one major component that characterises a BRTS, thus making the project a failure right from the onset. He concluded that the mere act of putting a number of buses on a corridor and calling it as a BRTS does not make it as such. His views were similar to those expressed by a senior member of the Urban Transport Project office of the Department of Urban Roads who pleaded anonymity because he was not authorised to speak on the subject.

The differing opinions expressed above are an indication of the dichotomy that usually prevail between policy makers, on the one hand and policy implementers on the other. Be that as it may, readers are reminded of an assertion by the IEA (2002) that communities can customise the building of a rapid transit system that meets their needs and fits within their budget. They note further that the extent of dedicated infrastructure and the level of sophistication of different systems vary considerably. Against this back drop, the term 'pilot' as used by the company in describing their kind of BRTS is seen as most appropriate.

6.4. Traffic Congestion on the Kimbu-Adenta Highway

As discussed previously, the entire road network of the city of Accra is congested. As such, it is reasonable to anticipate traffic congestion on the Kimbu-Adenta highway on which the pilot BRTS operated. However, the incidence of congestion on this corridor is not uniform. Congestion varies with the time of the day, as well as the days in the week. This is a true reflection of the variations in human activities during these noted times.

'*Average travel speeds*', as will be used in the ensuing paragraphs, actually represent only the '*median*' speed values that were obtained from the field survey. This is because statisticians prefer this descriptive statistic over the '*mean*' values in the measurement of central tendency. As Quiroga and Bullock (1998, p.124) has suggested in the literature, 'a high median speed represents average traffic condition much better than a low harmonic mean speed'. The mean traffic condition is added later on for comparative purposes only.

Again, readers must take note that the buffers created around the main highway in the three colour-coded maps below are a reflection of severity of traffic congestion at each segment of the road. A wider buffer represents very severe traffic congestion, and vice versa.

6.4.1 Traffic Congestion by Time of the Day

During the morning (i.e. 06:00 a.m. to 09:00 a.m.), traffic congestion, as measured by the average travel times, is most conspicuous in the direction of the central business district at Kimbu, in Accra from Adenta. These periods represent the morning peak hours when most economic, social and other activities are directed towards the CBD.

According to Figure 6.1 below, an average speed of less than 10 km/hr was recorded at segment 12 on the corridor. However, for the greater part of the corridor, speeds of in-between 10 and 20 km/hr on the average were recorded. In spite of this generalisation, it can be observed that as the buses move southwards from Adenta, congestion is most severe from segment19 to 17. The congestion eases a little bit even though travel speeds are still low as the buses traverse segments 16 and 15 but becomes severe again at segment 14. A similar situation is found at segments 6 and 5. Also within this same average speed range, segments 2 and 1 are noted for severe traffic congestion as the buses are about to finish the journey. When the buses reached segments 3, 11 and 13 on the corridor, they could travel at a rate of between 20-30 km/hr. At segment 4, average speed rises to between 30 and 40 km/hr. Segment 7 was the only point on the highway that recorded a relatively high average speed value of 44 km/hr. This relatively high value is, however, below the posted speed limit of 50 km/hr for the entire corridor.

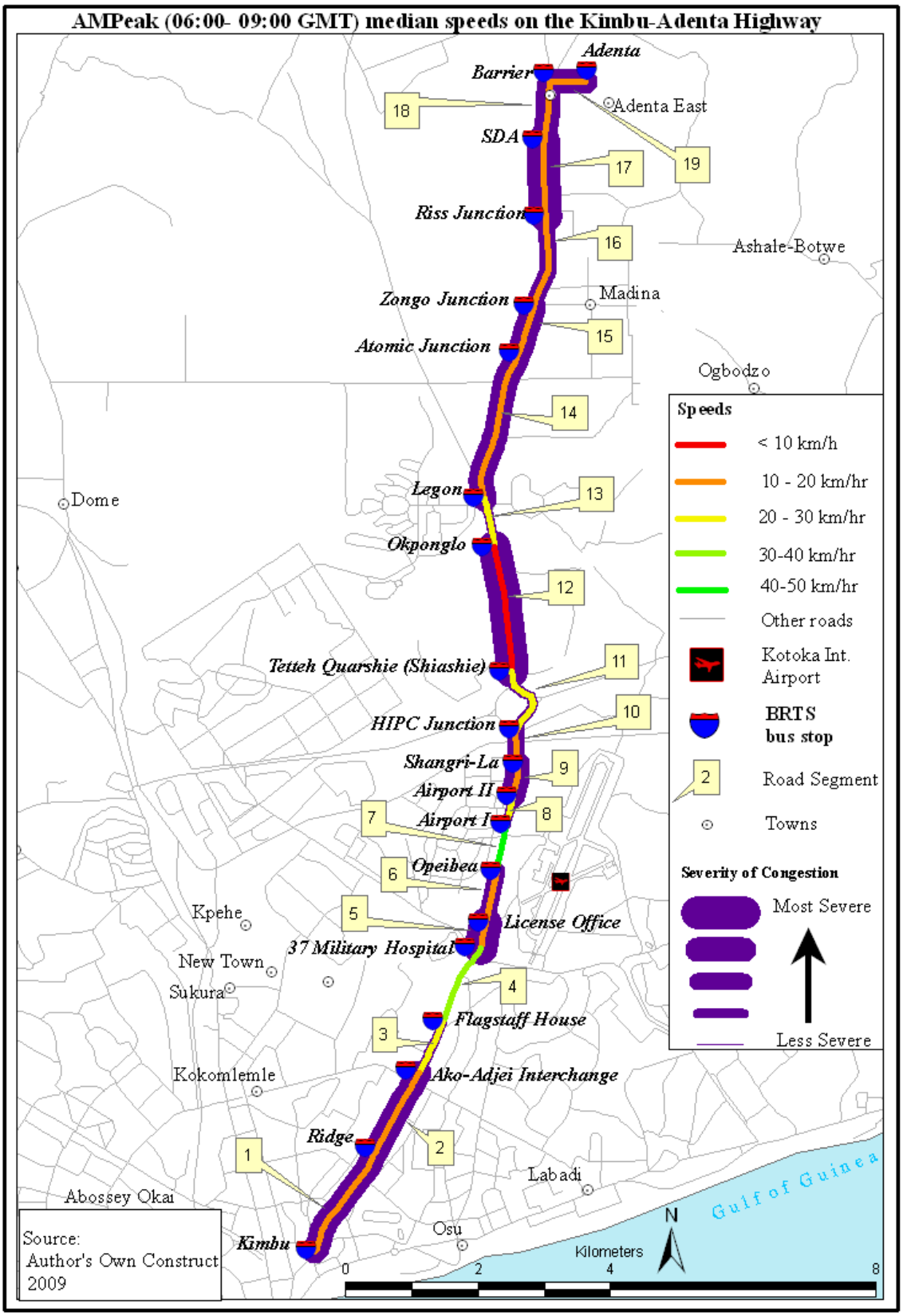


Figure 6.1 AM Peak Thematic Map

In the off-peak period, (i.e. 12:00-15:00 GMT) as represented in Figure 6.2 below, movement of the buses in both directions, either from the CDB at Kimbu towards Adenta or vice versa, was above the minimum average speed of 10 km/hr as was observed in the AM Peak. This is perhaps the only major feature that differentiates the afternoon off peak travel times from the peak travel times observed in the mornings. This is due to the fact that about thirty-two percent of the segments had average speed values that ranged in-between 10 and 20 km/hr. This particular speed range begins with segment 15 all the way to 19 but as could be observed from the varying sizes of the buffers around the road network, congestion is more severe at segments 15 and 16 than it is for the rest of the journey northwards. A greater part of the corridor, about fourty-two percent had speed values averaging from 20 to 30 km/hr on the average. The severity of the congestion also varies. For instance, even though segments 13 and 14 are within the same speed range, congestion is more severe at the former than the latter. Also, four of the segments, representing twenty-one percent, had comparatively higher speeds with an average of between 30 and 40 km/hr. However, only segment 2 had an average speed value which was a little above 40 km/hr. Of course, this value also falls below the posted speed limit.

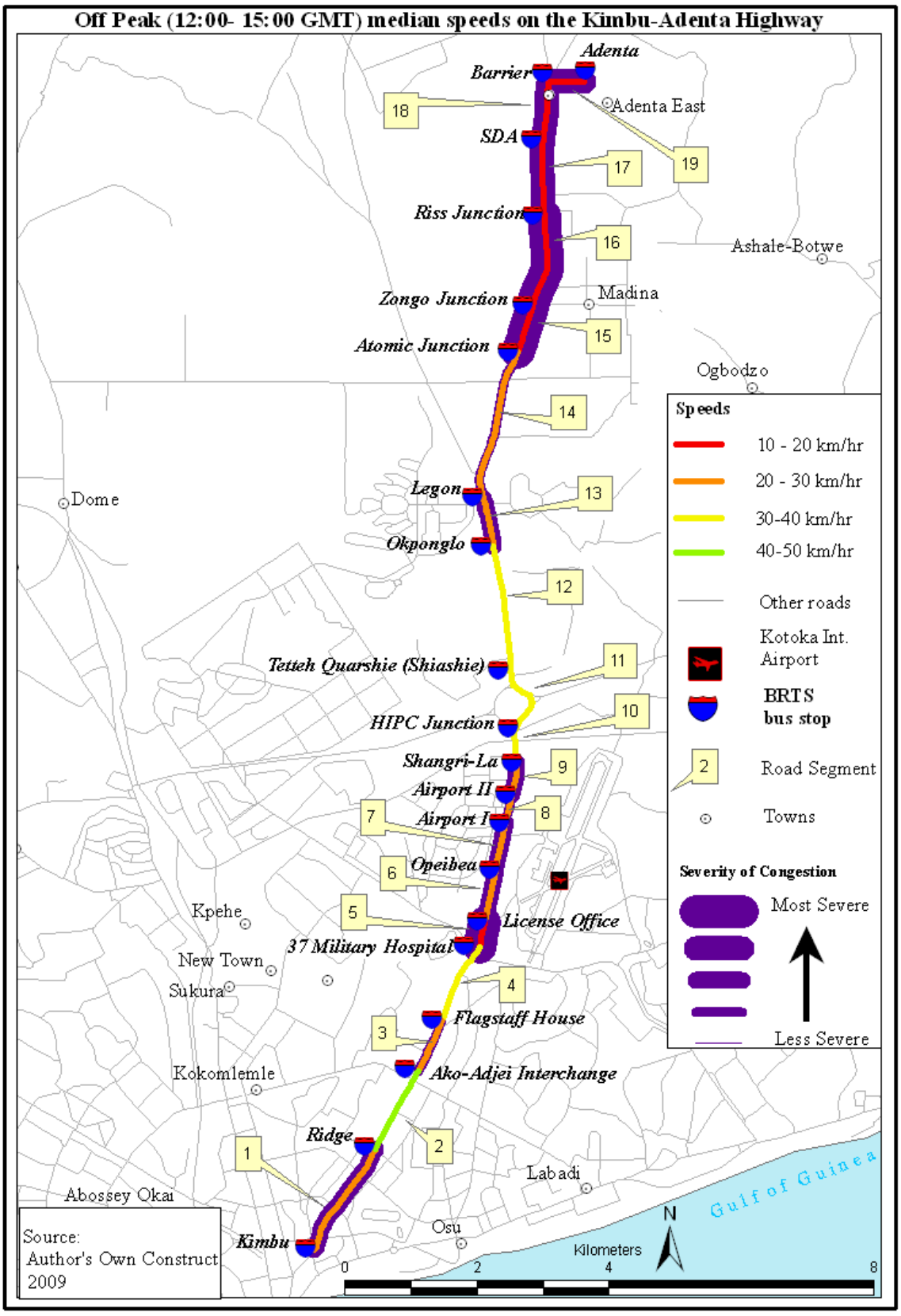


Figure 6.2 Off Peak Thematic Map

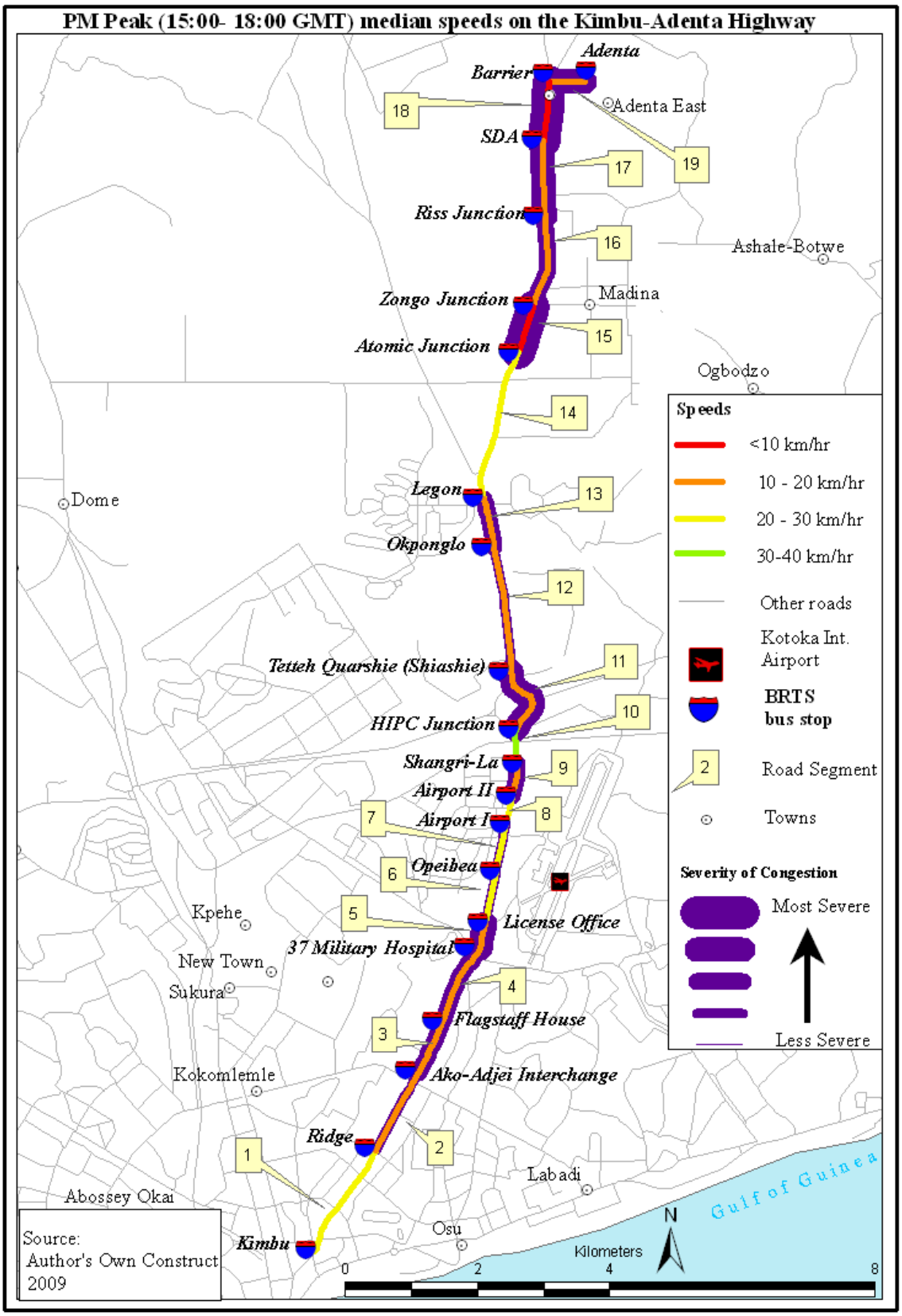


Figure 6.3 PM Peak Thematic Map

In the late afternoon period, i.e. (15:00 – 18:00 GMT), human activities generally move from the centre of town towards the peripheries. This period represents the afternoon peak. As such, much traffic congestion is observed as the buses move northwards towards Adenta from Kimbu. According to Figure 6.3 above, two segments i.e. 15 and 18 representing eleven percent of the total corridor, had average speeds limits below 10 km/hr. Again, it can be observed that congestion is more severe at segment 18 than at segment15. On fifty-eight percent of the highway, the buses could travel at a rate of only 10 and 20 km/ hr on the average. As can be observed, notable variations, for instance at segments 11 and 13 as compared with segment 12 prove that the severity of congestion changes geo-spatially. Again, average speeds of between 20 and 30 km/hr were possible on only twenty-six percent of the corridor. Expectedly, only segment 10 had an average travel speed of 34 km/hr.

6.4.2 Traffic Congestion by Day of Week

Traffic congestion, as a dynamic phenomenon, did not show variations only with the time of the day but with the various days of the week as well.

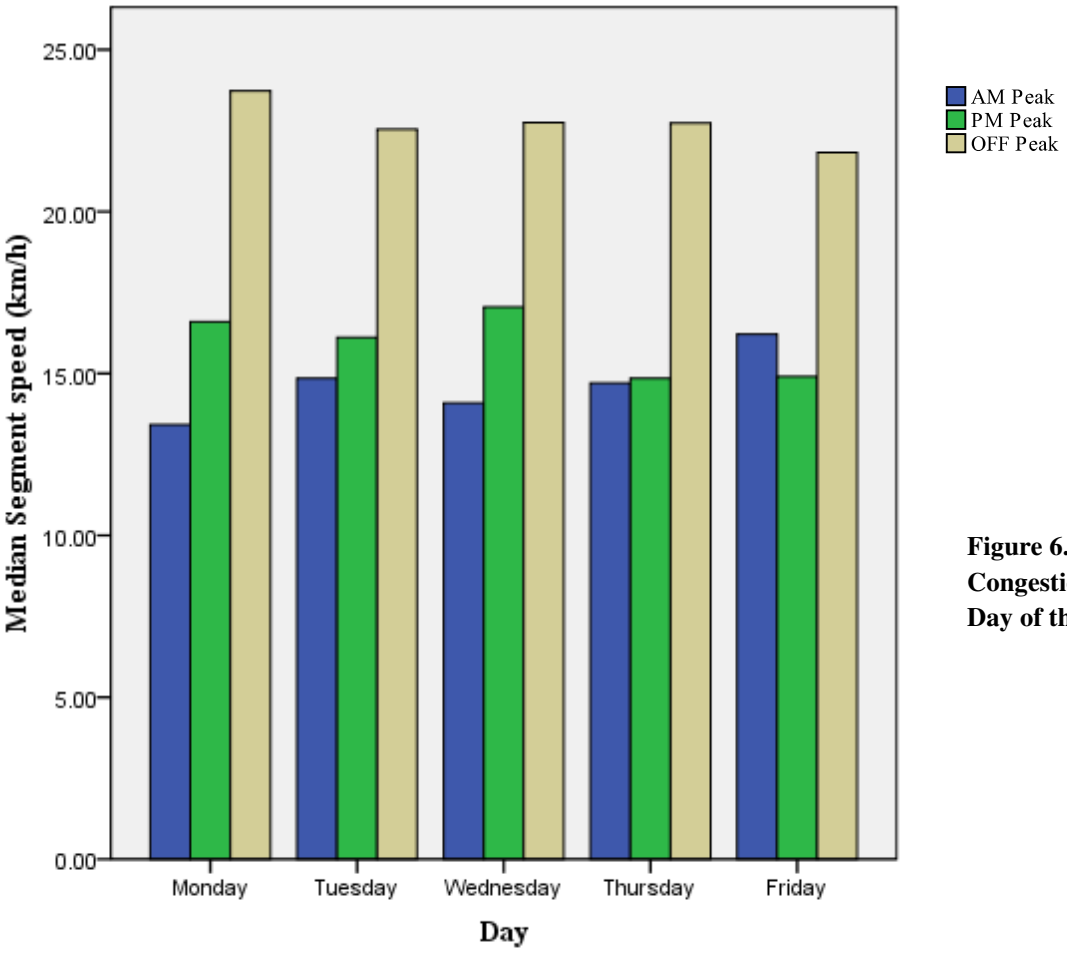


Figure 6.4 Traffic Congestion by Day of the Week.

According to Figure 6.4 above, on a typical Monday morning, average speeds are at their lowest, about 14 km/hr as the buses move towards the Kimbu direction from Adenta. During the PM Peak, however, average speeds rise just a little close to 16 km/hr as the vehicles move in the opposite direction. Comparatively, the median speeds during the off peak period, in both directions, was around 24 km/hr.

On Tuesdays, the average travel speeds recorded for both AM and PM peaks are slightly different from each other with values of 15 and 16 km/hr respectively. The Off-Peak periods on Tuesdays, however, showed a minor drop in average travel speed to 23 km/hr from the Monday figure obtained during that same period.

Average travel speeds obtained during the AM and PM Peaks on Wednesdays were a little under 15 and 17km/hr respectively. These values are not so significantly different from those obtained for the previous day. Also, the average Off-Peak travel speeds for Wednesday maintained the same value as obtained for Tuesday.

On Thursday, the average travel speeds obtained for both AM and PM Peak periods were almost similar. With speed values just a little close to 15 km/hr on the average, there were no significant changes in the travel speed of the buses, whether they travelled towards the CBD or towards Adenta. As in the two previous days, the average travel speeds during the Off-Peak periods on Thursdays did not show any change.

Of all the days, Fridays stand out as the period on which the incidence of traffic congestion is more pronounced during the PM Peak vis-a-vis the AM Peak hour. Whereas the average travel speed dropped to a little below 15 km/hr during the PM Peak, the AM Peak showed a rise to about 16km/hr. In the same vein, the Off-Peak average travel speed for Friday (22 km/hr) was the slowest in comparison with the rest of the days in the week.

The data also suggest that of all the days, Monday stood out as the day with the lowest average travel speed value during the AM Peak. On the other hand, Thursday and Friday recorded the lowest average travel speed value during the PM Peak period.

In spite of the observed variations in the incidence of traffic congestion on the Kimbu-Adenta highway, it is significant to note that none of the segments had average speed values that was equal to or more than the official speed limit of 50 km/hr. Putting all the daily values together, it was observed that before a bus could travel the entire Kimbu-Adenta highway, which is just approximately 20 kilometres, it will require cumulative or total travel speeds of 87 minutes (or 1.45 hours); 86 minutes (or 1.43 hours) and 59 minutes (or 0.98 hours) for the

AM, PM and Off Peak periods respectively. For further studies, refer to Appendix 5 *Congestion Scorecard on the Kimbu-Adenta Corridor.*

6.4.3. Reasons for the Observed Traffic Congestion Pattern

The point has been made that the factors that cause traffic congestion at the study area are just microcosm of the general situation that affect Accra in general. It is also important, at this point, to note the multi-facet nature of the phenomenon. Hence, there is the need to employ the General Systems and Structuration theories respectively to help illuminate the issues (See Figure 2.3).

From the analysis of the traffic congestion data obtained from the Kimbu-Adenta highway, it is reasonable to say that in most cases, the congestion phenomenon is one that recurs almost during every time of the day and also during the weekdays. The congestion situation might change for the better during weekends, notably Sundays, but certainly not for Saturdays, even though this study could not obtain empirical data in support of this assertion. The question then is: why has this highway gained such notoriety for serious traffic congestion, especially during the weekdays, and on Saturdays? The obvious answer might be that traffic is indeed a function of human activity. Human activities determine land use. As said previously, land use –one of the three sub systems identified for the purpose of this study – may be seen as the legal use of land, the type of structures and socioeconomic activities that people engage in.

In Accra, as in most cities of the developing economies, it is not uncommon to identify a situation where various land use types such as residential, commercial, industrial, recreational and educational structures are localized in a particular region, especially at the Central Business District, with the hope that the positive effects of such regionalization of facilities will trickle down to the periphery. Sadly, the failure of such 'trickle down' policies is obvious to all. Major formal and public institutions, such as the ministries of the state, the *Castle* which acts as the seat of government, the parliament house, the supreme and high court buildings, and other excellent banking facilities are all centralized at the hub of Accra.

Again, with the adoption of liberalization policies in recent years, the urban economy has become primarily trading-oriented. It is therefore a common occurrence to see a justaposition of both the informal and the formal economies in the centre of Accra. For instance, the renowned *Makola Market* which has been the hotbed for commerce over the years by women traders who sell fresh produce, manufactured and imported foods, clothes

etc. and which recently has been upgraded into a shopping mall, is located right in the middle of town. Within some few distance away, one comes across the *Kantamanto Market,* also located in central Accra, where traders deal mostly in imported second hand clothing, shoes and household items. The *Agbogbloshie Market*, which is located near the *Timber Market* on the Fadama Road, and the *Kaneshie Market Complex* are all cases in point to illustrate the land use pattern in Accra that combines both elements of the formal and informal sector. Most of these traders use the *trotros*, passenger mini-buses or taxis to fetch their goods to these markets. Again, by reason of their central location, residents in Accra have few options available other than to go to these places for their basic needs. Owing to their low occupancy, the implication is that more of such transport means are needed to service the market women and shoppers, therefore creating traffic congestion.

In contrast with the advanced countries where one could obtain all that one craves for in his or her small town without having to travel to the capital city, the situation in Accra, and perhaps in most cities of the developing countries, is different. The market complexes mentioned above do not serve only residents of Accra but attract shoppers from other regions in the country as well, especially during the Christmas holidays. These regions are usually the Volta, Eastern and Central due to their proximity to Accra. Though empirical data as to the exact number of holiday shoppers in Accra are difficult to obtain, it does not negate the reality that many people do make such trips to the city. This could be the main reason for the unusually heavy traffic congestion that is observed at the festive periods, especially at the CBD and on most major roads of Accra.

It must be pointed out that along the Kimbu-Adenta highway, one can find the *Madina Market* which is located next to the *Zongo Junction* pilot BRTS bus stop but its relevance cannot be compared to the other market centers already mentioned since it is mostly vibrant only on Wednesdays and Saturdays. Added to this, a new shopping mall has been put up some few meters away from the *HIPC Junction* pilot BRTS bus stop (on segment 10) but its ability to attract the majority of shoppers and prevent them from travelling all the way to the bigger shopping centers in Accra is unknown. As a direct consequences of these factors, traffic congestion is most severe in the AM Peak hours when people have to frequent the central business district of Kimbu and its environs in order to access these socio-economic facilities.

The movement of people to Accra from the other regions does not only suggest the primacy of the city to the Ghanaian regional economy but also, this could account for the

observed heavy traffic situation during Monday mornings and Friday evenings, especially. It is possible that people migrate to Accra to work at the beginning of the week and commute back to their hometowns either before or during the weekends.

Another prominent center of attraction along the Kimbu-Adenta corridor is Ghana's premier and largest public university –the University of Ghana –which is located to the west of the *Legon* pilot BRTS bus stop, (between segments 13 and 14). With vehicles belonging to both staff and students of the university all joining or leaving the main corridor at various times of the day, usually for academic purposes, in addition to commercial drivers who use the university road to connect to Achimota and its environs, it was observed that traffic congestion was most severe, especially during the AM Peak when thousands of students come for lectures in the morning, as represented by an average travel speed of less than 10 km/hr for that portion of the road.

The situation is a bit different during the PM Peak, as seen in average travel speed in the range of 10 and 20 km/hr. This could be accounted for by two main reasons. First, while most lectures are scheduled to begin about the same time in the morning, thereby attracting many students to the university campus, the times for finishing lectures are not the same. Again, most students remain on campus after lectures in order to access library and internet facilities or to do other academic exercises and may leave very late in the evening when the 'rush hours' are over. Other students may 'perch' or spend the night with their colleagues who have on-campus accommodation, especially on days when lectures are scheduled late in the evenings. Therefore, the number of students who enter the campus in the mornings might not be the same as those who leave in the evenings.

The second important reason is the attitude of commercial drivers who avoid the traffic congestion at segment 13 of the Kimbu-Adenta highway during the PM Peak hours. Upon reaching Tetteh Quarshie (Shiashie) at segment 12, most commercial drivers depart from the main corridor for local roads which goes through residential areas such as East Legon, La Bawaleshie, and the Trinity Theological Seminary. They then join the main Kimbu-Adenta Highway at IPS Junction, which is located some few meters away from the *Atomic Junction* BRTS bus stop (i.e. on segment 15).

The poor development, location and management of passenger terminals and transit points along the Kimbu-Adenta corridor constitute another land use practice that has either created or perpetuated traffic congestion. These terminals defy planning and architectural principles. They spring up spontaneously due to lack of discipline and strict compliance with

laid down planning principles as contained in the master development plan of Accra. Most often, residential areas are developed without any consideration of public transport terminals. It is not uncommon to identify terminals that are built either near streets or on privately owned land, which inhibits the development of permanent structures (Addo, 2002). Usually, it takes only one or two drivers to initiate such illegal acts. Within an overnight, others take advantage of the situation and join. With the setting up of such 'terminals' and the attraction of passengers, economic activities, usually informal trading such as food joints, mobile phone business transactions locally referred to as *space-to-space* as well as other traders who hawk all kinds of goods and services mushroom up. The situation then becomes the norm and the law enforcement agencies find it too late to intervene. In addition to other undesirable consequences of these illegal acts, severe but highly avoidable traffic congestion occurs. A classical case in point is at the *Zongo Junction* on the Kimbu-Adenta highway (between segments 15 and 16). The author's personal observations are captured in plate 6.2 below.

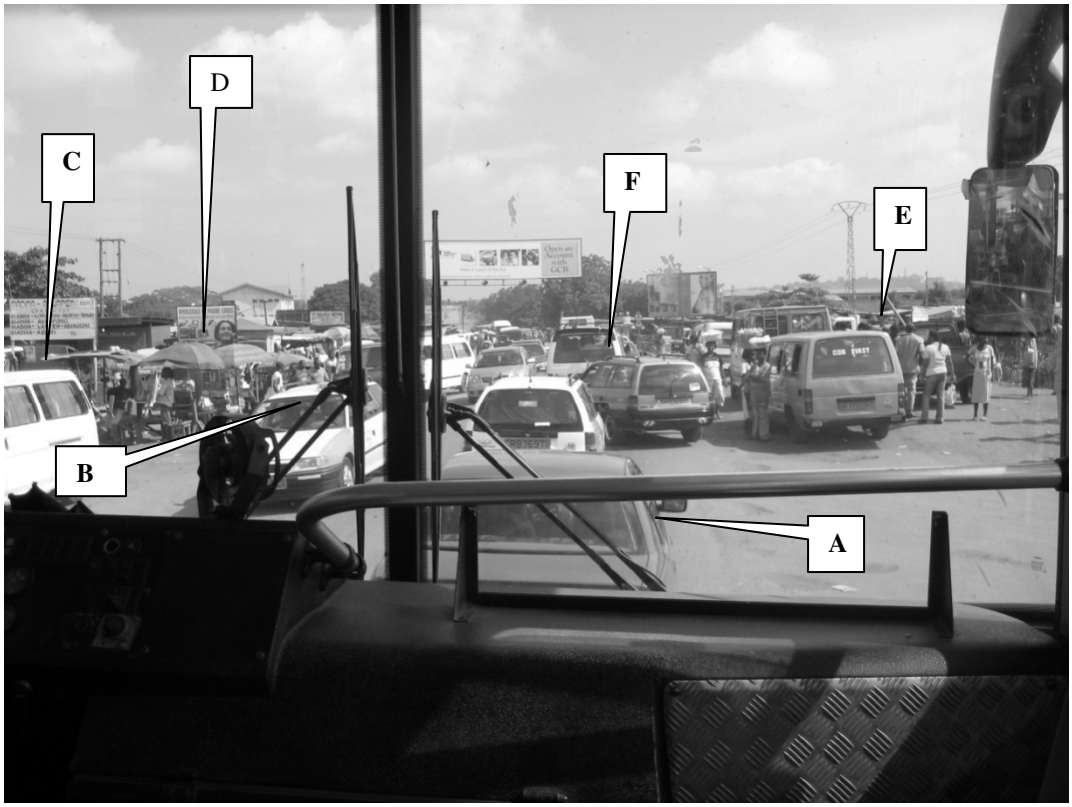


Plate 6.2 Land Use practises at the Zongo Junction. Source: Field Survey, 2008.

Vehicles marked '**A**' and '**B**' are driving on the main corridor while '**C**' is entering a lorry terminal (out of view) which is located close to the main corridor. The area marked '**D**' represents pedestrian walkway that had been invaded on by traders (with umbrellas for shade

against the sun) and advertisements and sign posts. This invasion of the walkway consequently forces pedestrians into the main corridor which usually results in traffic accidents or causes traffic congestion as drivers have to slow down to avoid knocking down pedestrians. The vehicle marked '**E**' is a *trotro* that has been parked on the shoulders of the road for passengers to disembark and also to allow other passengers to embark until it is full to capacity. As soon as that is achieved, and without warning, the driver of the trotro will quickly force its way into the main corridor again, as represented by the taxi marked '**F**'. The vehicles marked '**A**' and '**B**' which are on the main highway could either crush into vehicle '**F**' , which is usually the case, or slow down and cope, thereby prolonging the travel times on this segment of the road. A similar situation is observed at segment 5 i.e. from the License Office to the 37 Military Hospital areas.

Closely linked the point expressed above on the spontaneous development of terminals is the extent to which institutions, seen by the structuration theory as 'the rules of the game in society' (North, 1993, p.3) undertake certain policies that may *enable* or *constrain* human interactions and enforce the laws to ensure that sanity prevails.

In the early 1980's, Ghana underwent series of structural adjustments aimed at 'improving the competitiveness and efficiency of the economy' (Ellis, 2000, p. 164). Among other effects of these austere neoliberalistic policies, Anyemedu (2000, p.5) contends that an estimated 73,000 workers were retrenched from 1987 onwards under the Civil Service Reform Programme. Another 100,000 workers are estimated to have been retrenched from the Ghana Cocoa Board from the mid-1980s to the early 1990s. The situation has led to the creation of an urban economy that is largely informal. The significance of the informal sector –employing up to 60 % of the workforce and producing nearly 40 % of GDP in the developing world–cannot be overemphasised (Schneider & Enste, 2000). It is argued that the first law of the informal economy states that 'opportunities to make money must be exploited when and where they occur, regardless of whether officialdom approves' (Stock 2004, p.263).

From the author's observation, hawking[24] along the Kimbu-Adenta highway is such a thriving business. These hawkers will quickly rush to any vehicle that stops or slows down in order to sell their wares ranging from food, medicines, clothing, household items, just to mention but a few. Beggars seeking alms were not an unusual sight on this corridor. Moreover, some young men were observed washing the windows of vehicles that has stopped

[24] The act of selling goods for a living. http://www.thefreedictionary.com/Hawking. Accessed on 03.05.09

briefly in the middle of the road due to traffic light signage. Owing to the short time duration at such joints, these roaming vehicle washers must hastily do whatever it takes in order to serve as many customers as possible.

In an interview with the managing director of the MMT, he was of the view that these hawkers only take advantage of the traffic congestion but they are not necessarily the root cause. While acknowledging that there might be an iota of truth in this assertion, it was also observed that moving vehicles had to slow down, stop abruptly, or swerve to avoid hitting hawkers whose only focus was to eke out their daily bread.

The informal economy is ubiquitous along the highway but it is more pronounced as one travels towards the central business district on segments 5 and 6 along the License Office and 37 Military Hospital areas, and also along segments 1 and 2, i.e. the Ridge and Kimbu environs. It therefore comes as no surprise when the average travel speeds recorded for these areas were around 10 and 20 km/hr. From the foregoing discussions, one can safely conclude that the informal economy impedes traffic flow in order to benefit from the traffic congestion.

Unfortunately, successive governments have learnt the hard lesson not to intervene or regulate the informal economy or risk losing their votes and power. It is said that 'African governments are [often] more interested in survival rather than development' (Kuada & Chachah 1999, p. 30). A classical example is the decongestion exercise undertaken by the Accra Metropolitan Assembly to rid the city of hawkers and to relocate them to a new shopping mall. Weeks after successfully implementing the measures and receiving widespread public approval, the authorities had to relax the laws and allow the hawkers back on to the streets due to the political costs the government was likely to incur.

As illustrated by Plate 6.3 below, a hawker is busily selling food items to a customer (under umbrella) at the *HIPC Junction* pilot BRTS bus terminal (between segment 10 and 11) which incidentally is located some few meters away from the private residence of ex-President Kufuor. This picture was taken while he was still the president and daily commuted from his house to the Castle with armed police escorts! It is only a matter of time that a full blown informal market springs up, if no official disapproval is registered.

Plate 6.3 An informal economy along the Kimbu-Adenta Highway. Source: Field Survey, 2008.

Transport supply, i.e. the available infrastructures (such as road network, terminals, signage and traffic management systems) has been identified as the second of the three sub-systems that might account for the severe traffic congestion on the Kimbu-Adenta highway. Even though the Ministry of Transportation and the Ghana Statistical Service maintain that the Greater Accra Region has the highest road network, one may argue that the road infrastructure capacity is woefully inadequate given the quantum of vehicular traffic that use the existing space.

The three colour-coded thematic maps used in this study (Figures 6.1 –6.3) are graphical representations of how average travel speeds on the various segments on the Kimbu-Adenta corridor correspond with the nature of the road network. In most instances, it was observed that average travel speeds were comparatively higher for those portions of the network that had four lanes. For instance, during the AM Peak, average travel speeds ranging from 30 to 50 km/hr were registered along segments 4 (from Flagstaff to the 37 Military Hospital area); 7 and 8 (all the way from Opeibea to Airport II) and also at segment 11 (from the HIPC Junction to Tetteh Quarshie). These segments have four lanes, thus facilitating free vehicular flow. During the same period, however, average travels speeds around 10 and 20 km/hr are observed all the way from Tetteh Quarshie to Adenta. These segments have double lanes. At segment 13 (between Okponglo and Legon), however, speeds are even below 10

km/hr. This is due to the ongoing road expansion project that had begun from that particular segment. During the PM Peak also, two segments i.e. 15 (from Atomic Junction to Zongo Junction) and at 18 (from SDA to Barrier) recorded speed values that were less than 10 km/hr on the average. At these segments, motorists could only drive in a single file manner. Therefore, should any minor incident occur, traffic congestion easily builds up.

One would have thought that on portions of the road that had the four lanes, especially from segment 2 to 11 (i.e. from Ridge all the way to Tetteh Quarshie), average speeds will be comparatively higher but as the PM Peak thematic map in Figure 6.3 shows, they are mostly up to 20 km/hr. This is due to the fact that the multiple lanes from Accra suddenly give way to a double lane beyond this point so all the vehicles have to slow down and join the queue. Not only is the width of the road network very narrow beyond this point but the roads are also not maintained frequently resulting in pot-holes and eroded sand that usually pile up in the road especially after torrential downpour.

As illustrated in Plate 6.4. below, vehicles moving from segments 16 to 17 (Zongo Junction towards Riss Junction) have to slowly descend into the potholes in the middle of the road or to bypass them. It was observed that some young men in the area occasionally filled the pot holes with earth after which they collected monies from motorists. Although some may argue that these good Samaritans are somehow ameliorating the situation for motorists since the Ghana Highway Authority and the Department of Urban Roads are not doing their job as they should. However, the activities of these men could cause or worsen traffic congestion. Besides, it will take just another heavy downpour, which is usually the case, and they are in business again. It must be pointed out that with the completion of the road expansion projects, the situation might improve for the better and that again underscores the importance of the institutional framework, as identified by the structuration theory, in providing infrastructure that could either enable or constrain the free flow of vehicles on the corridor in question.

Plate 6.4 Road Infrastructure on the Kimbu-Adenta Highway. Source: Field Survey, 2008.

Signage and traffic management systems along the Kimbu-Adenta highway greatly impact on the occurrence of traffic congestion. The calibration of the signage systems seem not to commensurate with the flow and intensity of vehicular traffic. The traffic lights could stay red for the road network with many vehicles while indicating green for other networks that might not even have vehicles moving on them. This phenomenon most often than not compel some motorists to jump the red lights, with its associated consequences. Other than that, traffic congestion ensues. On other times, the signage systems break down due to frequent power disruptions. It was observed that in instances where the law enforcement agencies, such as the MTTU police and the specially-trained Community Protection personnel were present at any of these faulty signage systems, motorists behaved well and there was free flow of traffic, albeit at a slow pace. At intersections where the law enforcement agencies were absent, which was usually the case for most parts of the corridor, the youth (some with reflective vests and wielding tree leaves or branches) were observed directing traffic for voluntary fee contributions from motorists. Not only is this risk-taking behaviour of these otherwise good Samaritans the cause of many avoidable traffic accidents, which often involve them and recalcitrant drivers who flout their orders, but the lawless situation could degenerate into chaotic traffic congestion.

The summary of the foregoing discussion on the reasons for the observed traffic congestion on the Kimbu-Adenta highway perfectly confirms the existing literature that

whereas demand varies over time, supply is relatively fixed over long time periods and output is not storable, therefore the occurrence of congestion in all transportation facilities is inevitable (Palma & Lindsey, 2002).

6.5. Factors that collapsed the Pilot BRTS in Accra

6.5.1. Traffic Congestion

As suggested by the data and from personal observation, the Kimbu-Adenta highway, like most major corridors spread all over the capital city, is heavily congested. So endemic and recurring is the phenomenon that motorists are not able to travel at speed levels which are even close to the posted speed limit of 50 km/hr, regardless of the time of the day or the day of the week.

Against this backdrop, it is reasonable to agree, to a large extent with the management and drivers of the bus company whom I interviewed that traffic congestion was the bane of the pilot BTRS. Management was of the view that in spite of the huge fleet of buses that was designated for the project, even though the precise figure could not be obtained, traffic congestion made it impossible to adhere to the policy of putting a *VDL* Bus on the corridor in every 15 minute time interval.

Laying the blame squarely on traffic congestion, Managing Director of the MMT explained that even though he was yet to make a serious financial analysis on the effect of congestion on the operational costs of the Company, he could reasonably conclude that congestion really had adverse effects on the operations of the pilot BRTS, leading to its eventual collapse. Giving reasons to back him claim, he further argued:

> '*when the buses are locked up on the corridor due to traffic congestion, they waste a lot of time; burn fuel inefficiently without making revenue to keep operations going. This affects both the operational and total costs involved in keeping the buses functional while taking into consideration the effects of depreciation on the finances of the Company. Besides, the Yaxing buses that were primarily used for the pilot BRTS frequently developed technical faults especially with the clutches due to the delays associated with traffic congestion. Of course, this also exposes the weakness of the buses that were used for the project but it would not have occurred in the first place if there was no incidence of traffic congestion on that corridor*' (Field work, 2008).

Though the company did not officially revert from the express service to the current service where drivers are now allowed to hawk for passengers along the highway and to wait at bus stops until their buses were full before starting the journey, the managing director noted that circumstances beyond their control i.e. traffic congestion forced them to gradually phase out the express services. “Initially, a decision was taken to take some of the bus stops or ticket booths out and place conductors in the buses instead. As some point in time, it was realised that there was so much congestion that it became natural that there was no pilot BRTS”, he concluded.

His views were corroborated upon by Mr. Emmanuel Opoku, who had actually driven some of the pilot BRTS buses. He recounted that due to traffic congestion, there were uncountable number of times when buses were held up in traffic while prospective passengers queued at the transit points. His view was however challenged by another driver, Mr. George Ahiati who saw the traffic congestion as a blessing in disguise for the project. During congested periods of the day, he argued, most prospective passengers are stranded due to the fact that most of the *trotro* and mini bus drivers used what he described as ‘shortcuts’ (i.e. local roads in residential areas) other than the main corridor. Owing to their limited carrying capacity, the few *trotros* and minibuses that opt to remain on the main corridor cannot accommodate extra passengers besides their maximum carrying capacity. As such, these passengers will clamour for any available space in the express buses even if that will demand that they stand in the buses for whole duration of the journey. On the contrary, when there is no congestion, these same passengers prefer to board the *trotros* because of their small sizes and the ability of their drivers to involve in all illegalities to beat the traffic jam.

His opinion, however, cannot go uncontested. Two out of the three passengers who took part in the focus group discussion noted how exciting the express service was initially when everything was moving on smoothly but when later on it became difficult to get a connecting bus on time and even when they finally did, there were instances when they had had to stand in the vehicle all throughout the journey, it became unpleasant to use the pilot BRTS buses anymore for their journeys.

6.5.2. Unhealthy Competition from Other Commercial Drivers

The introduction of the metro mass transit system in general, and specifically the concept of a pilot BRTS came onto the Ghanaian public transport scene at a time when the transport

market has seen decades of dominance by the private sector. As mentioned previously, these privately-owned transport operations came to fill in the vacuum left by the collapse of the erstwhile state transport system. Following their successful organisation in powerful unions and effectively controlling the quantity and quality of service, it is not unusual to expect the private interest to view the new transport system as a threat to their survival. According to a news item carried by the Ghana News Agency in its 29th October 2002 edition, the GPRTU, which is by far the largest transport union in the country, is reported to have seen the introduction of the metro mass transit system in Accra as a major challenge and had accordingly advised vehicle operators, especially *trotro* and taxi drivers to exercise the greatest restraint during their rounds.[25]

Beyond such verbal pleas, Addo (2002) and Oppong (2000) have identified gross indiscipline among some commercial drivers who perceive themselves as being above the law. The gross indiscipline on the roads of Accra and the sheer lack of respect for public assets like the MMT vehicles which are perceived to belong to the 'government' and also as a threat to the revenue base of the private commercial drivers, a lot of illegalities are resorted to in order to outcompete the MMT buses for passengers. There is absolutely nothing wrong with a healthy competition among these public transport providers. However, when it borders on illegalities and animosities towards perceived rivals, it calls for concern.

Using the time geographic framework to conceptualise the above acrimony between the commercial drivers vis-a-vis the pilot BRTS buses, as the express buses plied their time-space prism from Kimbu to Adenta and vice versa, they encountered what Hägerstrand (1970) refers to as *coupling constraints* in the sense that they needed to interact with, and compete for *potential path space* with other commercial and private vehicles. As the competition becomes unhealthier due to the rough tactics employed by the commercial vehicles, for instance, the express buses became efficient in trading time for space, thereby requiring more time per unit space in their movement, indicating a steeper slope or less efficiency until such time that the path of the pilot BRTS buses became vertical or stationary in space.

Recounting how such animosities contributed to the demise of the pilot BRTS, Mr. Henk Visschers argued that by focusing all their attention on pedestrians with the hope of getting passengers out of them, some of the commercial vehicle drivers deliberately slow down in the middle of moving traffic, while their aides shout to attract the attention of

[25] http://www.ghanaweb.com/GhanaHomePage/NewsArchive/printnews.... Accessed on 12.01.2009

passengers who are then allowed to board the vehicles before speeding off. In the same vein, these drivers adopt the same practice for passengers who wish to alight at any point on the corridor instead of only at the approved bus stops. Added to the above, once they approach traffic jams, they usually drive on the shoulders of the road for a while and then without warning or regard for vehicles, they forcefully and quickly join the mainstream traffic flow. Finally, when they get to the approved bus stops, they deliberately park in a manner that leaves lots of space in front of them so that they can quickly set off again.

From observation, it appears that most commercial drivers are either totally ignorant or wilfully disregard the Road Traffic Act of 2004 which has been replaced with the Road Traffic (Amendment) Act 2008, Act 761 which states inter alia that 'no vehicle may obstruct the free movement of traffic on a road by parking, standing, loitering or in any other manner. No person shall park a motor vehicle on a road abreast of another motor vehicle'. If effectively enforced, as in for instance, the payment of huge fines for illegal driving, these regulations would have allowed for free flow of vehicular traffic in Accra, in general, and specifically on the Kimbu-Adenta corridor.

On the other hand, with the kinds of restrictions imposed on drivers of the pilot BRTS buses, not only did some passengers perceive the bigger buses as not being innovative enough as the minibuses are, but there were several instances when their vehicles were crushed due to the recklessness attitude of the commercial vehicle drivers to enter the mainstream traffic. When many of the buses are sent to the workshop for repairs due to accidents, pressure is exerted on the few remaining vehicles which quickly developed wear and tear. These regular maintenance of the buses involved in traffic accidents, and the financial pressures put on the resources of the company served as c*apability constraints* which made the operation of the pilot BRTS uneconomical.

My personal observation on the Kimbu-Adenta highway also confirms the above description of how commercial drivers could misbehave with impunity towards the metro mass buses. During one morning rush hour, I saw some prospective passengers who were waiting some few metres away from the MMT bus I was using to capture the traffic situation on the corridor. A commercial driver who also might have seen the waiting passengers ahead of us, quickly accelerated while approaching our vehicle from behind. He sped around the bus, swerved back into the travel lane and screeched to a sudden halt. But for the timely intervention of the elderly and skilful bus driver, something terrible might have happened. To the chagrin of the commercial driver, the waiting passengers who saw all what

happened, refused to board his vehicle but opted for the bigger bus instead. Such is the level of acrimony between the trotros and the metro mass transport system in Accra.

In the focus group discussion, a man narrated how some of the commercial drivers and their aides waged what may be described as psychological warfare against passengers who used the pilot BRTS buses. According to him, verbal insults such as 'One-One Thousand' (in apparent reference to the highly subsidised fare of one thousand cedis per ride) 'misers', 'cheap side' etc were heaped on patrons of the service without provocation from some notorious *trotro* and taxi drivers whenever they walk past their vehicles to board the express buses. In a country where subsidised items are perceived as inferior and of low quality, one can only imagine the extent to which these unguarded statements might have contributed to the dwindling ridership, and the subsequent collapse of the pilot BRTS in Accra.

6.5.3. Lack of Supporting Legislative Instruments

In a study of urban public transport conditions in Accra, Ghana conducted by the IBIS Transport Consultants Ltd (2005), it came to light that a number of legislative instruments have been enacted for the operations of public transportation in the country. For instance, under the *Local Government Act (No.462 of 1993)*, urban passenger transport is under the authority of the relevant Metropolitan, Municipal or District Assembly under which a particular transport service is operated. For the greater Accra conurbation, these relevant authorities include the Accra Metropolitan Assembly, the Tema Municipal Assembly, and the Ga District Assembly. Each has jurisdiction within its own boundaries, but there is no formal co-ordination between them or a higher-level authority to which they could defer.

Besides the above described governing regulatory framework, the operation of all road vehicles in Ghana is governed by *Omnibus Services Authority Decree (NLCD 337 of 1969*) which was repealed and replaced by *The Omnibus Services Decree (NRCD 71 of 1972*); *The Omnibus Services (Amendment) Decree (NRCD 181 of 1973)*; *The Road Traffic Regulations (LI 953 of 1974)* and *The Road Traffic Offences Regulations (LI 952 of 1974).* In more recent times, *The Road Traffic Act of 2004* has been replaced with *The Road Traffic (Amendment) Act 2008, Act 761*, which happens to be the most current. All these legislative instruments respectively deal with the registration, licensing, use and construction of vehicles in general (and of commercial vehicles in particular) and codify offences in these regards.

However, none of these legislative instruments give a legal basis for the operation of an exclusive right-of-way pilot BRTS. According Dr. Darku of the Department of Urban Roads, in contrast with BRTS-implementing cities like Lagos, Curitiba, Bogota and Sao Paolo where the existing roads were redesigned to accommodate buses with dedicated infrastructure, adequate and spacious bus terminals as well as permitting minibuses to serve as feeders for the main express service, his department was only tasked to mark some segments of the Kimbu-Adenta highways as '*Bus Only'*. However, without recourse to any legislative instrument, it meant that the traffic police cannot intervene to ensure strict compliance of the ROW directive by other motorists. Therefore, it was only a matter of time that the pilot BRTS collapsed.

Thus, without any *authority constraints,* as argued by the time-geographic framework, to provide general rules or laws that will limit other potential motorists from having access to the '*Bus Only'* lanes, coupled with the lack of institutional framework, as argued by the structuration theory, that will ensure that 'the rules of the game in society' (North, 1993, p.3) are adhered to, the operation of a pilot BRTS by a quasi-private transport provider in Accra surely suffered serious setbacks, leading to its demise.

6.5.4. Bad Attitudes of Driving Crew and Maladministration of the Service

The poor attitudinal behaviour of some staff of the MMT towards their work also contributed to the collapse of the pilot BRTS. In an interview with the management of the company, they lamented on how some of the drivers did not drive fuel-efficient enough, caused too many avoidable accidents and were generally apathetic towards the success or otherwise of the express service. These ill-practises affected the finances of the service. Coupled with the above, revenue thefts was not uncommon even though these malpractices are not exclusive only to the former pilot BRTS but to all other services being currently operated by the bus company. According to the newsletter *Metro Mass Weekly,*[26] in just a week of assuming office, the managing director reportedly signed the summary dismissal letters of more than 75 workers due to theft of funds.

Perhaps, realising how this illegal act contributed to the collapse of the pilot BRTS and how it might collapse other current services being operated, the MD and his management team have mapped out a number of measures to curb the menace of stealing in the company.

[26] http://www.metromass.com/newsletter2.pdf Downloaded on 24 March, 2009.

Of particular interest is the creation of an Inspection Unit of the Internal Audit Department to check not only bus drivers and conductors but to also check commuters who attempt to cheat the company. On several occasions, such random checks were observed in the buses. However, the effectiveness of this mechanism is yet to be known as some of the bus drivers and their conductors were also seen signalling to their colleagues coming from the opposite direction as to the location of the few inspection team, perhaps to cover up their illegalities before the inspectors got on-board.

Again, some of the drivers were generally discourteous towards the passengers. Others were also not willing to assist passengers, mostly market women to offload their goods from the buses on the excuse that they are only paid to drive and such 'extra' duties were to be done solely by the conductors. However, most of the conductors were young women.

In the same vein, one of my informants, a driver of the bus company who took part in the pilot project also noticed that administrative lapses could be blame for the demise of the express service. He was of the view that avoidable delays at the company's Head Office with regards to the issuance of tickets occasionally stifled the smooth conduct of business. He further argued that the monitoring and supervision of the service were inadequate. There were few or no on-the-spot monitoring of the operations of the BRTS by the field supervisors. Once that occurs, it was only a matter of time that employees acted in a way that was detrimental to the success of the pilot BRTS, specifically and to other general services provided by the company. He was quick to add also that some of the drivers and conductors too habitually reported late for their duties.

6.5.5 Inadequate Publicity about the Service

According to Mr. Martin Afram, the deputy managing director of the bus company, a public launch was done to outdoor and also advertise the pilot BRTS to the people of Accra. Besides this, no major advertisements were done in the print and electronic media. It is therefore reasonable to expect that most passengers were oblivious as to what that particular service was all about, their rights and responsibilities as passengers as well as other operational characteristics such as the arrival and departure times of the pilot BRTS buses and the approved bus terminals. The people who bore the brunt of the passengers' frustration at the system were usually the driving crew comprising the drivers and the conductors.

All the three drivers who took part in the interview unanimously recounted their horrible tales and those of their counterparts who had been verbally and occasionally physically abused and had unprintable profanities hurled at them when they had enforced the strict policy of not allowing passengers to disembark at any other point on the corridor but the few selected pilot BRTS terminals. They further argued that there were several instances where they had had to by-pass my waiting passengers due to the fact that they stood at the 'wrong' place. Some of the drivers even opted to allow passengers to board so that they could pay later to the conductors when the buses reached the ticket booths but this practise was disallowed due to allegations of theft of funds by some their colleague drivers. These unfortunate incidents, according to them, adversely affected the revenue that could have been made.

Even though the conflict of interest discussed above borders on the lack of relevant knowledge among the travelling public, some people may hold the opinion that the average Ghanaian traveller is so used to the *trotro* culture of boarding and disembarking at his or her doorstep regardless of the inconvenience it causes other road users, to the extent that no amount of education could ensure a successful implementation of a BRTS. However, a professor and expert in transportation geography at the University of Ghana, Samuel Tetteh Addo holds a contrary opinion. Just like the opinions expressed above, he believes that inadequate publicity and education could also account for the failure of the pilot BRTS.

CHAPTER SEVEN: SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1. Introduction

This chapter wraps up the study by summarising the various findings and conclusions drawn for the purpose of this research. Again, recommendations regarding how to forestall the reoccurrence of the factors that collapsed the pilot BRTS specifically, and by extension, how to improve upon the overall performance of public transport provision in Accra, are presented. Some general reflections and suggestions for further research follow.

7.2. Summary and Conclusion

With the use of the former pilot Bus Rapid Transit System (BRTS) on the Kimbu-Adenta Highway as a case study, this research sought to identify the causes of traffic congestion on the said corridor; to explore the extent to which traffic congestion was the nemesis of the pilot project, as well as identifying other possible factors that might have jointly contributed to collapse the express service. Information obtained from a review of current literature on the subject, the Time-Geographic framework as well as the Structuration and General Systems theories respectively were used as keys to unlock and interpret the study.

Concerning the methodology, both primary and secondary sources of generating data were used. In relation to the primary data, the triangulation approach (i.e. quantitative and qualitative methods) was adopted even though maximum weight was given to former over the latter. GIS-based techniques such as the GPS, the stopwatch and a computer readable traffic congestion registration form were the main tools used in deriving the quantitative data. The research tools used in generating the qualitative data were: in-depth interviews with five key informants; semi-structured interviews with three MMT drivers; a focus group discussion with three MMT passengers and personal observation. Secondary sources of data were obtained from books and journals, in the libraries and on the internet, census data and newsletters of the MMT. The study also explored some characteristics of the study area and the general nature of traffic congestion and public transport delivery in the city of Accra.

With regards to the initial research questions formulated for the study, the following questions and observations were made:

7.2.1. What are the factors that culminate in the occurrence of traffic congestion on the BRTS corridor?

The study revealed that the Kimbu-Adenta highway on which the pilot BRTS operated is heavily congested from vehicular traffic albeit with variations with regards to the particular time of the day, the day of the week, as well as the segments of the road. These variations correspond with human activities that vary spatio-temporally.

The first factor that culminates in the occurrence of traffic congestion on the said corridor is the haphazard manner with which various land use types such as residential, commercial, industrial, recreational and educational are developed and managed. The study revealed that the CBD is the main hub of all socio-economic activities in Accra ranging from business and commerce, public administration to education. It therefore comes as no surprise to realize that traffic congestion is most severe towards Kimbu in the CBD of Accra during the morning rush hours and towards Adenta during the evening rush hours.

Beside the above mentioned point, land use practices such as siting terminals and transit points without due regard for planning principles could be blamed for the incidence of traffic congestion at the study area. It came to light that terminals are built close to the main corridor. Examples were found at the *Zongo Junction* and the *License Office* terminals on the Kimbu-Adenta highway.

Coupled with the above, the informal economy as represented by the drove of hawkers and other physically challenged individuals who beg for alms impede vehicular traffic flow with their commercial activities thereby causing and benefiting as well from the ensuing traffic congestion on the highway.

Moreover, the existing transport infrastructures (e.g. road network, terminals, signage and traffic management systems) have been identified as a factor that causes traffic congestion on the Kimbu-Adenta highway. Not only is the road infrastructure capacity, as it exists now, woefully inadequate given the quantum of vehicular traffic that uses the road capacity but they are seldom maintained leading to the development of pot-holes and rain-eroded earth in the road. Closely tied to this point is the calibration of the signage systems which was observed as not being proportional to the flow and intensity of vehicular traffic. They frequently become dysfunctional due to frequent power disruptions. Again, the youth who sometimes direct traffic flow when the signage systems break down and there are no law enforcement agencies around, could degenerate into chaotic traffic congestion.

7.2.2. To what extent did traffic congestion affect the operations of the pilot BRTS?

The study did indeed reveal that the recurring nature of the traffic congestion on the Kimbu-Adenta highway was the bane of the pilot BRTS. It is almost next to impossible to expect motorists to travel at average speed levels which are even close to the posted speed limit of 50 km/hr regardless of the time in the day or the day in the week except on Sundays for the obvious reason that most Ghanaians are off the road for church and other social activities which do not necessarily require excessive driving. Traffic congestion made it impossible to adhere to the policy of putting a VDL Bus on the corridor in every 15 minute time interval. It was also observed that when the buses are help up in traffic, they waste a lot of productive man hours; burn fuel inefficiently and causes the buses to develop wear and tear easily.

7.2.3. Are there other factors that jointly contributed to the collapse of the pilot BRTS project in Accra?

Besides traffic congestion, the study identified other factors which adversely worked against the pilot project on the said corridor. The first of such factors is the unhealthy competition that existed between the operators of the express service and private commercial drivers in Accra. Rather than seeing each other as playing complementary roles in ensuring efficiency in the provision of transportation services to the public, there was a severe conflict of interest between the quasi-public and the private operators. The study identified acts of gross indiscipline, psychological warfare and illegalities embarked upon by the latter to out-compete the former.

Coupled with the above, the lack of any legislative instrument to give a legal basis for the operation of an exclusive right-of-way express bus service means that the operation of the pilot BRTS by the MMT existed only in name but not in reality.

Moreover, internal human factors such as apathy on the part of drivers towards driving fuel-efficiently, reckless driving and the consequent involvement in accidents, lateness to report for duty, poor interpersonal skills towards passengers, theft of revenue by the driving crew as well as administrative lapses could be blamed for contributing to the demise of the pilot BRTS in Accra.

Finally, it came to light that apart from the public launch of the project, the operators of the service did not undertake any major publicity or advertisements in the media to

adequately inform and educate the travelling public about the existence and the operational characteristics of the pilot BRTS.

The theoretical frameworks employed in the study have proven quite effective in helping throw much light on the factors that, in addition to traffic congestion, led to the collapse of the pilot BRTS in Accra.

With the help of the General Systems theory, for instance, it was identified that two basic sub-systems within the wider urban environment i.e. land use and transport supply were largely to blame for the recurring nature of traffic congestion and its subsequent adverse effects on the pilot BRTS in Accra. As a clear symptom of planning failure in the city, there is overconcentration of various land use types and socioeconomic activities at the central hub of the city. Again, bus terminals are constructed without due recognition of the laid down urban planning and architectural blueprint for the city. Major lapses were also identified in the supply of transport infrastructures (such as road network, terminals, signage, and traffic management systems). The failure of the two sub-systems directly affected the third i.e. traffic flow in the city of Accra.

The Structuration theory also shed light on the extent to which the existing institutional framework did enable or constrained the functioning of the express bus project in Accra. The provision and maintenance of road infrastructure is the preserve of the central government. However, until quite recently, budgetary constraints had limited the amount of investment government could make into the roads sector. With limited infrastructure vis-a-vis a growing vehicle population, traffic congestion is inevitable. Therefore, operating an express bus service like a BRTS on the existing network was such an uphill task. The lack of political will to deal with the informal economy in a way that could ensure free flow of vehicular traffic was also identified as a major weakness of the institutional framework of the country. Traffic law enforcement by the relevant state institutions such as the MTTU and the Community Protection is also constrained by limited personnel and inadequate logistical support to deal with motorists' misconducts.

The Time Geographic framework also conceptualised the level conflict of interest that existed between some commercial drivers and the pilot BRTS bus drivers and the extent to which this unfortunate situation served as *coupling* and *capability constraints* that eventually led to the collapse of the express bus pilot project in Accra. However, two of the factors that conspired to collapse the former pilot BRTS i.e. misconducts of MMT driving crew,

maladministration of the express service and the inadequate publicity are all extra information which is unaccounted for by the theories employed in the study.

7.3. Recommendations

On the basis of the findings that came out of this study, the recommendations below are aimed at policy makers and future researchers not only to address the challenges that usually beset public transport provision in cities of the developing world in general but also to create a congenial environment for a successful implementation of a BRTS in Accra.

7.3.1 Traffic Congestion

The findings from this study suggest that of all the factors that worked against the pilot BRTS project, traffic congestion is most outstanding. It is therefore imperative to address the several bottlenecks that culminate in the occurrence of traffic congestion, especially the recurring type, in order to ensure that public transport service provision is enhanced.

First and foremost, there is the urgent need to improve upon the road infrastructure so as to increase the capacity of the network to accommodate the soaring fleet of vehicles in the city. I say so in view of the reality that the existing network capacity is woefully inadequate. On this note, the recent upgrading of some major highways in Accra, and especially from the Tetteh Quarshie area through Adenta and beyond, is most commendable. A major weakness on the highways was usually observed at the junctions, due to the break down or absence of traffic signage to ensure smooth transition by vehicles that need to join or depart from the main corridors onto the arterial roads. It is expected that the reconstruction of the highways will address some of these bottlenecks. Flyovers, for instance, can be constructed at points of road intersections on major arteries to avoid traffic interference. Priority attention must be given to *Legon* (segment 13); *Atomic Junction, Zongo Junction, Riss Junction* (segments 15-16) and *Barrier* (segment 18) for the construction of flyovers to mitigate traffic interference from drivers who are either departing from, or joining the main Kimbu-Adenta Highway. Proper traffic management must be put in place to ensure that the traffic light system, for example, is calibrated to suite the corridor with the heaviest traffic flow (Addo, 2008, field interview).

However, the expansion of the road capacity should be seen only as a short term solution. This is because, academic research and practical experience have demonstrated that increases

in highway capacity usually lead to increases in vehicle travel – reducing, or in some cases negating, the congestion-fighting benefits of the projects – a phenomenon known as 'generated traffic'. It is therefore reasonable to expect that with the completion of the road expansion on the Tetteh Quarshie –Adenta highway, motorists from Adenta, Madina and the rest who hitherto were driving through the University of Ghana campus to connect to Achimota, Abeka, La-Paz, Mallam etc would now find it more convenient to use the highway instead, resulting in the occurrence of traffic congestion in the long run.

Similar instances of 'generated traffic' occurred in the U.S. Evidence from Portland-Vancouver, which saw the greatest expansion of highway capacity and vehicle travel in the state, also experienced the greatest degree of congestion growth. Again, a 2000 review of 26 years of transportation data determined that one-third of all new road capacity in the Baltimore/Washington, D.C. area has been used up by new travel that would not have occurred without highway expansion. Other studies from across the country (U.S.) show even greater effects from 'induced travel' (Dutzik & Pregulman, 2003).

In the long run, policy makers are advised to visit the issue of congestion pricing. The idea of congestion pricing usually involves the use of an electronically-collected toll system to charge drivers more to use the most congested roads at the most congested times but prices can be cheaper at off-peak times. For busy highway corridors, congestion pricing can be used to maintain the free flow of traffic. Cities around the world are beginning to use congestion pricing systems to cut traffic in their urban centers and along heavily-used corridors and as a means to financially support public transportation.[27]

Singapore was one of the first large cities to adopt congestion pricing, starting in 1975 with a flat-rate S$3 charge to enter the central business district during morning rush hours. Other charges and a second cordon area were added later. In 2003, London began charging a premium to drive into the city's congested business district, where traffic gridlock threatened the city's economic competitiveness and quality of life. A remarkable thing happened. Congestion quickly dropped, and average traffic speed increased. Emissions of the most dangerous air pollutants and greenhouse gases have dropped. London raised hundreds of millions of dollars in new revenue, which it invested in better transit such as new buses, delivering immediate benefits to affected commuters. Bus ridership rose dramatically, and use of bicycles also increased. Initial public skepticism has turned into support, and London's Mayor Ken Livingston enjoyed popular re-election after adopting the charge.

[27] http://www.edf.org/page.cfm?tagID=6241 Accessed on 05.04.2009

Norway has put charging systems into practice in several cities, including Oslo, Bergen and Trondheim. Their systems yielded traffic reductions of about six to ten percent. Initial revenues tended to be invested in new roads, but Trondheim also used the money raised for projects such as bicycle paths and a fleet of free bicycles for public use. All three cities use electronic transponders with manual payment mechanisms as an alternative. Oslo is considering a plan for a major expansion of their system (ibid).

Stockholm initiated a trial period of cordon pricing for its central city for the first half of 2006. According to Luciani (2006), traffic passing over the city's cordon dropped 22 %, traffic accidents causing injuries fell 5 % to 10 %, and carbon dioxide levels fell 14 % in the inner city. Since Stockholm is a city made up of many small islands and bridges, it was prone to traffic snarls and gridlock. Despite this, by the end of the trial period, which went from January to July, the time it took to drive home during peak hours decreased by a third. In the process, all forms of public transit rose 6 %, even bike ridership increased.

One could argue that in the economically advanced societies where the implementation of congestion pricing has been successful, majority of the people are not only rich but they are enlightened well enough to appreciate the positive benefits of such initiatives. Even so, some people could see this practise as a human right issue and discriminatory against the poor who might not be able to pay to enter the cordoned areas in their private vehicles, especially in countries where the public transit system is also virtually non-existent. It could also have political implications and politicians would not readily accept proposals that might cause them to lose votes. The fact that New York City came very close to getting a congestion pricing plan in spring 2008 but was given cold feet by the state legislature despite City Council approval (Environmental Defense Fund, 2009) may provide ample evidence as to the controversy that congestion pricing initiative could generate.

From the foregoing discussion, is it imperative that cities in the economically less advanced countries like Ghana to adopt congestion pricing to mitigate traffic congestion? The answer is: yes but it should be adopted in the long run. Yes, because research and practise have shown that if current trends are not changed, these cities will be overcrowded with cars and they will be affected the most from the negative externalities associated with congestion. Owing to differences in economic status between and among the developed and less developed societies, policy makers in the latter should not adopt completely the congestion pricing mechanisms in the former. Such initiatives must be tailored to suit local conditions.

In Accra, for instance, long term measures must be taken to streamline public transport operations by strengthening the operational capacity of the MMT with more fleet of vehicles that are big, comfortable and safe. Besides this, members of the Ghana Road Transport Co-ordinating Council, which comprises the twenty three privately owned public transport operators, must be assisted with soft loans to invest in large buses for intra-city operations by the government. With this mechanism put in place, and followed with massive public awareness campaigns as to the negative implications of congestion, a pilot congestion pricing project could be initiated on selected corridors within the CBD and other heavily congested highways in the city. As observed from the cities that were successful in this project, the revenues that accrued from pricing were used to benefit travellers directly, by helping to pay for innovative transit choices and faster travel options. Transparency and accountability must guard the managers of such projects in cities of the developing countries and with time, the public will see the tangible benefits and will come to accept the congestion pricing initiative. It is high time our policy makers eschewed the 'it-cannot-be-done' syndrome.

Again, no one can rule out non-recurring traffic congestion, due for instance, to motor accidents. However, mechanisms must be put in place to quickly identify such incidents with for example passersby being able to phone and inform the relevant authorities. What usually happens in Accra presently is that members of the public call into local radio stations to inform them about such incidents who them relay such information to the police. The relevant authorities can capitalise on that goodwill of the public to educate them on emergency telephone numbers they could call to ensure rapid response and management so as to mitigate traffic congestion from developing. Travellers should be informed with real time information on roadway conditions so that they would not compound the problem.

Accra's recurrent traffic congestion can be dealt with in the long run if the city planners and policy makers make deliberate efforts to break the monopoly of the market centers in the CBD by encouraging the setting up of other competitive markets in the peripheries that could attend to the basic needs of shoppers. In the short run, however, the concept of periodic market outside of the city core could be initiated and strengthened to redirect the flow of traffic away from the city centre.

Lastly, state licensing authorities, especially the Drivers and Vehicle Licensing Authority, must be stricter in their licensing policies concerning the number of private cars that could ply the roads in order that they do not exceed the carrying or infrastructure

capacity, which often leads to traffic congestion. This must be done in tandem with improved public transport system.

7.3.2 "A Successful BRTS in Ghana? Of course! And why not?"

The above heading is a quote from Professor Samuel Tetteh Addo, a renowned transport geographer with the University of Ghana when asked about the prospects of a future BRTS in Ghana, given the several decades of the existence of the 'trotro culture', and the failure of the pilot BRTS in Accra.

Quite recently, the government of Ghana, through the Ministry of Road Transportation and its agencies, especially the Department of Urban Roads, has adopted a new transportation policy known as the ***Urban Transport Project (UTP)*** with the financial support of the World Bank (US$45.0 million); the Global Environmental Facility (US$ 7.0 million); the Agence Francaise de Development (US$ 27.0 million) and the government of Ghana (US$16.0 million). The UTP's policy direction will, among other things, see to the introduction of a fourty-six million dollar, high capacity, scheduled *BRTS*.

The project has five main components. According to the UTP's *Brochure for Public Forum* (2008), the first is ***institutional development*****,** which involves developing capacity (in the areas of policy formulation, planning, regulation and management of urban passenger transportation) of Ministries, Departments and Agencies (MDAs) concerned with urban transport as well as transport operators to provide higher standard urban passenger transport services. The second is ***traffic engineering, management and safety*** which aim at the introduction of an area wide traffic signal control system for Accra and Kumasi (the second largest city) where all traffic signals will be linked to a central control centre. Other measures will include road signs and marking, transport terminal improvement, provision of pedestrian facilities; bus bays, pedestrian walkways, signalization of selected intersections, covering of open drains, banning on-street parking and rehabilitation of existing bicycle routes. The third is the proper ***development of a Bus Rapid Transit System*** which will begin with infrastructure design and implementation, operationalization of the system and a communications strategy, all through the provision of goods, works and technical advisory services. The fourth component will see the ***integration of urban development planning and transport planning for better environmental management*** by focusing on some 'Quick Win Projects' drawn out of the recommendations of the 1991 (Greater Accra Metropolitan Area) GAMA plan. Finally, proper ***monitoring and evaluation*** to collect annually traffic and

transport data to regularly monitor the performance of the transport system in the Accra metropolitan area and Kumasi will be done.

A Pilot BRTS Corridor from the CBD to Mallam is fully developed and will become operational in Accra soon. Basic operational characteristics of the BRTS include: no on-board fare collection system; closed system; entry/ exit turn stiles; magnetic smart cards and off site ticket sales.[28] It is estimated that the pilot BRTS will reduce travel time from 60 minutes to 25 minutes during the peak hour, attract 10,000 passengers during the peak hour, increase productivity of bus service (passenger share of large buses) and lead to a reduction in CO_2 emissions along the BRT pilot corridor in Accra (Hesse, 2008).

In order to ensure a successful implementation of another BRTS in Accra, useful lessons are to be drawn from the failure of the first pilot BRTS on the Kimbu-Adenta highway. First of all, the decision to use the CBD-Mallam corridor is most ideal since that corridor has recently been upgraded into multiple lanes. Again, the decision to undertake major infrastructural works on the Obetsebi Lamptey Circle and the Railway Bridge over the Odaw River will remove all major bottlenecks from the road network. With a solid infrastructure, the CBD-Mallam pilot BRTS project will not suffer some of the setbacks that were identified in the Kimbu-Adenta pilot BRTS.

Coupled with the above, the active participation of the regulatory authority i.e. the local governments acting through the district and metropolitan assemblies must be encouraged in order to provide the requisite legislative instruments to ensure the successful implementation of the project. To achieve this objective, Hesse (2008) who is the UTP Team Leader notes that institutional reforms are underway to empower the Assemblies to modernize, plan and regulate urban passenger transport delivery. The Assembly will, among other things, plan, register, license, and ensure protection for exclusive use of ROWs by licensed operators. They will also facilitate contact with financial institution for appropriate credit facilities. This is also a major step in the right direction and it is expected that with such active involvement of the regulatory framework, the BRTS project will succeed. Closely tied to this point is the need to adequately resource the MTTU to enforce strict compliance of the ROWs by the licensed operators so that recalcitrant drivers will be dissuaded from competing for space with the BRTS buses especially when the other lanes are clogged due to traffic congestion.

[28] See Appendix 6 Design of the BRTS Terminals.

Moreover, it is believed that in societies that have ssuccessfully implemented BRTS, 'they were only successful when the implementation was integrated with all the stakeholders participating in the implementation in a sort of systemised approach. Definitely this calls for a holistic approach' (Mr. Visschers, MD of MMT, field interview 2008). Against this backdrop, other identified players in the transport industry should be seen as co-partners. Once the private transport providers see the new pilot BRTS as a threat to their survival, it is natural to expect the same kind of unhealthy competition that led to the demise of the Kimbu-Adenta pilot BRTS project. It is heart-warming to note that in the CBD-Mallam pilot BRTS, members of the GRTCC are to be assisted to source for bank loans to invest in bigger, high capacity buses to be used only for the trunk route and CBD circulations. This sense of ownership of the project must be encouraged by all stakeholders as it holds the key to a successful implementation of a BRTS in the city of Accra. On the other hand, other private commercial drivers who will still opt to operate the *trotros* must only be permitted to operate as on the adjoining arteries as feeders for the BRTS buses that ply the main corridor.

It is suggested that planners of the BRTS must conduct a feasibility studies to identify the number of prospective passengers that will use the service so as to adequately prepare for them. Such feasibility studies must also take on-board potential stops where most passengers usually disembark so as not to create any inconveniences for the driving crew in the future when they try to implement the policy to stop only at designated terminals.

Coupled with the above, the management team of the BRTS must also be selected on the basis of merit to avoid putting square pegs in round holes. Again, monitoring and effective supervision must be done to ensure that the driving crew do not steal funds or misbehave towards passengers. As such it will be prudent to employ more field, but not arm chair, supervisors to do systematic unannounced checks, sometimes on motor bikes so that they are not constrained in the event of traffic congestion. Stakeholders could look into the prospects of investing in ***intelligent transportation system*** (ITS) so that by the use of modern technology, the operation of the transport services such as vehicles location, routing systems, safety issues, travelling times, automation of traffic signage to give priority to advancing BRTS buses and fuel consumption can be monitored and improved to ensure service quality and quantity. With such enhanced system, the driving habits of drivers can also be monitored to ensure efficiency in the system. A unit where driver misconduct can be reported must be created and the public must be given adequate assurances that such complaints are dealt with.

Finally, massive publicity must be made to inform the public before the buses are put on the road. Major radio stations that have wider coverage as well as the print media must be used to disseminate information about the service. With education and cultural change, the new BRTS is bound to overcome some of the bottlenecks that collapse the first one.

7.4. Areas for Further Research

Even though one could argue that the sample size of 120 trips is enough given the time and financial constraints imposed on this study. However, in order to make conclusions that could be made more generalisable, it is recommended that the scope of any future research work on the theme on traffic congestion and its effects on public transport provision must be more comprehensive. Given adequate resources, future researchers could borrow a leaf from Quiroga and Bullock's (1998) one year intensive segment travel time and speed records data generation in three metropolitan areas of the United States. Rather than concentrating on just one corridor as was done in this study, the prospects for research on several corridors –and there are many of such congested corridors – in Accra, could be explored.

Besides the above, this study focused on only one out of the many public transport providers in Accra. It is recommended for future researches to study the other providers and to ask how traffic congestion has been affecting their delivery of quality service to the travelling public. Again, research-worthy questions which answers could be sought for may include: what are the traffic congestion coping mechanisms employed by these commercial drivers? What are the policy implications of such coping mechanisms on public transport provision in general?

Finally, this study gave much attention on the adverse effects of traffic congestion on the provision of public transport services, using the former BRTS as a case study. The other adverse effects of traffic congestion, such as air pollution, traffic accidents, etc could be the focus of future researches.

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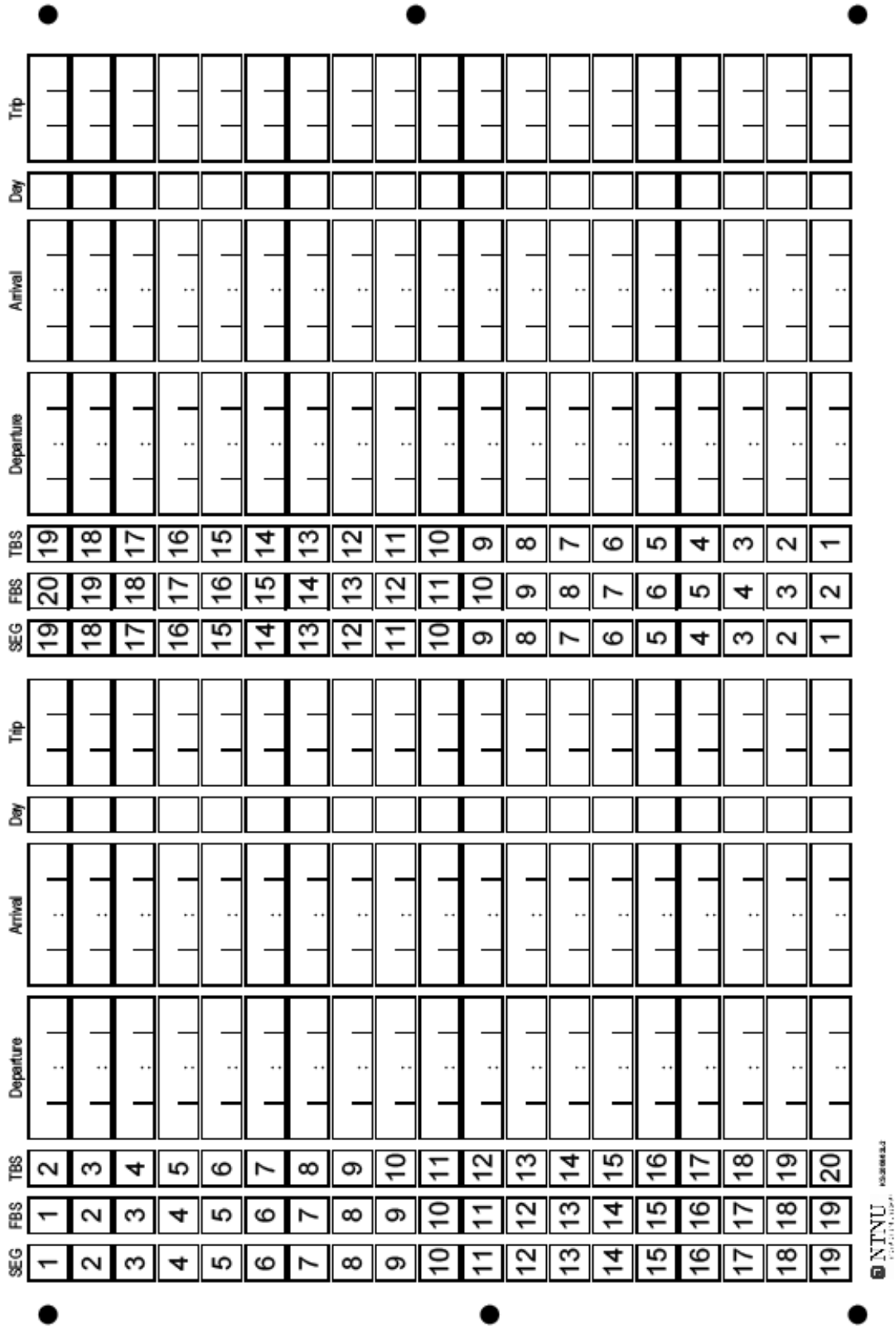
APPENDIX 1 TRAFFIC CONGESTION REGISTRATION FORM



APPENDIX 2. INTERVIEW GUIDE FOR KEY INFORMANTS

(MANAGEMENT OF THE MMT)

Background

1.Can you please start by telling me a little bit about yourself and what you do in the Metro Mass Transit Limited?

Operations of Bus Rapid Transit System in Accra

2. Can you describe to me the kinds/types of bus services rendered by MMTL to the travelling public?

3. Can you describe to me what a Bus Rapid Transit System is?

4. May I know when you started implementing the BRTS?

5. Can you discuss with me how the BRTS was supposed to operate?

6. May I know why the MMTL decided to offer this particular kind of service?

7. Can you show me where or which corridor(s) were selected for the BRTS?

8. What was the average number of BRTS buses that plied the selected corridor on a daily basis?

9. May I know to whom the BRTS was targeted at?

10. Would you say that the initial pilot BRTS project was a success? If so, how in terms of ...
    Economic gains/profits
    Social benefits
    Environmental benefits etc.

11.When did the MMTL officially revert from the 'express' BRTS to a 'regular' bus service?

12. Can you describe to me how the 'regular' bus service operates now vis-a-vis the former BRTS?

13. Why did the Company take the decision to opt for a 'regular' bus service?

Congestion on the corridors of Accra

14. Can you share with me your thoughts about what traffic congestion is?

15. Concerning the former BRTS corridor(s), can you discuss with me which segments of the corridor were the hot spots for traffic congestion?

16. Would you say that the nature or type of traffic congestion on this corridor was either *recurrent (*frequently occurring*), occasional* or both? Explain.

17. When does this corridor usually experience traffic congestion?

18. May I know from you what you think might be the reasons for the occurrence of traffic congestion on this particular corridor?

Congestion versus the operations of a BRTS in Accra

19. To what extent did traffic congestion affect the smooth operations of the former BRTS, in terms of:

-operational costs to the Company
- service quantity
- service quality e.g. meeting time schedules, peak hour overcrowding etc.
- Others

20. Would you say that the incidence of traffic congestion on this corridor is the main primary cause for the 'failure' of the BRTS?

21. Can you share with me if there are other possible factors that might have conspired to collapse the operations of the BRTS? E.g. complaints from passengers about the attitude of the driving crew, loss of revenue due to theft, stiff intermodal competition especially from the single operator services like taxis, trotros etc.

Useful lessons to be learnt for future BRTS in Accra

22. Do you think the operations of a BRTS in the future can be made possible, even on the congested streets of Accra? If yes, how?

23. How do you think the involvement of all major stakeholders, e.g. highway authorities, representatives of single operator services, the police department (who will enforce traffic laws and ensure safety and security of BRTS workers and customers) and indeed the general public, during the initial planning and development of a BRTS project contribute to making it a success?

24. Do you think the packaging of the system elements, e.g. provisions of exclusive, traffic-free-bus-only lanes and safe pedestrian access to bus stations enable the running of a BRTS? How?

25. Do you think the development of a unique image and identity, such as the use of special graphics to convey information (e.g. where to catch a BRTS service) and opportunities for advertisement on BRTS buses make their operations successful? How?

26. Will the introduction and adoption of Information Technology Systems (ITS) that could for instance monitor/control bus operations; provide priority at signalised intersections; enhance safety and security on board vehicles and at bus stations etc make future BRTS operations successful? How?

27. What do you think about the desirability of off-board fare collection for the BRTS services?

28. What are you views on how to improve upon service quality when it comes to operating a BRTS?

29. What are you views on how to improve upon service quantity when it comes to operating a BRTS?

30. If there were other factors, such as theft of revenues; poor driver-passenger relations etc that contributed to the 'failure' of the BRTS, what must operators of a future BRTS do to check some of these things?

31. Are there other useful lessons that are worthy to note for a successful future BRTS operations in Accra? Thank you.

APPENDIX 3. INTERVIEW GUIDE FOR MMT DRIVERS & PASSENGERS

Background

1.Can you please start by telling me a little bit about yourself ?

2. What you do in the Metro Mass Transit Limited? +++[29]

3. When did you start working with the MMT? +++

4. Since when have been using the MMT buses?

Operations of Bus Rapid Transit System in Accra

4. Can you describe to me how the Kimbu-Adenta pilot BRTS operated?

5. May I know when you started implementing the BRTS? +++

6. Was there any feasibility study done before the service begun? +++

Congestion on the corridors of Accra

7. Would you say that the Kimbu-Adenta corridor is congested? If yes, how?

8. Would you say that the nature or type of traffic congestion on this corridor was either *recurrent (*frequently occurring*), occasional* or both? Explain.

9. When does this corridor usually experience traffic congestion?

10. May I know from you what you think might be the reasons for the occurrence of traffic congestion on this particular corridor?

Congestion versus the operations of a BRTS in Accra

11. Would you say that traffic congestion affected the smooth operations of the former BRTS? If so, how?

12. Would you say that the incidence of traffic congestion on this corridor is the main primary cause for the 'failure' of the BRTS?

13. Can you share with me if there are other possible factors that might have conspired to collapse the operations of the BRTS?

Useful lessons to be learnt for future BRTS in Accra

14. What are you views on how to improve upon service quality and quantity of any future BRTS?

Thank you.

[29] +++ represent questions reserved for MMT drivers only

APPENDIX 4. INTERVIEW GUIDE FOR KEY INFORMANTS

(PUBLIC TRANSPORT POLICY MAKERS AND EXPERTS)

Operations of Bus Rapid Transit System in Accra

1. Can you describe to me the nature and purpose of the MMT?

2. Can you describe to me what a Bus Rapid Transit System is?

3. Did the MMT implement a BRTS, although on a pilot basis?

4. What was the official involvement of the state institutions in the pilot BRTS?*** [30]

5. What are some of the key challenges the pilot BRTS was likely to encounter?

6. Has the state any plans of its own to operate a BRTS?***

7. Can you share with me how the BRTS of the state will be different from the MMT BRTS?***

Useful lessons to be learnt for future BRTS in Accra

7. Do you think the operations of a BRTS in the future can be made possible, even on the congested streets of Accra?

8. If yes, which measures can be put in place to avoid the challenges that led to the collapse of the MMT BRTS?

Thank you.

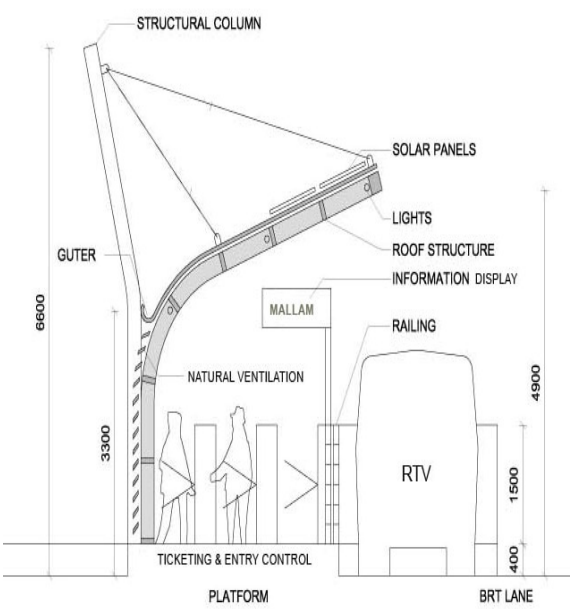
[30] *** represents questions reserved for the government officials only

APPENDIX 5. CONGESTION SCOREBOARD on the KIMBU-ADENTA CORRIDOR

Segment ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Segment Length (in Metres)	1786.94	1343.05	853.85	1251.33	391.31	799.3	725.58	434.8	494.93	568.43
Posted Speed Limit (Km/h)	50	50	50	50	50	50	50	50	50	50
AM Peak										
Average Travel Speed (Km/h)	24.92	27.02	26.47	47.05	15.1	22.08	33.56	22.61	20.29	21.09
Median Travel Speed (Km/h)	12.66	13.43	25.62	37.54	11.74	15.99	43.53	26.09	14.85	17.05
Cumulative Travel Speed (Mins.)	8.95	15.2	17.8	20.1	22.2	26.3	28.04	29.59	31.54	33.99
Off Peak										
Average Travel Speed (Km/h)	27.06	39.49	34.26	41.22	13.41	29.96	30.71	20.7	21.89	32.19
Median Travel Speed (Km/h)	21.44	40.29	25.62	37.54	11.74	23.98	21.77	26.09	22.27	34.11
Cumulative Travel Speed (Mins)	5.73	8.31	10.73	13.32	15.61	18.26	20.07	21.62	23.37	24.57
PM Peak										
Average Travel Speed (Km/h)	23.15	20.45	21.29	23.56	12.82	31.77	28.66	20.82	17.73	28.28
Median Travel Speed (Km/h)	26.8	18.13	14.94	15.02	11.74	23.98	21.77	26.09	14.85	34.11
Cumulative Travel Speed (Mins)	5	9.75	13.79	18.28	20.33	22.25	24.09	26.05	28.8	30.24

Segment ID	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
Segment Length (in Metres)	1094.2	1894.75	745.1	2299.2	727.64	1408.87	1137.36	899.21	540.38
Posted Speed Limit (Km/h)	50	50	50	50	50	50	50	50	50
AM Peak									
Average Travel Speed (Km/h)	34.5	30.77	26.86	31.91	16.48	26.71	20.19	22.35	15.59
Median Travel Speed (Km/h)	24.62	9.47	22.35	12.54	14.55	16.91	11.37	13.49	13.51
Cumulative Travel Speed (Mins)	37.93	49.38	52.16	63.16	68.01	73.56	80.41	84.41	87.16
Off Peak									
Average Travel Speed (Km/h)	40.09	44.89	30.61	33.15	15.62	20.82	20.65	19.02	15.77
Median Travel Speed (Km/h)	32.83	37.9	22.35	27.59	14.55	14.09	17.06	17.98	16.21
Cumulative Travel Speed (Mins)	26.66	30.05	32.05	38.13	42.37	48.55	52.87	56.89	59.33
PM Peak									
Average Travel Speed (Km/h)	16.9	19.9	14.05	30.89	8.68	22.02	14.55	5.08	9.87
Median Travel Speed (Km/h)	12.04	18.95	14.9	27.59	7.28	14.09	11.37	4.15	10.81
Cumulative Travel Speed (Mins)	35.59	41.59	45.54	50.89	57.14	63.63	70.48	82.33	86.28

APPENDIX 6. DESIGN OF THE BRTS TERMINALS.



Source: Urban Transport Project, 2008